NALLAMUTHU GOUNDER MAHALINGAM COLLEGE
(AUTONOMOUS) POLLACHI - 642 001.

M.Sc., BOTANY

SYLLABUS
&
SCHEME OF EXAMINATION

OUTCOME BASED EDUCATION (OBE)

[FOR THE STUDENTS ADMITTED DURING THE ACADEMIC YEAR 2025-2027 BATCH & ONWARDS]

NGM COLLEGE (AUTONOMOUS)

Vision

Our dream is to make the College an Institution of Excellence at the national level by imparting quality education of global standards to make students academically superior, socially committed, ethically strong and culturally rich citizens to contribute to the holistic development of the self and society.

Mission

Training students to become role models in academic arena by strengthening infrastructure, upgrading extension through an enlightened management and committed faculty who ensure knowledge transfer, instill research aptitude and infuse ethical and cultural values to transform students into disciplined citizens in order to improve quality of life.

PG AND RESEARCH DEPARTMENT OF BOTANY

Vision

Our vision is to perform cutting-edge education, research and outreach on the patterns and processes of life, with a particular emphasis on plants and their habitats.

Mission

Our mission is to make students become scientifically well-trained and highly skilled botanists and on cutting edge technologies in life sciences and make good citizens with environmental and social concern.

Program Educational Objectives (PEOs)	
The M. Sc. Botany program describe accomplishments that graduates are expected to attain within five to seven years after graduation	
PEO 1	Postgraduate students are prepared to apply new ideas in the field of biological science and to become an entrepreneur
PEO 2	Postgraduate students are trained to take up higher learning programmes in research
PEO 3	Postgraduate students are known about the organization of plants and their role in Human Welfare
PEO4	Postgraduate students are prepare for competitive examinations, especially UGC-CSIR NET, SET and TNPSC Examinations.
PEO5	Postgraduate students are perform their competency with professional ethics in their working place.

Programme Outcomes

On successful completion of the M. Sc. Botany program to	
PO1	**Disciplinary knowledge:** Apply the fundamental knowledge of science and technology for solving complex problems.
PO2	**Research-related skills** : Ensure the use of advanced tools and techniques in understanding the scope and significance of Botany.
PO3	**Problem solving:** Develop the scientific problem solving skills during experimentation, research projects, analysis and interpretation of data.
PO4	**Life long learner** : Exploration of diverse plant life-forms, anatomical, Physiological and Biochemical disciplines and to conserve the biodiversity.
PO5	**Critical thinking:** Enhanced capacity to think critically; ability to understand, design and execute experiments independently and/or team under multidisciplinary settings
PO6	**Multicultural competence:** Design and standardize protocols for public health and safety, and cultural, societal and environmental considerations.
PO7	**Information/digital literacy:** Apply appropriate techniques, resources, and modern ICT tools for understanding plant resources.
PO8	**Reflective thinking:** Demonstrate the contextual knowledge in sustainable exploitation of medicinal, economically important and endangered plants as per the National Biodiversity Act.
PO9	**Professional ethics:**Follow the concept of professional ethics and bioethics norms for practicing the value of plant kingdom
PO10	**Communication Skills:** Communicate proficiently with various stakeholders and society, to comprehend and to write and present reports effectively

Programme Specific Outcomes	
After the successful completion of M.Sc., Botany program the students are expected to	
PSO1	**Disciplinary knowledge:**acquire deep knowledge on botanical terms, facts, concepts, theories and principles of plant sciences and become a good academician and a successful researcher
PSO2	**Research-related skills**: become highly skilled in advanced techniques in biological science and become suitable for various careers.

MAPPING

PEOs / POs/PSOs	**PEO1**	**PEO2**	**PEO3**	**PEO4**	**PEO5**
PO1	M	H	M	H	M
PO2	H	H	M	M	M
PO3	M	M	L	M	M
PO4	L	M	M	H	L
PO5	M	M	M	L	M
PO6	M	M	H	L	L
PO7	L	M	L	L	M
PO8	M	L	M	M	L
PO9	L	L	M	L	L
PO10	L	L	M	M	H
PSO1	M	M	M	H	M
PSO2	H	M	M	H	M

OBE Rubric Mapping System

The attainment level of the students as Low, Medium, High is replaced by the numerals as 1, 2 and 3

HOD	CDC & COE
Name: Dr. R. Rakkimuthu Signature:	Name: Mr. K.Srinivasan Signature:

SCHEME OF EXAMINATION

Semester	Course Code	Course Title	Class hours /Week		Exam Hrs	Maximum marks			Credits
			T	P		CIA	ESE	Total	
I	25PBY101	**Core – I** Plant Diversity I (Phycology, Mycology, Lichenology and Bryology)	6	3	3	25	75	100	4
	25PBY102	**Core – II** Plant Diversity II (Pteridophytes, Gy mnosperms and Palaeobotany)	6	2	3	25	75	100	4
	25PBY103	**Core – III** Applied Microbiology and Plant Pathology	6	1	3	25	75	100	4
	25PBY104	**Core - 4 Laboratory course-I** (for core courses I, II, III)	-	6	4	40	60	100	5
	25PBY1E1/ 25PBY1E2	**Elective -I** Ecology and Phytogeography/ Seed technology	6	-	3	25	75	100	4
		Total	**24**	**6**		**140**	**360**	**500**	**21**
	25PBY205	**Core - V** Plant Anatomy and Embrology	6	3	3	25	75	100	4
	25PBY206	**Core - VI** Plant physiology	6	2	3	25	75	100	4
	25PBY207	**Core – VII** Cytology, Genetics and Plant Breeding	5	1	3	25	75	100	4
	25PBY208	**Core - VIII Laboratory course II** (for core courses V,VI.VII)	-	6	4	40	60	100	5
	25PBY2E3/ 25PBY2E4	**Electi ve –II** Horticulture and Landscaping / Applied Botany	5	-	3	25	75	100	4
	25PBY2N1/ 25PBY2N2	**Non- Major Elective-1** Plants in Tamil Culture/ **Non- Major Elective-2** Plant Tissue Culture	2	-	2	-	100	100	2
		Total	**24**	**6**		**140**	**460**	**600**	**23**
III	25PBY309	**Core - IX** Plant Taxonomy of Angiosperms and Economic Botany	6	3	3	25	75	100	4
	25PBY310	**Core -X** Plant Biochemistry and Biophysics	6	2	3	25	75	100	4
	25PBY311	**Core -XI** Plant Biotechnology	6	1	3	25	75	100	4
	25PBY312	**Core – XII Laboratory course – III** (for core course IX,X and XI)	-	3	4	40	60	100	5
	25PBY3E6/ 25PBY3E7	**Electi ve-III** Forestry and Wood science /Herbal technology	6	-	3	25	75	100	4
	25PBY3IN	**Industrial Training / Internship**	-	-	-	20	30	50	2
		Total	**24**	**6**		**160**	**390**	**550**	**23**
IV	25PBY413	**Core - XIII** Research Methodology	6	3	3	25	75	100	4
	25PBY414	**Core - XIV** Bioinformatics and Cyber Security	6	3	3	25	75	100	4
	25PBY415	**Core - XV Laboratory course –IV** (for core courses XIII and XV)	-	6	4	40	60	100	4
	25PBY416	Pharmaceutical Botany	3	3	2	20	30	50	2
	25PBY4E7/ 25PBY4E8	Ethno Botany / Pharmacognosy	6	-	3	25	75	100	4
	25PBY4P1	**Core - XVI** Project Work and Viva – Voce	6	-	-	25	75	100	5
		Total	**18**	**6**	**-**	**170**	**330**	**550**	**23**
		Grand Total	**90**	**24**	-	**590**	**1610**	**2200**	**90**

	CO-SCHOLASTIC COURSES						
SEMESTER	COURSE	Hours/ week	Total Hours	Internal mark	External mark	Total	Credits
	ADVANCED LEARNER COURSE (Optional)						
III	Plant ecology, tissue culture and Phytochemical techniques	-	-	25	75	100	Grade
IV	Online- Comprehensive examination	-	-	25	75	100	Grade
	ONLINE COURSES						
I /II	Swayam, MOOC Course etc.,	-	-	-	-	-	2
	VALUE ADDED COURSE						
III	Value Added Course	2	30	25	25	50	2
	CERTIFICATE COURSES (Optional)						
III	Certificate Course - I	2	40	25	75	100	2
	Certificate Course - II	2	40	25	75	100	2
	The scholastic courses are only counted for the final grading and ranking. However for the award of the degree, the completion of co-scholastic one online course is mandatory. All other co-scholastic courses are optional only.						

Question Paper Pattern

(Based on Bloom's Taxonomy)

K1-Remember; **K2**- Understanding; **K3**- Apply; **K4**-Analyze; **K5**- Evaluate

1. Theory Examinations: 75 Marks (Part I, II, & III)

(i) Test- I & II, ESE:

Knowledge Level	Section	Marks	Description	Total
K1 & K2 (Q1 -10)	A (Q1 – 5 MCQ) (Q6–10Define/Short Answer/MCQ)	10 * 1 = 10	MCQ /Define	**75**
K3 (Q11-15)	B (Either or pattern)	5 *5 = 25	Short Answers	
K4 & K5(Q16 – 20)	C (Either or pattern)	5 * 8 = 40	Descriptive/ Detailed	

2. Theory Examinations: 100Marks (NME)

Knowledge Level	Section	Marks	Description	Total
K1 & K2 (Q 1 -10)	A – (Answer 5 out of 8)	5 x 5 = 25	Short Answers	100
K3, K4 & K5 (Q 11-18)	B (Answer 5 out of 8)	5 x 15 = 75	Descriptive/ Detailed	

3. Practical Examinations: 100Marks

Knowledge Level	Criterion	External/Internal Marks	Total
K3	Record work & Practical	60/40	100
K4			
K5			

4. Project:

Paper	Maximum Marks	Marks for		
		CIA	CEE	
			Evaluation	Viva-voce
Project	100	25	50	25

***** CIA – Continuous Internal Assessment & CEE – Comprehensive External Examinations

Components of Continuous Assessment

THEORY

Maximum Marks: 100; CIA Mark: 25

Components		Calculation	CIA Total
Test 1	75	75+75+15+10=175/7	25
Test 2 / Model	75		
Assignment / Digital assignment	15		
Others	10		

*Others may include the following: Seminar / Socratic Seminars,Group Discussion, Role Play, APS, Class participation, Case Studies Presentation, Field Work, Field Survey, Term Paper, Workshop / Conference Participation, Presentation of Papers in Conferences, Quiz, Report / Content Writing, etc.

PRACTICAL

Maximum Marks: 100; CIA Mark: 40

Components		Calculation	CIA Total
Test / Model	30	20+10+10=40	40
Observation Note	05		
Record	05		

PROJECT

Maximum Marks: 100; CIA Mark: 25; CEE Mark: 75

Components		Calculation	CIA Total
Review I	5	5+5+5+10	25
Review II	5		
Review III	5		
Report Submission	10		

** Components for 'Review' may include the following:*

S. No	External Components	Marks
1	Originality of Idea	10
2	Relevance to Current Trend	10
3	Candidate Involvement	10
4	Thesis Style / Language	10
5	Presentation of Report	10
6	Viva-Voce	25
Total		**75**

STUDENT SEMINAR EVALUATION RUBRIC

Grading Scale:

A	B	C	D
8-10	5-7	3-4	0-2

CRITERIA	A - Excellent	B - Good	C - Average	D - Inadequate
Organization of presentation	Information presented as an interesting story in a logical, easy-to-follow sequence	Information presented in logical sequence; easy to follow	Most of the information is presented in sequence	Hard to follow; sequence of information jumpy
Knowledge of the subject & References	Demonstrated full knowledge; answered all questions with elaboration **&** Material sufficient for clear understanding **AND** exceptionally presented	At ease; answered all questions **but** failed to elaborate **&** Material sufficient for clear understanding **AND** effectively presented	At ease with information; answered most questions **&** Material sufficient for clear understanding **but** not clearly presented	Does not have a grasp of information; answered only rudimentary Questions **&** Material not clearly related to the topic **OR** background dominated seminar
Presentation Skills using ICT Tools	Uses graphics that explain and reinforce text and presentation	Uses graphics that explain the text and presentation	Uses graphics that relate to text and presentation	Uses graphics that rarely support text and presentation
Eye Contact	Refers to slides to make points; engaged with the audience	Refers to slides to make points; eye contact the majority of the time	Refers to slides to make points; occasional eye contact	Reads most slides; no or just occasional eye contact
Elocution – (Ability to speak English language)	Correct, precise pronunciation of all terms The voice is clear and steady; the audience can hear well at all times	Incorrectly pronounces a few terms Voice is clear with few fluctuations; the audience can hear well most of the time	Incorrectly pronounces some terms Voice fluctuates from low to clear; difficult to hear at times	Mumbles and/or Incorrectly pronounces some terms Voice is low; difficult to hear

WRITTEN ASSIGNMENT RUBRIC

Grading Scale:

A	B	C	D	F
13-15	10-12	7-9	4-6	0-3

CRITERION	A - Excellent	B - Good	C - Average	D - Below Average	F - Inadequate
Content & Focus	Hits on almost all content exceptionally clear	Hits on most key points and the writing is interesting	Hits in basic content and writing are understandable	Hits on a portion of content and/or digressions and errors	Completely off track or did not submit
Sentence Structure & Style	* Word choice is rich and varies * Writing style is consistently strong * Students own formal language	* Word choice is clear and reasonably precise * Writing language is appropriate to the topic * Words convey intended message	* Word choice is basic * Most writing language is appropriate to the topic * Informal language	* Word choice is vague * Writing language is not appropriate to the topic * Message is unclear	* Not Adequate
Sources	Sources are cited and are used critically	Sources are cited and some are used critically	Some sources are missing	Sources are not cited	Sources are not at all cited
Neatness	Typed; Clean; Neatly bound in a report cover; illustrations provided	Legible writing, well-formed characters; Clean and neatly bound in a report cover	Legible writing, some ill-formed letters, print too small or too large; papers stapled together	Illegible writing; loose pages	Same as below standard
Timeliness	Report on time	Report one class period late	Report two class periods late	Report more than one week late	Report more than 10 days late

Industrial Training / Internship

The students may undergo industrial training for a period as specified in the Curriculum during summer/winter vacation. In this case, the training has to be undergone for 7-14 days period.

The students may undergo Internship at Research organization / University (after due approval from the Department Consultative Committee) for the period prescribed in the curriculum during summer / winter vacation, in lieu of Industrial training.

Mark Split UP

Industrial Training or Internship for students is evaluated for 50 marks, out of which 20 are given by the respective guide of the student and 30 by an external examiner.

Internal Components		**Calculation**	**CIA Total**
Review I	5	5+5+10	20
Review II	5		
Report Submission	10		

S. No	**External Components**	**Marks**
1	Originality of Idea	02
2	Relevance to Current Trend	02
3	Candidate Involvement	02
4	Thesis Style / Language	04
5	Presentation of Report	05
6	Viva-Voce	15
Total		**30**

Course Designed by	Verified by HOD	Checked and Approved by
Name and Signature	Name and Signature	CDC & COE
Name: Dr. R. Rakkimuthu Signature:	Name: Dr. R. Rakkimuthu Signature:	Name: Mr. K.Srinivasan Signature: :

Guidelines for Project

- The final year students should undergo a project work during IV semester
- The period of study is for 2-3 Months.
- Work on the project must be done in the department laboratory (or) work on anyindustrialproblem outside the organization is permitted.
- Students are divided into groups and each group is guided by a mentor.
- The group should not exceed four students, also interested student can undergo individually.
- A problem is chosen, objectives are framed, and data is collected, analyzed anddocumented in the formof a report / Project.
- Viva – Voce is conducted at the end of 4th semester, by an external examiner andconcerned mentor (Internal Examiner).
- Project work constitutes 100 marks, out of which 25 is internal and 75 is external marks.

Mark Split UP

S. No	Internal Components	Marks
1	Review - I	5
2	Review - II	5
3	Review - III	5
4	Rough Draft Submission	10
Total		**25**

S. No	External Components	Marks
1	Originality of Idea	10
2	Relevance to Current Trend	10
3	Candidate Involvement	10
4	Thesis Style / Language	10
5	Presentation of Report	10
6	Viva-Voce	25
Total		**75**

Course Designed by	Verified by HOD	Checked and Approved by
Name and Signature	Name and Signature	CDC & COE
Name: Dr. R. Rakkimuthu Signature:	Name: Dr. R. Rakkimuthu Signature:	Name: Mr. K.Srinivasan Signature: :

Programme code	M.Sc.	Programme Title : Master of Science in Botany		
Course Code: 25PBY101		Title: Core - I Plant Diversity I (Phycology, Mycology, Lichenology and Bryology)	Batch	2025 -2027
			Semester	I
Hrs/Week:	6		Credits	4

Course Objective

The main objectives of this course are to:

- Study the classification, characteristic features, distribution, and reproduction cycleof algae, fungi, lichens and bryophytes.
- Know the ecological and economic importance of algae, fungi, lichens and bryophytes
- Understand the concept of lichens and bryophytes as indicator for air pollution

Course Outcomes (CO)

On the successful completion of the course, student will be able to:		
CO1	Remember the values of lower plant forms and its diversity	K1
CO2	Get an idea on evolution of lower plants and its architectural specialization in cells	K2
CO3	Apply economic values of lower plants to manufacture value added products	K3
CO4	Review the developmental stages of lower group of plant diversity	K4
CO5	Understand and learn the classification and economic importance of lower plants	K2&K4
K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** – Evaluate		

Unit	Content	Hrs
Unit I	Phycology: Phycology – introduction - history - definition- classification of algae (Fritsch, 1945) – Phylogeny and interrelationship – thallus organization (range of thallus), evolution of thallus in green algae- reproduction (vegetative, asexual, sexual) - modes of perennation- Ultra structure of cell, flagella, chloroplast, pyrenoids and eye spot in major groups of algae- algae in diverse habitats (terrestrial, fresh water, marine)- algae distribution in India - life cycle patterns in algae and algal blooms - **economic importance of algae as food - bio-fuels - source of chemicals and drugs - algal bioinoculants*.	**18**
Unit II	Comparative study of classes of Cyanophyceae, Chlorophyceae, Xanthophyceae, Bacillariophyceae, Phaeophyceae and Rhodophyceae with reference to range of structure of plant body including - ultra structure - methods of reproduction and variations in life cycles - life histories of *Nostoc*, *Caulerpa*, *Vaucheria,* Diatoms, *Padina* and *Gracilaria* - Culture and cultivation of fresh and marine algae- fossil algae.	**17**
Unit III	**Mycology:** General characteristics - classification of fungi (J. Alexopoulos and C.W. Mims 1979) - cell wall composition, mode of nutrition- range of structure, Heterothallism, reproduction and interrelationship of Myxomycetes, Oomycetes, Zygomycetes, Ascomycetes, Basidiomycetes and Deuteromycetes - structure and life-histories of *Plasmodiophora, Phytophthora, Rhizopus, Penicillium, Pleurotus* and *Cercospora*- ecology of fungi (Habit and Habitat) - VAM Ecto and endophytic mycorrhiza - economic importance of fungi- fossil fungi - comparison of algae and fungi.	**18**

Unit IV	**Lichenology:** Origin and evolution of lichens - classification of Lichens (Miller, 1984) - thallus types and internal structure - occurrence and Inter-relationship of Phycobionts and Mycobionts - structure and reproduction in Ascolichens, Basidiolichens and Deuterolichens – Lichens as indicators of pollution -ecology of lichens- economic importance of lichens.	**19**
Unit V	**Bryology:** Classification (Proskauer, 1957), general and reproductive characters of major classes -distribution of bryophytes - comparative study of gametophytes and sporophytes of major classes - Hepaticopsida: *Marchantia*, *Porella*, Anthocerotopsida: *Anthoceros*, Bryopsida: *Sphagnum* and *Polytrichum*- alternation of generations in the life-cycle of bryophytes- Economic importance of bryophytes - bryophytes as pollution indicators- fossil bryophytes.	**18**

**Self-study topics*

Power point presentations, Group discussions, Seminar, Quiz and Assignment.

Text Books

1. Sharma, O.P. 2011. Diversity of microbes & Cryptogams – Algae, Tata McGraw Hill Education Private Limited, New Delhi.
2. Singh, S.K. 2006. Text Book of Bryophyta, Campus Books, New Delhi.
3. DharaniDharAwasthi, 2000. A Handbook of Lichens. Vedams eBooks (P) Ltd. NewDelhi
4. Alexopoulos, C.J. and Mims, C.W. 1979. Introductory Mycology. Wiley Eastern Ltd., New Delhi.

Reference Books

1. Sureshkumar, 2009. An Introduction to Algae.Campus Book International, New Delhi.
2. Muthukumar, S. and Tarar, J.L. 2006. Lichen Flora of Central India, Eastern book Corporation, New Delhi.
3. Prem Puri. 2001. Bryophytes– morphology growth and differentiation. Atma Ram &Sons. Lucknow, India
4. Kevin K. 2018. Fungi biology and Application, 3rd Edition, Wiley Blackwell.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1.Algae lecture Notes: http://www.uobabylon.edu.iq/eprints/paper_11_20160_754.pdf

2.Fungi YouTube Videos: https://www.youtube.com/watch?v=vcYPI6y-Udo 3.Lichen YouTube Videoshttps://www.youtube.com/watch?v=XQ_ZY57MY64

4.Bryophytes lecture Notes: http://www.plb.ucdavis.edu/courses/bis/1c/text/Chapter22nf.pdf

PO/ PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	H	M	M	H	M	H	M	H	L	L	H	H
CO2	H	M	M	H	H	M	M	H	M	L	H	H
CO3	H	L	H	M	H	H	L	H	H	M	H	M
CO4	H	H	L	H	M	M	L	L	M	L	H	H
CO5	H	H	H	M	H	H	L	H	M	H	H	H

H-High M- Medium L –Low

Course Designed by	Verified by HOD	Checked and Approved by
Name and Signature	Name and Signature	CDC & COE
Name: Dr. A. M. Anandakumar Signature:	Name: Dr. R. Rakkimuthu Signature:	Name: Mr. K.Srinivasan Signature: :

Programme code	M.Sc.	Programme Title : Master of Science in Botany		
Course Code: 25PBY102		Title: Core – II Plant Diversity II (Pteridophytes, Gymnosperms and Palaeobotany)	Batch	2025 -2027
			Semester	I
Hrs/Week:	6		Credits	4

Course Objective

The main objectives of this course are:

- To understand the composition level of plant diversity emphasized in ecological, organizational, genetic and cultural.
- To realize the fundamental values of diversity and their importance of humanwelfare.
- To define and characterize diversity of lower vascular plants to understand the dynamics of diversity to realize the significance of diversity.

Course Outcomes (CO)

On the successful completion of the course, student will be able to:		
CO1	Remember the diverse forms of plants in the plant kingdom	K1
CO2	Understand the life cycles of vascular plants	K2
CO3	Discover the importance of vascular plants to the Human community	K3
CO4	Connect the lower plants and higher plants by phylogenetic study	K4
CO5	Review the evolutionary idea of fossil diversity	K4
K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** – Evaluate		

Unit	Content	Hrs
Unit I	**Pteridophytes:** Introduction - classification of Pteridophytes (Sporne, 1970) - characteristic features and types of life cycles in Pteridophytes - comparative account of sporophytes, gametophytes and embryogeny in Psilotopsida- *Psilotum*, Lycopsida – *Lycopodium*, *Selaginella* and Sphenopsida - *Equisetum*.	**18**
Unit II	Comparative account of sporophytes - gametophytes and embryogeny in Pteropsida –*Ophioglossum*, *Adiantum, Marsilea* and *Salvinia*. Types of steles and their evolution in Pteridophytes - telome theory- heterospory and seed habit - apospory, apogamy and parthenogenesis - **economic importance of Pteridophytes - origin and evolution of Pteridophytes.*	**19**
Unit III	**Gymnosperms:** Introduction – classification of Gymnosperms (Sporne, 1974) – characteristic features and life cycles of Gymnosperms. Comparative study of morphology, anatomy, reproduction and phylogeny of Ephedrales, Pteridospermales, Bennettitales, Pentoxylales, Cycadales, Corditales and Taxales.	**18**
Unit IV	Comparative study of morphology, anatomy, reproduction and phylogeny of Ginkgoales and Gnetales –affinities of Gymnosperms with Angiosperms and Pteridophytes - **economic importance of Gymnosperms*	**17**
Unit V	**Palaeobotany:** Concepts of Palaeobotany – a general account on Geological Time Scale - techniques for Palaeo botanical study- types of fossils: compressions, Impression, incrustation, casts, molds, petrifactions, coalballs and compactions- age determination and methods of study of fossils- systematic and nomenclature of fossil plants- role of fossil in oil exploration and coal excavation- Palaeopalynology.	**18**

**Self study topics*

Power point presentations, Group discussions, Seminar, Quiz and Assignment.

Text Books

1. Vashishta, P.C. 2006. Gymnosperms. S. Chand & Company Ltd., Ram Nagar, New Delhi.
2. Vashishta, P.C. 2005. Pteridophyta S. Chand & Company Ltd., Ram Nagar, New Delhi.
3. Gangulee and Kar, 1970. College Botany Vol. II. New Central Book Agency, New Delhi.
4. Vashishta, P.C. 1991. Vascular Cryptogams. S. Chand & Company Ltd., Ram Nagar, New Delhi

Reference Books

1. Arnold, C.A. 2013. An Introduction to Palaeobotany. Academic Press, New York and London
2. Biswas, C. and Johrc, B.M. 1977. The Gymnosperms. Narosa publishing House, New Delhi.
3. Bower, F.O. 1923-28. The ferns. Vol., 1-3; Cambridge University Press, London.
4. Eames, A.J. 1936. Morphology of Vascular Plants. Lower groups, New York and London.
5. Meyen, S.V. 1987. Fundamentals of Palaeobotany. Chapman and Hall, New York.
6. Sporne, K.R. 1965. The Morphology of Pteridophytes. Hutchinson & Co., London
7. Sporne, K.R. 1967. The Morphology of Gymnosperms. Hutchinson & Co., London.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. Pteridophytes : https://www.easybiologyclass.com/pteriophytes-free-online-study-materials-tutorials-lecture-notes-ppts-mcqs/
2. Gymnosperms :https://www.easybiologyclass.com/general-characters-of-gymnosperms-lecture-notes-with-ppt/
3. Palaeobotany:https://www.biologydiscussion.com/botany/paleobotany/palaeobotany-concept-technique-and-important-strata-botany/18744

PO/PSO ——— CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	H	M	M	H	L	M	M	H	H	M	H	L
CO2	M	L	M	H	M	L	H	H	M	L	H	L
CO3	M	M	M	H	L	H	M	H	M	M	H	L
CO4	M	M	M	H	M	H	M	H	H	M	H	L
CO5	H	L	H	H	M	M	H	H	H	L	H	L

H-High M- Medium L – Low

Course Designed by	Verified by HOD	Checked & Approved by
Name and Signature	Name and Signature	CDC & COE
Name: Mrs. D. Sowmiya Signature:	Name: Dr. R. Rakkimuthu Signature:	Name: Mr. K. Srinivasan Signature:

Programme code	M.Sc.	Programme Title : Master of Science in Botany		
Course Code: 25PBY103		Title : Core – III Applied Microbiology and Plant Pathology	Batch	2025 -2027
			Semester	I
Hrs/Week:	6		Credits	4

Course Objective

The main objectives of this course are to:

- Provide students with the latest information in the field of microbiology and plant pathology.
- Explain the theoretical basis of the tools, technologies and methods commonly used in microbiology and plant pathology.
- Develop practical skills in the use microbiological methodologies, tools and techniques.

Course Outcomes (CO)

On the successful completion of the course, student will be able to:		
CO1	Recognize the different types of microorganisms present in an environment and their importance.	K1
CO2	Characterize and culture microorganisms present in soil,water and infectedplant tissue using appropriate techniques.	K2
CO3	Demonstrate the role of microorganisms in food processing and spoilage	K3
CO4	Apply the microbial culture in manufacturing of value added products	K3
CO5	Assess the role of microorganisms in plant diseases commonly occurring in crops	K4
K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** – Evaluate		

Unit	Content	Hrs
Unit I	**Microbiology:** History, scope and branches of microbiology - a general account, classification, growth and reproduction of bacteria (Bergey's manual of classification), virus and protozoa - economic importance of microbes	**16**
Unit II	**Microbiological Media:** Media types - preparation- methods of sterilization- enumeration of microorganisms in soil and water - isolation of microorganisms from infected plant tissue- isolation of microorganisms from industrial waste - techniques of pure culture- maintenance and preservation of microbes- staining techniques - **bacterial growth curve - nutritional types of microorganisms.*	**19**
Unit III	**Food Microbiology:** Introduction to Food Microbiology- Types of Microorganisms in Food- Sources of Microorganisms in Foods- Factors Affecting Microbial Growth in Food- Beneficial Uses of Microorganisms in Food Production- fermented foods like cheese, yogurt, bread, beer, and wine- Single cell protein- Food Spoilage and Preservation-* *Food adulteration- identification of adulteration in foods- concept of prebiotics and probiotics*.	**19**
Unit IV	**Industrial Microbiology:** Fermenter structure and its types - batch fermentation - continuous fermentation - industrial production of enzymes (amylase), amino acids (glutamic acid and L- Lysine), Antibiotics (penicillin), organic acids (lactic and citric acid) and biofuels (ethanol) - methods of cell and enzyme immobilization - applications of immobilized cells and enzymes – antimicrobial activity (Well and Disc method)-MIC- - medicinal plants as antimicrobial agents.	**18**

Unit V	**Pathology**: : Introduction to plant pathology – disease – concept, component and causes – Defense mechanisms in plants- plant diseases: symptoms, causative organisms and control measures of following diseases: Blast disease of Paddy - Red rot of Sugar cane - Late blight of Potato - Bunchy top of Banana – TMV - Leaf spots disease of coconut- Software for identification of plant disease.	**18**

**Self study topics*

Power point presentations, Group discussions, Seminar, Quiz and Assignment.

Text Books:

1. Bilgrami, K.S. &H.C. Dube, 2010 A text book of Modern Plant Pathology – Vikas Publishing House (P) Ltd., New Delhi
2. Dubey RC, Maheswari D.K., 2014. A text book of Microbiology, S.Chand& company, New Delhi.
3. Joanne Willey, Linda Sherwood and Chris Woolverton, 2013. Prescott's Microbiology, 9th edition, McGraw-Hill Companies.

Reference Books:

1. Prescott, Harley and Klein' S. 2008. Microbiology 7th edition, McGraw hill International Edition, New York.
2. Sharma, P.D. 2006. Plant Pathology. Narso Publishing House, New Delhi.
3. Michael, J. Pelczar, Jr. E.C.S. chan and N.R. Krief. 1995. Microbiology. Tata McGraw-Hill (Ed), New Delhi.
4. Alexopoulos, C.J. and Mims, C.W.1979. Introductory Mycology. Wiley Eastern Ltd, New Delhi.
5. Steindraus, K.H. (ed.) 1983. Hand Book of Indigenous Fermented Food, Parcel Dekker Inc., New York.
6. Das Gupta M.K. 1988. Principles of Plant Pathology. Allied publishers Ltd., New Delhi.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. Food Microbiology and Food Safety (https://swayam.gov.in/nd2_cec20_ag13/preview)
2. General Microbiology (https://swayam.gov.in/nd2_cec19_bt11/preview)

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	M	H	M	M	H	M	H	L	H	H	H	H
CO2	H	H	H	H	H	H	M	H	H	H	H	H
CO3	H	H	H	H	H	H	H	M	M	H	H	H
CO4	H	H	H	H	M	H	H	L	M	H	H	H
CO5	H	H	H	H	M	M	H	M	H	H	H	H

H-High M- Medium L –Low

Course Designed by	Verified by HOD	Checked & Approvedby
Name and Signature	Name and Signature	CDC & COE
Name: Dr. R. Rakkimuthu Signature:	Name: Dr. R. Rakkimuthu Signature:	Name: Mr. K. Srinivasan Signature:

Programme code	M.Sc.	Programme Title : Master of Science in Botany		
Course Code: 25PBY104		Title : Core - IV Laboratory course -I (Phycology, Mycology, Lichenologyand Bryology, Pteridophytes, Gymnosperms andPalaeobotany Applied Microbiology and Plant Pathology)	Batch	2025-2027
			Semester	I
Hrs/Week:	6		Credits	5

Course Objective

The main objectives of this course are to:

- Acquire practical skills in the use of instruments, technologies and methods in microbiology, thallophytes and non-flowering plant groups.
- Provides opportunities to collect and examine samples from various environments.
- Compare the structural diversity of fossil and extant plant species.

Course Outcomes (CO)

On the successful completion of the course, student will be able to:		
CO1	Demonstrate practical skills in microbiology, thallophytes, pteridophytes and gymnosperms.	K3
CO2	Classify bacteria based on staining techniques as well as isolate, culture and characterize microorganisms from different substrates.	K4
CO3	Apply practical skills for Manufacturing of value added products from microbes and lower plants	K3
CO4	Analyze the morphological and anatomical features of lower plants.	K4
CO5	Execute the culture techniques in laboratories	K5
K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** – Evaluate		

Part	Content	Hrs
Part 1	**Phycology, Mycology, Lichenology and Bryology** 1. Observe the range of thallus diversity in algae 2. Understand the Reproductive structures and their arrangement in algae 3. The collection and identification of microalgae using phytoplankton net fromvarious water bodies. 4. Culturing of microalgae using artificial media 5. Culturing of macro algae/seaweed using various methods (demo only) 6. Aware on Commercially available algal products available in markets *7.* Vegetative and reproductive structures of *Phytophthora, Rhizopus*, Penicillium, *Pleurotus* and *Cercospora* 8. Demonstration of Fungal spore count using Haemocytometer. 9. Performing slide culture technique for fungal culturing. *10.* Display of Lichens specimens - *Usnea* sp. 11. Morphological and anatomical study of bryophytes with reference to the following genera: *Marchantia, Anthoceros, Sphagnum* and *Polytrichum*. 12. Field trip for lower plant collection and submission of reports.	**45**

Part 2	**Pteridophytes, Gymnosperms and Palaeobotany** Study of morphology, anatomy and reproductive structures of the following genera: *1.* Pteridophytes: *Selaginella, Equisetum, Ophioglossum,* , and *Adiantum* *2.* Gymnosperms: *Pinus*, *Araucaria, Gingko* and *Ephedra* *3.* Palaeobotany: Impression, Petrification, *Rhynia, Lepidodendron, Lepidocarpon, Williamsonia, Lagenostoma, Lyngiopteris* and Amber.	
Part 3	**Microbiology and Plant Pathology** 1. Preparation of Basic medium - solid agar and broth 2. Preparation of agar plates, agar slants and agar deep tubes. 3. The staining of bacteria using simple staining process 4. Identification of bacteria using Gram's staining. 5. Isolation of Bacteria, Fungi from soil 6. Isolation of microorganisms from the infected plant tissues. 7. Culturing, sub culturing and maintaining the culture of bacteria isolated from various sources 8. Understanding the growth of bacteria using bacterial growth curve. 9. Making of biochemical tests to understand the character of the bacteria 10. Effect of antibiotics on pathogenic microorganism by Kerby - Bayer method. 11. Study of Antimicrobial activity using Minium inhibitory Concetraction method 12. Testing the milk quality using Methylene Blue Reduction Test (MBRT) 13. Identification of adulteration in some common foods Pathology Submission of herbarium of infected plant specimens (not less than five)	**45**

Power point presentation, Specimen observation, Sectioning, Field/Industrial visit, Experience discussion, and Case study

PO/PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PSO1**	**PSO2**
CO1	H	H	M	H	H	H	H	H	H	H	H	H
CO2	H	H	H	H	H	H	M	H	H	H	H	H
CO3	H	L	L	H	H	H	M	H	H	M	H	M
CO4	H	M	L	H	L	H	H	H	L	H	H	M
CO5	H	H	H	H	L	M	H	H	H	H	H	H

H- High M- Medium L -Low

Course Designed by	Verified by HOD	Checked & Approved by
Name and Signature	Name and Signature	CDC & COE
Name: Dr. R. Rakkimuthu Signature:	Name: Dr. R. Rakkimuthu Signature:	Name: Mr. K. Srinivasan Signature:

Programme code	M.Sc.	Programme Title : Master of Science in Botany		
Course Code:	25PBY1E1	Title : Elective -I Ecology and Phytogeography	Batch	2025 -2027
			Semester	I
Hrs/Week:	6		Credits	4

Course Objective

The main objectives of this course are to:

- Empower the student to know the concept and principle of ecology.
- Know the causes, effects and control measure of pollution.
- Learn Biodiversity conservation and management

Course Outcomes (CO)

On the successful completion of the course, student will be able to:		
CO1	Recall or remember environmental condition influenced by many factors	K1
CO2	Understand the applied aspect of environmental botany	K2
CO3	Apply their idea to protect the biodiversity	K3
CO4	Analyze insight into the vegetation types, species interaction and their importance and the factors influencing the environmental conditions	K4
CO5	Evaluate skills in biodiversity conservation through In- situ and Ex- situ.	K5
K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate		

Unit	Content	Hrs
Unit I	History and Scope of Ecology. Concept of Ecosystem, its structure and function –types of ecosystem - Ecological factors; edaphic, climatic, topographic, biotic and abiotic factors; Population Ecology - Characteristics - - growth curves - regulation - life history strategies (r and K selection); concept of metapopulation - demes and dispersal, interdemic extinctions, age structured populations.	**17**
Unit II	Ecological succession - Hydrosere, Xerosere. Bog succession, sand dune succession. Plant indicators - Terrestrial ecosystems, Fresh water ecosystem, Marine ecosystem. Biodiversity: cause for loss of Biodiversity, benefits, and conservation of (*in-situ* and *ex-situ*) Biodiversity, Phytosociological studies **Biodiversity Hotspots* (*RET species*).	**19**
Unit III	Environmental pollution – causes, effect and control measures of Air, Water, Soil, Thermal, Radiation, Noise, E-waste and solid waste pollution; micro plastics; Cumulative effect of Pollution on global environment; **Global warming*, climate change and its consequences – acid rain, ozone depletion – disaster management- - El Nino and La Nina.	**18**
Unit IV	Environmental Impact Assessment (EIA) - Scope, importance and application of EIA process - eco-restoration/remediation- ecological foot prints - carbon foot print - ecolabeling - environmental auditing –application of remote sensing in ecological studies and GIS – environmental acts and laws.	**18**
Unit V	Phytogeography - principles of plant geography - phytogeographic regions of India –latitudinal and longitudinal vegetations- continental drift hypothesis - Factors involved in distribution -Endemism, Age and Area hypothesis; dispersal and migration and their aims and methods.	**18**

Power point Presentations, Group discussions, Seminar ,Quiz, Assignment, Case study

Text Books:

1. Krishnamoorthy, K.V. 2003. An Advanced Text book on Biodiversity, Oxford & IBH Book Company, New Delhi.
2. P. D. Sharma, 2005. Ecology And Environment, Rastogi Publications, India.
3. Trivedi, R.K. and Goel, P.K. 1986. Chemical and Biological methods for water pollution studies, Environmental publication, India.
4. Shukla R. S. and P.S. Chandel, 2005. A Textbook of Plant Ecology, S Chand & Co Ltd

Reference Books:

1. Chiras, D. D., 2009. Environmental Science, 8th edition, Jones and Bartlett Publishers, Sudbury, Massachusetts (www.jbpub.com).
2. Melchias, G. 2001. Biodiversity and Conservation. Oxford IBH. New Delhi. 236pp.
3. Odum, E.P. 1975. Fundamentals of ecology, W.B. Saunders & Co., Philadelphia, USA.
4. Ambasht, R.S. 1974. A text book of plant ecology (3rd ed.), Students' Friends. & Co., Varanasi, India.
5. Chapman, J.L. and Reiss, M.J. 1999. Ecology; Principles and Applications. I Ed. Cambridge University Press. New York.
6. Groombridge, B. (Ed.) 1994. Global Biodiversity status of the Earth's livng resources.Chapma n & Hall, London.

Related Online Contents [MOOC,SWAYAM,NPTEL,Websitesetc.]

1. https://www.youtube.com/watch?v=qtTLiQoYTyQ
2. https://www.youtube.com/watch?v=208B6BtX0Ps
3. https://www.youtube.com/watch?v=6p1TpVJYTds

PO/PSO ——— CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	M	H	H	H	M	H	H	L	H	M	L	L
CO2	M	M	H	L	H	M	H	L	L	M	L	M
CO3	H	M	H	H	M	H	L	H	L	H	L	L
CO4	H	L	H	M	M	H	H	M	H	H	M	L
CO5	H	H	H	H	H	H	H	H	H	M	M	H

H-High M- Medium L –Low

Course Designed by	Verified by HOD	Checked & Approved by
Name and Signature	Name and Signature	CDC & COE
Name: Dr. P. Sathishkumar Signature:	Name: Dr. R. Rakkimuthu Signature:	Name: Mr. K.Srinivasan Signature:

Programme code	M.Sc.	Programme Title : Master of Science in Botany		
Course Code:	25PBY1E2	Title : Elective -I Seed technology	Batch	2025 -2027
			Semester	I
Hrs/Week:	6		Credits	4

Course Objective

The main objective of this course is:

- To refresh the basic knowledge of seed development and structures and apprisestudents with its relevance to production of quality seed.

Course Outcomes (CO)

On the successful completion of the course, student will be able to:		
CO1	Express knowledge gained on the principles of seed technology	K1
CO2	Understand biological bases of technologies used in modern seed science and technology.	K2
CO3	Apply knowledge on the seed multiplication and certification.	K3
CO4	Gaining knowledge on principles of seed processing, Seed drying and methods.	K2
CO5	Get aware on biological and technological aspects of seed production.	K5
K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** – Evaluate		

Unit	Content	Hrs
Unit I	Type of seeds, Classification of seeds, Recalcitrant seeds, Dicot and monocot seeds - Morphology and types, Seed reserves. External and internal structures of seed and their functional significance, Albuminous and Ex-Albuminous seeds	**17**
Unit II	Types of dormancy - physical, Physiological, Morphological, Chemical and mechanical, Primary and secondary dormancy, Photo and Skoto dormancy. Methods to overcome dormancy. Ecological significance of seed dormancy	**18**
Unit III	Seed maturation and germination - metabolism during germination. Epigeal and Hypogeal germination, Germination mechanism. Brief account of Germination value, Germination rate, Germination percentage. Germination ecology: Environmental factors and germination behaviour.	**18**
Unit IV	Seed production in self and cross pollinated plants, Classes of seeds- traditional, breeder, foundation and certified seeds. Viabilty tests- their significance and importance. Seed harvesting, processing, treatments, testing and seed sampling, viability and vigour. Critical role of seed moisture content and environmental factors on viability. Viability period of Indian forestry species.	**19**
Unit V	Effect of storage on seed longevity, Seed germplasm and storage in different conditions.Cryopreservation, Static conservation of seeds. Seed borne pathogens and pests – seed coating and treatments. Seed certification, Standard inspection, registration and seed law enforcement, seed Act (1972). Clonal seed orchards, seed banks.	**18**

**Self study topics*

Power point Presentations, Group discussions, Seminar ,Quiz, Assignment, Case study

Text Books

1. Copeland LO& McDonald MB. 2001. Principles of Seed Science and Technology. 4th Ed. Chapman & Hall.
2. Desai BB. 2004. Seeds Handbook. Marcel Dekker.
3. Thompson JR. 1979. An Introduction to Seed Technology. Leonard Hill.
4. Murray DR. 1984. Seed Physiology. Vols. I, II. Academic Press.
5. Singh SV. 1988. Indian Minimum Seed Certification Standards. Central Seed Certification Board, Ministry of Agriculture, New Delhi.

Reference Books

1. Agarwal, R.L. 1997. Seed Technology, Scientific Publishers, Jodhpur.
2. Agarwal. P.K. and M. Dadlani, 1992.Techniques in seed science and technology, Scientific Publisher, Jodhpur.
3. Khan, A.A. 1977. Physiology and Biochemistry of Seed dormancy and germination,
4. Oxford & IBH Publishing company (P) Ltd, New Delhi. Online resources available at internet sites

Related Online Contents [MOOC,SWAYAM,NPTEL,Websitesetc.]

1. http://www.jnkvv.org/PDF/30032020194456Principles_of_Seed_Technology_Dr_Rudrasen_Singh.pdf
2. https://www.slideshare.net/KarlLouisseObispo/seed-technology

PO/PSO ——— CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	H	H	H	L	M	M	M	L	M	H	M	M
CO2	H	M	H	L	M	L	M	L	M	H	L	M
CO3	H	H	H	L	M	L	M	L	M	H	M	H
CO4	H	H	H	L	M	L	M	L	M	H	M	H
CO5	H	H	M	L	M	L	M	L	L	H	M	H

igh M- Medium L –Low

Course Designed by	Verified by HOD	Checked & Approved by
Name and Signature	Name and Signature	CDC &COE
Name: Dr. A.M. Ananda kumar Signature:	Name: Dr. R. Rakkimuthu Signature:	Name: Mr. K.Srinivasan Signature:

Programme code	M.Sc.	Programme Title : Master of Science in Botany		
Course Code: 25PBY205		Title: Core – V Plant Anatomy and Embryology	Batch	2025 -2027
			Semester	II
Hrs/Week:	6		Credits	4

Course Objectives

The main objectives of this course are to:

- Understand the mechanism underling the shift from vegetative to reproductive phase.
- Trace the development of male and female gametophyte.
- Highlight the physiological role of endosperm in the morphogenesis of embryo.
- Classify meristems and identify their structures, functions and roles in monocot anddicot plants growth and secondary growth of woody plants.

Course Outcomes (CO)

On the successful completion of the course, student will be able to:		
CO1	Recall and remember the relationship between Plant anatomy and Embryology	K1
CO2	Understand the vascular system, cellular development and reproduction in various plant system of angiosperm	K2
CO3	Learn the structures, functions and roles of meristems, pre and post fertilizational change and embryological tissues in angiospermic plants	K2, K4
CO4	Apply the idea on study of plant anatomical structures and reproduction in plants growth and development for attaining green cover.	K3
CO5	Get aware of applied aspects and techniques for making profitable cultivationin agriculture.	K4
K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** – Evaluate		

Unit	Content	Hrs
Unit I	Anatomy: General account and theories of organization of shoot apex and root apex – quiescent centre and modern concept on meristems – structural diversity, functional complexity and phylogenetic trends in specialization of simple tissues (meristem) and complex permanent tissues (xylem and phloem) - cambium – origin – structure, storied and non-storied types – formation of cork cambium, and periderm - **Anomalous secondary growth in dicot and monocot*.	**19**
Unit II	Vascular differentiation in primary and secondary structure of root and stem in dicot and monocot – origin of lateral roots – root stem transition – anatomy of dicot and monocot leaves - stomatal types – nodal anatomy – petiole anatomy – trichomes – glands – secretory tissues – nectaries – laticifers and their significance.	**17**
Unit III	**Reproductive Biology**: Structure and development of Microsporangium - microsporogenesis - microspores - arrangement – morphology – ultra structure - microgametogenesis - classification of pollen – pistil - Interaction - incompatibility – types mechanism and methods to overcome incompatibility – Introduction and applicatoion of palynology .	**18**
Unit IV	Classification, structure and development of megasporangium, megasporogenesis, female gametophyte - types, ultra structure, and haustorial behavior - nutrition of embryo sac - double fertilization and triple fusion - endosperm - types and functions of endosperm- **Embryogeny*: *classification, development of monocot (grass) and dicot (crucifer) embryos*.	**18**
Unit V	Polyembryony- types - classification - causes - induction and practical application- apomixis and its significance - parthenocarpy and its importance seed and fruit development- role of growth substances.	**18**

**Self study topics*

Power point Presentations, Group discussions, Seminars and Assignment.

Text Books

1. Bhojwani, S.S. and Bhatnagar, S.P. 2009. The Embryology and Angiosperms. Vikas publishing house pvt. Ltd, New Delhi.
2. Easu, K. 1985. Plant Anatomy, Wiley Eastern Pvt. Ltd., New Delhi.
3. Johri, B.M. (ed.) 1983. Embryology of Angiosperms, Springer-Verlag, New York.
4. Pandey, B.P. 1993. Plant anatomy, S. Chand & Co, New Delhi.

Reference Books

1. Pullaiah, T., Lakshiminarayana, K. and HanumanthaRao, B. 2006. Text book of Embryology of Angiosperms. Regency Publications, New Delhi.
2. Bierhorst, D.W. 1971. Morphology of Vascular Plants. Macmillan publishers, New York.
3. Maheshwari, P. 1963. Recent Advances in Embryology of Angiosperms. Intl. Soc. Plant Morphologists, New Delhi.
4. Swanson, P. and Webster, P. 1977. The Cell. Prentice Hall, Inc. Englewood Cliffs, New Jersey, USA.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. https://www.askiitians.com/biology/sexual-reproduction-in-flowering-plants/
2. https://www.easybiologyclass.com/plant-anatomy-online-tutorials-lecture-notes-study-materials/
3. Introduction to Developmental Biology. https://swayam.gov.in/nd1_noc20_bt35/preview
4. Kishore, K. 2015. Polyembryony in Horticulture and its significance. https://www.researchgate.net/publication/316438576_Polyembryony_in_Horticulture_and_its_significance
5. Morphogenesis (https://www.youtube.com/watch?v=YVvUPQUjSNE)
6. Structural Organization: Anatomy of flowering Plants – 1 (https://www.youtube.com/watch?v=WfURKyslthI)

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	H	H	L	H	L	M	L	M	M	H	H	H
CO2	H	M	L	H	L	H	M	M	H	M	H	H
CO3	M	H	L	M	L	M	M	M	H	M	H	M
CO4	H	M	L	H	L	M	L	L	L	M	M	M
CO5	M	H	M	H	M	H	L	H	H	M	H	H

H-High M- Medium L –Low

Course Designed by	Verified by HOD	Checked & Approved by
Name and Signature	Name and Signature	CDC & COE
Name: Dr. A. M. Anandakumar Signature:	Name: Dr. R. Rakkimuthu Signature:	Name: Mr. K.Srinivasan Signature:

Programme code	M.Sc.	Programme Title : Master of Science in Botany		
Course Code: 25PBY206		Title: Core -VI Plant Physiology	Batch	2025 -2027
			Semester	II
Hrs/Week:	6		Credits	4

Course Objectives

The main objectives of this course are to:

- Learn physiological mechanisms underlying plant metabolism.
- Be familiar with the phytohormones and its metabolism in plants generating plantgrowth.
- Study about the movements in plants.
- Know the various responses of plants against stress and its mechanism of resistance.

Course Outcomes (CO)

On the successful completion of the course, student will be able to:		
CO1	Remember the basic metabolism in plants	K1
CO2	Deduce the biological pathways	K2
CO3	Execute the molecular based modification of metabolism in plants	K3
CO4	Able to identify the plant stress based on its responses and anti-oxidative defense.	K4
CO5	Validate the plant physiological scientific hypothesis by using various experiments	K5
K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate		

Unit	Content	Hrs
Unit I	Plant- water relations: imbibitions, diffusion and osmosis - water potential and chemical potential - absorption of water - water transport through xylem - transpiration and its significance - **factors affecting transpiration* - *physiology of stomatal movement* - transport of photosynthate - the mechanism of translocation in the phloem, assimilate partitioning.	**17**
Unit II	Signal transduction: overview - receptors and G-proteins - jasmonic acid signaling - Calcium and protein signalling. Mineral nutrition: Criteria of essentiality of elements; macro and micro - nutrients; role of essential elements; mineral deficiency symptoms and plant disorders - nutrient uptake and transport mechanism - role of cell membrane, ion pump carrier.	**19**
Unit III	Photosynthesis: Photosynthetic pigments - accessory pigments and photoprotective carotenoids - reaction center complexes - photochemical reactions - electron transportpathways in chloroplast membrane - photo phosphorylations - C3 cycle, photorespiration and C4 cycle - crassulacean acid metabolism.	**18**
Unit IV	Respiration: Glycolysis - TCA cycle and its regulation - aerobic and anaerobic respiration - electron transport in mitochondria - redox potential - oxidative phosphorylations - pentose phosphate pathway. nitrogen metabolism: importance of nitrogen to plants - nitrogen cycle - biological nitrogen fixation - *nif* gene - nitrate assimilation GDH and GS/GOGAT pathway - biosynthesis of nitrogen - radical scavenging activity	**18**

Unit V	Growth and development: Kinetics of growth - seed dormancy - seed germination and influencing factors of their regulation - the concept of photoperiodism - physiology of flowering - florigen concept - vernalization - biological clocks - physiology of senescence - fruit ripening. Photomorphogenesis: phytochromes and cytochromes, their discovery - physiological role and mechanism of action - *Stress physiology: Plant responses to biotic and abiotic stress, mechanism of biotic and abiotic stress tolerance.	**18**

**Self study topics*

Power point Presentations, Group discussions, Seminar, Quiz and Assignment.

Text Books

1. Pandey, S.N. and Sinha, B.K. 2010. Plant Physiology, Vikas Publishing, New Delhi.
2. Steward, F.C. 2012 Plant Physiology Academic Press, US
3. Jain, V.K. 2000. Fundamentals of Plant Physiology (5th ed.), S. Chand & Co Ltd; New Delhi.

Reference Books

1. Devlin, R.M. and Baker, N.R. 1973. Photosynthesis, Reinhold Affiliated East-West Press Pvt. Ltd, New Delhi.
2. Moore, T.C. 1979. Biochemistry and physiology of plant hormones. Narosa book Distributors, New Delhi.
3. Roberts, E.A. 1987. Plant growth regulators. Kluwer Academic publishers, London.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. https://apan.net/meetings/apan45/files/17/17-01-01-01.pdf
2. https://basicbiology.net/plants/physiology
3. https://learn.careers360.com/biology/plant-physiology-chapter/
4. https://swayam.gov.in/nd2_cec20_bt01/preview
5. https://www.nature.com/subjects/plant-physiology

PO/PSO ——— CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	H	H	H	H	M	M	H	L	M	L	H	L
CO2	H	H	M	H	L	M	H	L	L	L	H	L
CO3	H	M	M	H	M	H	H	H	H	M	H	M
CO4	H	H	H	H	M	H	M	L	H	L	H	M
CO5	H	H	H	H	M	H	H	M	M	H	H	M

H-High M- Medium L –Low

Course Designed by	Verified by HOD	Checked & Approved by
Name and Signature	Name and Signature	CDC & COE
Name: Mrs. D. Sowmiya Signature:	Name: Dr. R. Rakkimuthu Signature:	Name: Mr. K.Srinivasan Signature:

Programme code	M.Sc.	Programme Title: Master of Science in Botany		
Course Code: 25PBY207		Title : Core – VII Cytology, Genetics and Plant Breeding	Batch	2025 -2027
			Semester	II
Hrs/Week:	5		Credits	4

Course Objectives

The main objectives of this course are to:

- Enable to learn various cell structures and functions of prokaryotes and eukaryotesand understand the salient features and functions of cellular organelles.
- To study the fundamental principles of Genetics and understand the structure, function and changes in the genetic materials.
- To learn the principles of Plant Breeding and the application of molecular techniquesin crop improvement.

Course Outcomes (CO)

On the successful completion of the course, student will be able to:		
CO1	Remember the general features and organization of Ultra structure of cell wall and cell organelles in prokaryotes and eukaryotes	K1
CO2	Understand the structure and function of cell organelles in prokaryotes and eukaryotes	K2
CO3	Gain knowledge on chromosome structure and cell cycle process	K3
CO4	Gain knowledge on various types of genes and mutation	K3
CO5	Learn the different principles of plant breeding and the application of molecular marker techniques in crop improvement	K4
K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** – Evaluate		

Unit	Content	Hrs
Unit I	**Cytology:** Cell structure- organization of prokaryotic and eukaryotic cell - Cell wall - nucleus- mitochondria - Golgi bodies - lysosomes- endoplasmic reticulum- peroxisomes- plastids - vacuoles - structure and function of cytoskeleton – fine structure of DNA and RNA -Chromosome: Structure and types - overview of mitosis and meiosis - regulations of cell cycle.	**16**
Unit II	**Genetics:** Mendelian and non Mendelian inheritance - interaction of genes, complementary genes, epistasis, multiple factor inheritance - Sex- linked inheritance - theories of sex determination - sex determination in plants - linkage and crossing over - kinds of linkage – significance - types of crossing over mechanism- models for homologous recombination - Construction of genetic map - two point test cross- three point test cross- cytoplasmic male sterility in plants	**16**
Unit III	Classification of mutations - spontaneous and induced mutations – physical and chemical mutagens - molecular basis of gene mutation - chromosomal aberrations - epigenetics - genetic code - DNA as a genetic material. - gene regulatory mechanisms (prokaryotes & eukaryotes)	**14**
Unit IV	**Plant Breeding**: Introduction to breeding of cultivated plants - objectives of breeding - polyploidy and haploids in plant breeding –double haploid-Selection – mass selection - pureline selection - clonal selection merits and demerits - **Improvement of crop plants by pedigree method, bulk method, backcross method*	**14**

Unit V	Intervarietal, interspecific and intergeneric hybridization - heterosis - hybrid vigour - marker assisted breeding - **national and international organizations for crop improvement* - protection of plant varieties & farmers rights Act, India - Dus - Germplasm - The role of IBPGR and NBPGR -germplasm conservation (Rice and Sugarcane).	**15**

**Self study topics*

Power point Presentations, Seminar and Assignment

Text Books:

1. Singh, B.D. 2015. Plant Breeding: Principles and Methods. Kalyani Publications, Chennai, India
2. Sambamurthy A.V.S.S, 2005. Genetics, Published by Narosa Publishing House.
3. Sukhla R.M. 2012. Molecular Genetics, Published by Wisdom Press.
4. Verma P.S. and Agarwal V.K. 1999. Concept of Genetics, Human Genetics and Eugenics, Published by S Chand & Company Pvt Ltd.
5. Sinha, U. and SunitaSinha 1998. Cytogenetics, Plant breeding and evolution. Vikas Publishing House Private, Limited.
6. Gupta, P.K. 1994. Genetics, Rashtogi Publication, Meerut, India.

Reference Books:

1. Chaudhary, R.C. 2001. Introduction to Plant Breeding, India Book House Pvt Ltd
2. Lodish, *et al.* 2000. Molecular and Cell Biology. W.H. Freeman & Co. New York.
3. Allard, R.W. 1960. Principles of Plant Breeding, John Wiley and Sons, Inc. New York.
4. Gilber, N.W. 1978. Organellar heredity, Revan press, New York.
5. Simmonds, N.W. 1979. Principles of Crop improvement. Longman, London.
6. Strickberger, M.V. 1977. Genetics, Macmillan publishers, New York.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. Animations: https://www.videezy.com/free-video/genetic
2. Lecture Notes: https://www.mysciencework.com/publication/download/lecture-notes-cell-biology
3. Plant Breeding; https://www.youtube.com/watch?v=1WuwwYcDHMg
4. PPT slides: https://www.slideshare.net/earshadshinichi/cell-biology-the-cell-its-structure-and-history
5. Video lecture: https://www.youtube.com/watch?v=OIN4keY8q3k

PO/PSO / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	L	M	L	M	M	L	L	H	L	M	M	M
CO2	L	M	L	M	M	M	L	H	L	M	M	M
CO3	M	M	H	L	M	H	H	L	L	M	H	H
CO4	L	H	L	L	H	L	H	M	L	L	H	H
CO5	L	H	M	L	H	L	H	M	L	L	H	H

H-High M- Medium L –Low

Course Designed by	Verified by HOD	Checked & Approved by
Name and Signature	Name and Signature	COE & CDC
Name: Dr. R. Rakkimuthu Signature:	Name: Dr. R. Rakkimuthu Signature:	Name: Mr. K.Srinivasan Signature:

Programme code	M.Sc.	Programme Title: Master of Science in Botany		
Course Code: 25PBY208		Title : Core – VIII Laboratory course– II (Plant Anatomy and Embrology, Plant Physiology, Cytology, Genetics and Plant Breeding)	Batch	2025 -2027
			Semester	II
Hrs/Week:	6		Credits	5

Course Objectives

The main objectives of this course are to:

- Get knowledge on plant and water relations, chromatographic techniques and *in vitro* antioxidants quantification.
- Gain knowledge on various plant anatomical features through free hand sections,microtome sections and maceration method.
- Get adequate knowledge in internal structure of anther, pollen types and germination behaviors, L.S. of ovule, types of endosperms and dicot embryo dissection.
- Observe the different stages of mitosis and chromosome behaviour and organizationduring various stages and to learn staining techniques of various plant tissues.
- Understand the principles of genetics and plant breeding to apply crop improvement programmes.

Course Outcomes (CO)

On the successful completion of the course, student will be able to:		
CO1	Recall or remember the various aspects of plant physiology, embryology, plant tissue culture, anatomy and cytology	K1
CO2	Understand and apply various concepts of plant physiology, embryology, anatomy and cytology.	K3
CO3	Analyze the theory knowledge gained from Plant Anatomy and Reproductive Biology, Plant Physiology, Cytology into practical mode in order to acquire applied knowledge by hands-on experiences.	K4
CO4	Analyze or interpret the results achieved in practical session in the context of existing theory and knowledge	K4
CO5	Evaluate the theory and practical skills gained during the course to make any new product	K5
K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate		

Part	Content	Hrs
Part 1	**Anatomy** 1. Demonstration of process of Staining for various plant sections 2. Sectioning of Primary structure of dicot and monocot stem (*Tridax procumbens, Zea mays*) 3. Sectioning of dicot stem for Normal secondary thickening *4.* Sectioning of stems for Anomalous secondary thickening Multiple and successive cambial rings – *Boerhaavia* Included or inter xylary phloem – *Achyranthes* Intra xylary phloem/Ridged xylem – *Bignonia* Inverted cortical bundles – *Nyctanthes* 5. sectioning of monocot stem for secondary growth in *Dracaena* sp.	**45**

	6. Identification of stomatal types of various plant leaves 7. Sectioning of T.S of dicot leaf to study the Dorsiventral & isobilateral (*Nerium*) leaves 8. Sectioning of T. S. of monocot leaf using Bamboo or grass leaves. 9. Maceration of plant tissues to understand the anatomical nature 10. Demonstration of microtome and process of microtomy Prepare five permanent slide using standard staining and mounting procedures.	
Part 2	**Reproductive Biology** 1. Study on morphological features of pollens of various flowers 2. Estimation of pollen germination 3. Test for pollen viability using acetocarmine method 4. Charts on types of ovules 5. Display the mature embryo sac for its characters. 6. Observation of various types of endosperm 7. Dissection of embryos – dicot, monocot and polyembryony	
Part 3	**Plant Physiology** 1. Determination of DPD of plant tissues by plasmolytic method 2. Extraction and estimation of chlorophyll. 3. Separation of plant pigments by Thin Layer Chromatography. 4. Determination of stomatal frequency and stomatal index. 5. Measurement of respiration by simple respiroscope. 6. Hill reaction by isolated chloroplasts (demonstration). 7. Estimation of Nitrate reductase activity. 8. Determination of Total antioxidant activity by phosphomolybdenum reduction method. 9. Determination of Superoxide radical scavenging activity	**30**
Part 4	**Cytology, Genetics And Plant Breeding** 1. Preparation of slide for Mitotic study from *Allium cepa* root tips 2. Preparation of slide for meiotic study from flower bud 3. Problems in Mendelian and non – Mendelian inheritance 4. Problems in Mutation –Gene code alteration 5. Charts on plant breeding techniques- Emasculation, Bagging, Mass selection, Pureline selection and clonal selection	**15**

Ultrascopic images, Group discussions, Sectioning, Experimental setups and Genetic problems

PO/PSO ——— CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PSO1**	**PSO2**
CO1	H	H	H	H	H	M	H	H	M	H	H	M
CO2	H	H	H	H	H	H	H	H	L	H	H	M
CO3	H	H	H	H	H	H	M	H	M	H	H	H
CO4	H	H	M	H	H	H	L	L	L	H	H	H
CO5	H	H	H	M	M	M	H	H	M	H	H	M

H-High M- Medium L –Low

Course Designed by	Verified by HOD	Checked & Approvedby
Name and Signature	Name and Signature	CDC & COE
Name: Dr. A. M. Anandakumar Signature:	Name: Dr. R. Rakkimuthu Signature:	Name: Mr. K.Srinivasan Signature:

Programme code	M.Sc.	Programme Title : Master of Science in Botany		
Course Code: 25PBY2E3		Title : Elective -II Horticulture and Landscaping	Batch	2025 -2027
			Semester	II
Hrs/Week:	5		Credits	4

Course Objectives

The main objectives of this course are to:

- Know about the brief history, divisions, classification and structure of horticultural plants.
- Understand the plant growth environment in relation to soil, nutrients, fertilizers, and bio inoculants.
- Study the sexual and vegetative propagation methods including propagation through specialized vegetative structures.
- Highlight the aesthetics of horticulture and postharvest handling of horticultural products.

Course Outcomes (CO)

On the successful completion of the course, student will be able to:		
CO1	Understand about the importance of horticulture	K2
CO2	Apply knowledge on soil, climate and reclamation of soil	K3
CO3	Apply and analyze knowledge on crop establishment activities	K3,K4
CO4	Analyze plant growth structures in horticulture	K4
CO5	Understand about the importance of bio-organic fertilizers and crop establishment methods	K2,K5
K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate		

Unit	Content	Hrs
Unit I	Brief history - scope and importance - divisions of horticulture - Classification of horticultural plants - Plant growth environment: biotic and abiotic factors - primary and secondary nutrients and their functions	**15**
Unit II	Organic matter; fertilizers - organic, inorganic and potting media; bio-inoculants; methods of fertilizer application; irrigation types- sprinkler irrigation, trickle irrigation- surface, furrow, surge, pitcher. directing plant growth - pruning and thinning- mixed and intercropping	**15**
Unit III	Plant propagation: Seeds - advantages, viability, mechanism of dormancy and dormancy breaking methods - direct and indirect seedling production in nurseries and transplantation - medicinal plant cultivation - adaptive cultivation-Green house concept.	**15**
Unit IV	Propagation through specialized underground structures - corm, tuber, sucker, bulb, bulbil, rhizome; vegetative propagation - cutting, layering, grafting and budding. Soil- less production of horticultural crops - hydroponics, sand culture, gravel culture, terrace garden, rockery, vertical gardening.	**14**
Unit V	Esthetics of horticulture - design; elements and principles of design; flower arrangement - cut flowers - Significance of cut flower industry in India; terrarium culture; bonsai; growing plants indoors; turf production-landscaping . Post-harvest handling of Horticultural products - harvesting;	**16**

	**storage; processing* - pomology - cultivation of apple and pineapple. Commercial floriculture – cultivation of jasmine and rose. Commercial horticulture - extraction of Jasmine concrete and papain- fruit and vegetable carving techniques.	

**Self study topics*

Power point Presentations, Group discussions, Seminar, Quiz, Assignment, Field study

Text Books :

1. Adams, C.R. and M. P. Early. 2004. Principles of horticulture. Butterworth – Heinemam, Oxford University Press.
2. Bansil. P.C. 2008. Horticulture in India. CBS Publishers and Distributors, New Delhi.
3. Kumar, N.2020. Introduction to Horticulture, Published by Oxford &Ibh Publishing Co PvtLtd.New Delhi.

Reference Books:

1. Bose, T.K., Maiti, R.G., Dhua, R.S. and Das, P. 1999. Floriculture and Landscaping. NayaProkash, Calcutta.
2. Denisen, E.L. 1979. Principles of Horticulture. MacMillan Publishing co, Inc. New York.
3. Janik, J. 1972. Horticultural Science. W.H. Freeman & Company, San Francisco. Tolanus, S. 2006. Soil fertility, Fertilizer and Integrated Nutrient management.International Book Distributory Co

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. https://ncert.nic.in/textbook/pdf/ievs101.pdf
2. https://www.youtube.com/watch?v=rgc2UnxJhNI
3. https://www.slideshare.net/biologyexams4u/horticulture-introduction-definition-and-branches-of-horticulture

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	H	M	H	H	H	M	H	H	M	H	H	H
CO2	M	H	M	H	L	H	L	M	H	H	L	L
CO3	M	M	M	M	M	L	H	H	L	M	M	M
CO4	H	H	H	M	M	H	M	H	M	H	M	H
CO5	M	H	H	M	H	M	H	L	M	H	M	H

igh M- Medium L –Low

Course Designed by	Verified by HOD	Checked & Approved by
Name and Signature	Name and Signature	COE & CDC
Name: Dr. P. Sathishkumar Signature:	Name: Dr. R. Rakkimuthu Signature:	Name: Mr. K.Srinivasan Signature:

Programme code	M.Sc.	Programme Title : Master of Science in Botany		
Course Code: 25PBY2E4		Title : Elective – II Applied Botany	Batch	2025 -2027
			Semester	II
Hrs/Week:	5		Credits	4

Course Objective

The main objectives of this course are to:

1.Study the role of microbes and forest types in the commercial production

2. Know the methods of plant breeding and the importance of Biosafety, Bioethics and IPR

3. Learn the principles and application of genetic engineering and molecular markers for human welfare

Course Outcomes (CO)

On the successful completion of the course, student will be able to:		
CO1	Understand the concept of Stoichiometry of microbial growth for production formation through fermentation process	K1
CO2	Know the knowledge of social forestry, Agroforestry and Silviculture for commercial productions.	K2
CO3	Analyse the principles of immune system, immunizing agents like antibodies and vaccines and gene therapy methods	K3
CO4	Gain an insight into the methods of plant breeding the biosafety, Bioethics and IPR and farmers rights towards product development and commercial production	K4
CO5	Enhance the knowledge and skills needed for self-employment using the plants and microbial derived products	K5
K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate		

Unit	Content	Hrs
Unit I	Microbial growth – Quantification of microbial rates - Stoichiometry of microbial growth and product formation, Fermentation process: Mode of operation of fermentation process - Design and operation of Fermenters (Packed bed reactor, Bubble column reactor, Scale up of Bioreactor) - Down Stream processing - Recovery of product- Application of fermentation. Biosensors: General principle, Types of biosensors, Biochips, Microarrays, FISH - Application of modern sensor technologies	**15**
Unit II	**FOREST AND SOCIAL FORESTRY:** Forest: Components of forest - Types and classification of forest - Ecological and economic importance of forest - Afforestation and Deforestation - Chipko movements - forest production act - forest conservation methods. Social Forestry: scope, objectives and types - Silviculture and Agroforestry - Application of social forestry - Forest products - major and minor Forest Products	**15**
Unit III	Plant improvement: Concepts and Scope of Plant breeding - Methods of plant breeding - Selection: Pure line and clonal selection; Hybridization: Mutation breeding. rDNA Technology: Scope of Plant transgenics - Plant transformation techniques for crop improvement. Molecular markers: DNA finger printing - Genetic markers - SSR, ISSR. cDNA Library, PCR techniques - Genome sequencing (Automated, Pyrosequencing. and Next-generation).	**14**
Unit IV	The immune system: Principles of application – Types of immunity: Active, Innate, Adaptive – Antibodies – Immunizing agents: Passive and Active, Replicating and non-replicating vaccines – Antibody response to vaccine, Factors influencing the vaccine immune response - Immunodiagnostics: ELISA. Genomics and its application – Gene therapy (In vivo and In vitro)	**16**

Unit V	Biosafety: Introduction, guidelines and regulation (Government of India), biosafety issues in biotechnology - historical background; GMOs – Definition and application in food and Agriculture; Roles of Institutional Biosafety Committee, RCGM, GEAC. Bioethics: Introduction, benefits and risk of genetic engineering - Bioethics - framework for ethical decision making - Ethical, legal and social issues of GMOs. IPR: patents – trademarks - copyrights and industrial design; Plant variety certification and protection - Farmers rights: Protection of Plant varieties and Farmers Authority of India	**15**

**Self study topics*

Power point Presentations, Group discussions, Seminar, Quiz, Assignment, Field study

Text books:

1. Stanbury, P.E. and Whitaker, A. 1984. Principles of Fermentation Technology Pergamon Press, Oxford Press, London, UK.
2. Sagriya, K.P. 1997. Forests and Forestry, National Book Trust, New Delhi, India
3. Arora, M.P. 2010. Immunology. Ane Books Pvt., Ltd. New Delhi, India.

Reference Books:

1. Sinha, J.K. and Bhattacharaya, S. 2006. Immunology. Academic Publishers, Kolkata, India.
2. BAREACT, Indian Patent Act 1970 Acts & Rules, Universal Law Publishing Co. Pvt. Ltd., 2007.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. Microbial growth Lecture Notes: https://silo.tips/download/chapter-6-lecture-notes-microbialgrowth
2. Agroforestry YouTube Vides: https://www.youtube.com/watch?v=MZ6No1mL1QM
3. Types of vaccine YouTube Vides: https://www.youtube.com/watch?v=-Qu2ROOfpLc
4. IPR: Patent and Copy Right PPT slides: https://www.slideshare.net/prreeem/patent-ppt

PO/PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PSO1**	**PSO2**
CO1	H	H	M	L	M	L	M	M	L	L	M	M
CO2	M	M	L	L	L	H	L	M	H	L	M	M
CO3	M	M	H	L	L	L	M	H	M	L	L	H
CO4	L	H	M	M	M	H	L	L	L	L	M	M
CO5	M	M	M	L	H	L	M	L	M	S	M	H

H-High M- Medium L -Low

Course Designed by	Verified by HOD	Checked & Approved by
Name and Signature	Name and Signature	CDC & COE
Name: Dr. R. Rakkimuthu Signature:	Name: Dr. R. Rakkimuthu Signature:	Name: Mr. K.Srinivasan Signature:

Programme code	M.Sc.	Programme Title : Master of Science in Botany		
Course Code: 25PBY2N1		Title : Non Major Elective-1 Plants in Tamil Culture	Batch	2025 -2027
			Semester	II
Hrs/Week:	2		Credits	2

Course Objective

The main objectives of this course are to:
- Elaborates antiquity of Tamil land
- Emphasizes relationship between Tamil people and plants
- Usage of plants are supported by Tamil literature

Course Outcomes (CO)

On completion of this course, the students will be able to:		
CO1	understand and manage plants based on earlier literature	K2
CO2	Apply knowledge to conserve plants as sacred and would utilize plants as sustainable manner	K3
CO3	Apply and analyze knowledge on plantsusedinSangamLiterature	K3,K4
CO4	Analyze plant used in Tamil culture	K4
CO5	Understand about the importance of Plants Relevant to Astrological and influence of plants present-day	K2&K5
K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** – Evaluate		

Unit	Content	Hrs
Unit I	**Land, People and Literature**: Antiquity of Tamil land – occurrence of Paleolithic, Mesolithic, Neolithic and megalithic sites of human settlement- Landscape and vegetation and rainfall patterns.	**6**
Unit II	**A Brief Introduction to Sangam Literature**: Plants in "Kurinjipattu".Tinai as landscape and ecosystem conceptImportance of plants in five landscapes: Mullai, Marutham, Kurinji, Neythal and Palai.	**6**
Unit III	**Plants in Tholkkapiyam**: Plants used in early Tamil culture as food and economy. Plants in love and war.	**6**
Unit IV	**Sacred Plants**: Sacred plants associated with gods, temple, religion and rituals. Plants and poetic convention. Recent plant introductions and their adoption in Tamil culture.	**6**
Unit V	**Plants Relevant to Astrological Importance**: Constellation (Rasi) and star plants- the continuing influence of plants present-day Tamil culture	**6**

Power point Presentations, Group discussions, Seminar, Quiz, Assignment and Field visit

Text Books :

1. Hart, G.L. III. 1975. The Poems of Ancient Tamil. Their Milieu and Their Sanskritic Counterparts. University of California Press, Berkeley.
2. Ramanujam, A.K. 1975. The Interior Landscape: Love Poems from a Classical Tamil Anthology. Fitzhenry and Whiteside Limited. Ontario.

References:

1. Samy, P.L. 1967. SangaIllakkiathil Sedikodi Vilakkam. Saiva Siddhanta Publishing Society. Thirunelveli.
2. Samy, P.L. 1972. Plants in Kurinji Pattu. Journal of Tamil Studies.
3. Sasivalli, V.C. 1989. Pandai Tamilar Tolilkal. International Institute of Tamil Studies. Madras.
4. Sobidhraj, K.K.S. 1993. Thala Marangal. Sobitham. Tambaram East. Madras.
5. Srinivasan, C. Sanga IlakiaThavarangal, Tamil University Publication. Thanjavur.
6. Thaninayagam, X.S. 1966.Landscape and Poetry: A study of Nature in Classical Tamil Poetry. Asia Publishing House, Madras.
7. Varadarajan, M. 1957. The treatment of Nature in Sangam literature. S.I.S.S.W Publishing Society, Madras

Related Online Contents

1. WWW. Thavarathagavalmaiyam.com
2. WWW.plantinfocentre.com

PO/PSO ——— CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	H	M	H	H	H	M	H	H	M	H	H	H
CO2	M	H	M	H	L	H	L	M	H	H	L	L
CO3	M	M	M	M	M	L	H	H	L	M	M	M
CO4	H	H	H	M	M	H	M	H	M	H	M	H
CO5	M	H	H	M	H	M	H	L	M	H	M	H

H- High M- Medium L -Low

Course Designed by	Verified by HOD	Checked & Approved by
Name and Signature	Name and Signature	CDC & COE
Name: Dr. P. Sathishkumar Signature:	Name: Dr. R. Rakkimuthu Signature:	Name: Mr. K.Srinivasan Signature:

Programme code	M.Sc.	Programme Title : Master of Science in Botany		
Course Code: 25PBY2N2		Title : Non Major Elective-1 Plant Tissue Culture	Batch	2025 -2027
			Semester	II
Hrs/Week:	2		Credits	2

Course Objective

The main objectives of this course are to:
1. Principles and culture techniques of cells, callus, organs, pollen, anthers, embryos, and protoplasts.
2. Applications in clonal propagation and research in breeding, physiology, and pathology.

Course Outcomes (CO)

On completion of this course, the students will be able to:		
CO1	Recall or remember the principles and culture techniques of cells, callus, organs, pollen, anthers, embryos, and protoplasts.	K1
CO2	Understand the techniques used in plant growth and regeneration under *in vitro* conditions	K2
CO3	Apply clonal propagation and research techniques in plant breeding, physiology, and pathology.	K3
CO4	Analyze the conditions that are suitable for direct and indirect plant regeneration.	K4
CO5	Compare the performance of in vitro raised plantlets with those of in vivo raised plants.	K5
K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** – Evaluate		

Unit	Content	Hrs
Unit I	**FUNDAMENTALS OF PLANT TISSUE CULTURE**: Totipotency of plant cells, Introduction to plant tissue culture, explant selection and medium composition and plant growth regulators, In vitro culture: physical, genetic, chemical and genotypic factors. Assessment of growth and development in vitro. Problems in plant tissue culture (Recalcitrance, Contamination, Phenolic Browning, and Seasonal Variation).	**6**
Unit II	**TISSUE CULTURE MEDIUM PREPARATION**: Introduction to plant tissue culture, lab facilities and operations, tissue culture media: preparation and handling, establishing aseptic cultures	**6**
Unit III	**PLANT REGENERATION:** Role of plant growth regulators, micropropagation via axillary and adventitious shoot proliferation; organogenesis, Somatic embryogenesis	**6**
Unit IV	**TECHNIQUES IN PLANT TISSUE CULTURE**: Double haploid production by androgenesis and gynogenesis; production of virus free plants by meristem, shoot-tip culture; Cell suspension cultures; protoplast isolation and regeneration	**6**
Unit V	**Application:** Somatic hybridization and cybridization; Protoclonal, Somaclonal variation for crop improvement; Synthetic seed technology and Cryopreservation. Hardening and acclimatization of tissue culture plants in Green house.	**6**

Power point Presentations, Group discussions, Seminar, Quiz, Assignment and Field visit

Text Books :

1. Bhojwani, S.S. and Razdan, M.K. 2004. Plant Tissue Culture: Theory and Practice. Revised Edition, Elsevier Publication, Amsterdam.
2. Srivastava, P.S. 1998. Plant Tissue Culture and Molecular Biology. N.R. Book Distributors, New Delhi

References:

1. Dixon, R.A. and Gonzales, R.A. 1994.Plant cell culture: A Practical approach, 2 nd ed. Oxford University Press, UK.
2. George, E.F. 1999. Plant Propagation by Tissue Culture: Volume 1 & 2. Exegetics Limited, Worcester, UK.

Related Online Contents

1. https://nptel.ac.in/courses/102/103/102103016/
2. http://ugcmoocs.inflibnet.ac.in/ugcmoocs/spoc.php?coordinator=574
3. https://www.youtube.com/watch?v=bi755vQVNx8

PO/PSO ——— CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	H	M	H	H	H	M	H	H	M	H	H	H
CO2	M	H	M	H	L	H	L	M	H	H	L	L
CO3	M	M	M	M	M	L	H	H	L	M	M	M
CO4	H	H	H	M	M	H	M	H	M	H	M	H
CO5	M	H	H	M	H	M	H	L	M	H	M	H

H- High M- Medium L -Low

Course Designed by	Verified by HOD	Checked & Approved by
Name and Signature	Name and Signature	CDC & COE
Name: Dr. P. Sathishkumar Signature:	Name: Dr. R. Rakkimuthu Signature:	Name: Mr. K.Srinivasan Signature:

Programme code	M.Sc.	Programme Title : Master of Science in Botany		
Course Code:25PBY309		Title : Core - IX Plant Taxonomy of Angiosperms and Economic Botany	Batch	2025 -2027
			Semester	III
Hrs/Week:	6		Credits	4

Course Objectives

The main objectives of this course are:

- To know about the basic concepts and principles of plant systematics.
- To establish a suitable method for correct identification and adequate characterizationof plants.
- To be aware of the importance of taxonomic relationships in plant systematic studies.
- To enable knowledge on various classification systems

Course Outcomes (CO)

On the successful completion of the course, student will be able to:		
CO1	Remember the basic principles of systematics, including identification, nomenclature, classification, and the inference of evolutionary patterns from data.	K1
CO2	understand of evolutionary processes and patterns in the major plant groups	K2
CO3	Apply scientific terminology accurately through effective oral and written communication and the use of dichotomous keys in a regional floristic manual.	K3
CO4	Analyze and ability to handle plant materials in the laboratory and herbarium and in the field.	K4
CO5	Evaluate the medicinal and economic importance of plants.	K5
K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate		

Unit	Content	Hrs
Unit I	**Taxonomy and Systematics** : Botanical exploration and contribution with special reference to India by William Roxburgh, J.D. Hooker, Robert Wright, Nathanial Wallich and Gamble, J.S. Principles of classification as proposed - Artificial - Linnaeus, Natural - Bentham and Hooker, Phylogenetic system - Hutchinson, Modern - Takhtajan. Angiosperm Phylogeny Group (APG – IV). Botanical gardens and herbaria of world, preparation and maintenance of Herbarium, Botanical survey of India - its organization and role.	**19**
Unit II	**Modern trends in taxonomy -** Modern trends in taxonomy, chemotaxonomy, numerical taxonomy, biosystemics. ICBN uninominal systems- genesis binomial nomenclature, importance and principle. Important articles, typification, principles of priority, effective and valid publication, author citation, recommendations and amendents of code. Glossories and dictionaries, Taxonomic literature (Index Kewensis)	**18**
Unit III	**Systematic analysis of plants-I:** Polypetalae - Nympheaceae, Portulaceae, Zygophyllaceae, Oxalidaceae, Tiliaceae, Lythraceae, Rhamnaceae, Sapindaceae, Combretaceae, Cactaceae	**17**
Unit IV	**Systematic analysis of plants-II:** Gamopetalae – Sapotaceae, Oleaceae, Plumbaginaceae, Boraginaceae, Pedaliaceae, Bignoniaceae, Verbenaceae. Monochlamydeae – Moraceae, Loranthaceae, Nyctaginaceae. Monocots –	**18**

	Commelinaceae, Liliaceae, Orchidaceae, Poaceae and Cyperaceae.	
Unit V	**ECONOMIC BOTANY -** General account on utilization of selected crop plants: (i) Cereals (rice and wheat) – (ii) Pulses (red gram and black gram), (iii) Drug yielding plants (Withania somnifera and Coleus aromaticus) (iv) Oil yielding plants (Groundnut, Coconut). (v) Sugar yielding plants (sugarcane and Stevia), (vi) Spices and condiments (cardamom, cinnamon). (vii) Commercial crops - fibre (coconut), (viii) Timber (Teak, Melia azedarach and red sanders wood), (ix) Resins and gums (Asafoetida and gum arabic) - (x) Essential oils (lemon grass and Eucalyptus), (xi) Beverages (Cassia auriculata and lemon grass), (xii) Plants used as avenue trees for shade, pollution control and aesthetics (xiii) Energy plantation - uses of Casuarina	**18**

**Self study topics*

Power point Presentations, Group discussions, Seminar ,Quiz, Assignment, Case study

Text Books:

1. Gamble J.S. 2012. Flora of the Presidency of MadraVolI ,II, III, Revized edition, Pragun Publications.
2. Pandey B.P. 2001. Taxonomy of Angiospersm, S.Chand (G/L) & Company Ltd; New edition.
3. Singh V and Jain K. 2009. Taxonomy of Angiosperms, Rastogi Publication
4. Jones B., 1987. Plant Systematics, McGraw-Hill, 1987
5. N.S. Subrahmanyam, 1997. Modern Plant Taxonomy, Vikas Publication House Pvt Ltd; First edition (1 January 1997).
6. Lawerance. H.M., 1962.Taxonomy of vascular plants.The Mac Millan& Co. publishers. 7. Pandey, S. N. and S. P. Misra, 2009. Taxonomy of Angiosperms.Ane Books Pvt. Ltd, New Delhi.

Reference Books:

1. Devis& Hey wood, 1963. Principles of angiosperm Taxonomy. Published by Oliver & Boyd, Edinburgh ; London.
2. Jain and R.R. Rao. 1926. A hand book of field and Herbarium methods, Today and Tomorrow Publications. New Delhi.
3. An update of the Angiosperm Phylogeny Group Classification for the Orders and Families of Flowering Plants: APG III. Botanical Journal of the Linnean Society, Volume 181, Issue 1, 1 May 2016, Pages 1–20.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. https://www.biologydiscussion.com/essay/angiosperms-essay/taxonomy-of-angiosperms-aims-and-principles-essay-botany/76587
2. https://www.youtube.com/watch?v=67RKWdWTnPA
3. https://www.easybiologyclass.com/angiosperm-systematics-and-taxonomy-free-online-study-materials-and-lecture-notes/
4. https://www.slideshare.net/avishekbhattacharjee7/flora-revision-and-monograph

PO/PSO ——— CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	H	H	H	H	M	H	M	H	H	H	H	M
CO2	H	H	H	M	M	M	H	L	M	L	M	M
CO3	H	H	M	H	L	H	M	H	H	L	M	H
CO4	H	M	H	H	M	H	M	L	M	H	M	H
CO5	H	H	M	H	L	H	L	H	H	H	M	M

H-High M- Medium L –Low

Course Designed by	Verified by HOD	Checked & Approved by
Name and Signature	Name and Signature	CDC & COE
Name: Dr. P. Sathishkumar Signature:	Name: Dr. R. Rakkimuthu Signature:	Name: Mr. K.Srinivasan Signature:

Programme code	M.Sc.	Programme Title : Master of Science in Botany		
Course Code: 25PBY310		Title: Core - X Plant Biochemistry and Biophysics	Batch	2025 -2027
			Semester	III
Hrs/Week:	6		Credits	4

Course Objective

The main objectives of this course are to:

- Emphasize functions of plants biomolecules and their metabolism.
- Learn structural and functional properties of carbohydrates, proteins and lipids.
- Study about the mechanism of enzyme action and inhibition.
- Provide specific knowledge of compounds and biochemical pathways that occur in plants.

Course Outcomes (CO)

On the successful completion of the course, student will be able to:		
CO1	Remember the fundamentals of biochemistry	K1
CO2	Get an idea on Biochemical pathways and its significance	K2
CO3	Learn the structure and functions of carbohydrates, Lipids, Proteins	K3
CO4	Analyze and apply the biomolecular techniques	K4
CO5	Execute the biophysical laws	K4
K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate		

Unit	Content	Hrs
Unit I	Basic principles: Structure of atoms, molecules and chemical bonds- ionic bond - covalent bond - Vander Vaal's forces- hydrogen bonding and hydrophobic and hydrophilic interactions - pH - pH scale - Henderson-Hasselbalch equation - buffers - definition- **biological role of buffer system*.	**17**
Unit II	Carbohydrates: Introduction, Structure and properties - metabolism - gluconeogenesis, glycogenolysis and glycogenesis - classification and properties of amino acids - biosynthesis and degradation of amino acids- structure, classification and properties of Protein - structure, classification and properties of lipids - biosynthesis and oxidation of fatty acids- types and benefit of fatty acids – plant waxes, cholesterol and lecithin.	**19**
Unit III	**Secondary metabolites**: shikimic acid pathway - classification, functions and biosynthesis of alkaloids, terpenoids, and polyphenolic compounds - plant pigments - structure, classification and functions of chlorophyll, anthocyanins, betacyanins, carotenoids and antho-xanthins.	**18**
Unit IV	**Enzymes**: Nomenclature, classification and properties - mechanism of enzyme action (Lock and key & induced fit model) and factors affecting enzyme activity (substrate, pH and temperature) - Michaelis - Menton kinetics - enzyme inhibition and its types - enzyme utilization in industry - **enzymes applications in medicine*.	**18**
Unit V	**Biophysics:** Energy flow - laws of thermodynamics – enthalpy and entropy - concept of freeenergy - energy transfer and redox potential. radio labeling techniques - properties of different types of radioisotopes normally used in biology, their detection and measurement -	**18**

	incorporation of radioisotopes inbiological tissues and cells - molecular imaging of radioactive material safety guidelines	

**Self study topics*

Power point Presentations, Seminar and Assignment

Text Books:

1. Satyanarayana, U. 2005. Biochemistry. Books and Allied (P) Ltd. Calcutta.
2. Satyanarayana, U. and chakrapani, U. 2005 Biochemistry, Books and Allied (P) Ltd. Calcutta.
3. Casey, E.J. 1962. Biophysics: Concepts and Mechanics. Van Nostrand Reinhold Co. and East-West Press, New Delhi.
4. Lehninger, A.I. 1987. Biochemistry, Kalyani Publishers, New Delhi
5. Veerakumari, I. 2004. Biochemistry, MJP Publishers, Chennai.
6. Meyyan R.P. Prasannakumar S *et al*., 1994. Elements of Biochemistry, Saras Publications, ARP Camp Road, Kottar, Nagercoil, KanyakumariDt,

Reference Books:

1. Campbell, M.K. 1999. Biochemistry, Saunders College Publishing, New York.
2. Harborne, J.B. 1999. Plant Biochemistry. Chapman & Hall, New Delhi. Jain, J.L. 2005. Fundamentals of Biochemistry. S. Chand & Co. New Delhi.
3. Plummer, D.T. 1996. An introduction to practical biochemistry. McGraw Hill.
4. Conn E.E. and P.K. Stumpf. 1987. Outlines of Biochemistry, Wiley Eastern Ltd, Chennai.
5. LubertStryer. 1986. Biochemistry, CBS Publishers, New Delhi.
6. Salil Bose, S. 1982. Elementary Biophysics. Vijaya Printers, Madurai.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. http://priede.bf.lu.lv/grozs/AuguFiziologijas/Augu_biokimija/Plant%20Biochemistry%204.pdf
2. http://www.brainkart.com/subject/Plant-Biochemistry_257/
3. https://swayam.gov.in/nd2_cec20_bt12/preview
4. https://www.biorxiv.org/content/10.1101/660639v2
5. https://www.scribd.com/document/378882955/Plant-Biochemistry-Lecture-Notes-Study-Materials-and-Important-questions-answers

PO/ PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	H	H	M	M	H	M	H	H	M	M	H	H
CO2	H	H	M	M	H	M	H	H	M	M	H	H
CO3	M	H	M	L	H	M	H	M	H	M	M	H
CO4	H	H	H	L	H	M	M	M	H	M	H	H
CO5	H	H	H	L	H	M	M	M	L	M	H	H

H-High M- Medium L –Low

Course Designed by	Verified by HOD	Checked & Approved by
Name and Signature	Name and Signature	CDC & COE
Name: Mrs. D. Sowmiya Signature:	Name: Dr. R. Rakkimuthu Signature:	Name: Mr. K.Srinivasan Signature:

Programme code	M.Sc.	Programme Title: Master of Science in Botany		
Course Code: 25PBY311		Title: Core – XI Plant Biotechnology	Batch	2025 -2027
			Semester	III
Hrs/Week:	6		Credits	4

Course Objectives

The main objectives of this course are to:

- Know about the Genome organization in plants
- Understand the Principles and culture techniques of cells, callus, organs, pollen,anthers, embryos, and protoplasts
- Know the applications of nanoparticals

Course Outcomes (CO)

On the successful completion of the course, student will be able to:		
CO1	Students will keep in mind the knowledge on techniques in plant tissue culture	K1
CO2	Understand the fundamentals of DNA Replication and central dogma of life	K2
CO3	Execute knowledge on molecular achievements in environmental stress management in plants	K3
CO4	Apply the basic concepts of Nanotechnology to synthesis the nanoparticles from plants	K3
CO5	Analyze the important of nanoparticles in Environment	K4
K1 – Remember; **K2** – Understand; **K3** – Apply; **K4** – Analyze; **K5** – Evaluate		

Unit	Content	Hrs
Unit I	**Essential Plant biology concepts for plant biotechnology:** Genome organization- mitochondrial genome organization- chloroplast genome organization- nuclear genome organization.-protein targeting- protein targeting to nuclear, mitochondria and chloroplast –molecular markers in plants (RAPD, RFLP, AFLP and SNP),	**17**
Unit II	DNA Replication (Eukaryotic and prokaryotic) – semi conservative mode of DNA replication –protein synthesis – Transcription – Translation - PCR – DNA sequencing methods (Sanger and Maxam and Gilbert)	**18**
Unit III	**Plant Tissue Culture:** History, Laboratory organization, sterilization methods – media preparation –micropropagation– meristem culture – callus culture – suspension culture- organogenesis – somatic embryogenesis – artificial seed preparation- cryopreservation. Haploid production – protoplast isolation and culture- somatic hybridization –cybrids–somoclonal variation.	**18**
Unit IV	Development of plant transformation cassettes – Structure and function of Ti plasmid of *Agrobacterium*– mechanism of T-DNA transfer to plants – Ti plasmid vectors for plant transformation – promoter and marker genes in plant transformation - **physical, chemical and biological method for plant gene transfer*– transgenic plants for viral resistance – herbicide tolerance – delay of fruit ripening – resistance to insects, pests and pathogens – ethics in plant biotechnology – IPR – copyright, Patent and Trade marks and Geographical indications (GI).	**19**

Unit V	Types of nanomaterials: nano rods, nanowires, nanoparticles, nanocapsules, nano membranes, nanomesh, nanofibres, nano catalysts, and carbon nano tubes – silver nano-particle synthesis– methods of preparation of nanomaterial: top down and bottom up approaches- emulsifiers, homogenizers, MOCVD. Environmental applications: Nano clays, nano adsorbents, zeolites, release of nutrients and pesticides, biosensors – green technologies - **treatment of industrial waste water using nano-particles.*	**18**

**Self study topics*

Power point Presentations, Seminar and Assignment

Text Books:

1. Slater A. Scott N. and Fowler M., 2008. Plant Biotechnology: The Genetic Manipulation of Plants. Oxford University Press Inc.
2. Lodish, H. 2008. Molecular Cell Biology. 6th ed.W. H. Freeman and Company, New York, USA.
3. Satyanarayanan U., 2007. Biotechnology.Books and Allied (P) Ltd., Kolkata.

Reference Books:

1. Mahesh S. 2008. Plant Molecular Biotechnology. New Age International Publishers.
2. Ramavat K.G. 2006 Plant Biotechnology S. Chand and Co. Ltd., New Delhi
3. Trivedi P.C. 2000. Plant Biotechnology – Recent Advances. Panima Publication Corporation, New Delhi
4. Lea, P.J, Leegood, R.C. 1993. Plant Biochemistry and Molecular Biology. Eds. John Wiley and Sons, Chichester and New York.
5. Ignacimuthu, S. 1998. Plant Biotechnology. Oxford and IBH publishers.
6. Reynolds P.H.S 1999. Inducible Gene Expression in Plants. CABI Publishing, U.K.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. https://www.youtube.com/watch?v=1LAKKvhVLms&list=PLKlDmF-iIyAlE_WaNGQU0wAnect COMvR1
2. https://www.youtube.com/watch?v=GsWo8dCivWs
3. https://www.youtube.com/watch?v=I4uaBXwaXXw
4. https://www.youtube.com/watch?v=47pkFey3CZ0
5. https://www.youtube.com/watch?v=XKboZQMCrB0
6. https://www.youtube.com/watch?v=BExZrIqlvWU
7. https://ocw.mit.edu/courses/biology/7-014-introductory-biology-spring-2005/

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	H	H	H	H	H	L	M	H	H	H	H	H
CO2	H	H	H	H	H	L	H	H	H	H	H	H
CO3	H	H	H	L	H	M	M	L	L	H	H	H
CO4	H	H	H	L	H	H	H	L	M	H	H	H
CO5	H	H	H	L	H	H	H	L	M	H	H	H

H-High M- Medium L –Low

Course Designed by	Verified by HOD	Checked & Approved by
Name and Signature	Name and Signature	CDC &COE
Name: Dr. R. Rakkimuthu Signature:	Name: Dr. R. Rakkimuthu Signature:	Name: Mr. K.Srinivasan Signature:

Programme code	M.Sc.	Programme Title: Master of Science in Botany		
Course Code:25PBY312		Title : Core – XII Laboratory course – III Taxonomy of Angiosperms and Economic Botany,Plant Biochemistry and Biophysics and Plant Biotechnology	Batch	2025 -2027
			Semester	III
Hrs/Week:	6		Credits	5

Course Objectives

The main objectives of this course are to:

- Understand and develop skill sets in plant morphological, floral characteristics andartificial key preparation
- Expedite skilled workers to carry out research in frontier areas of plant sciences
- Understand the basic principle and methodology in biochemistry experiments
- Expose the students to gain recent advances in molecular biology and plant biotechnology

Course Outcomes (CO)

On the successful completion of the course, student will be able to:		
CO1	Identify salient features of families	K3
CO2	Understand about different floral characteristics and artificial key preparation which employed for plant identification and conservation	K4, K5
CO3	Apply the various techniques to produce disease free plants	K3
CO4	Analyze the conditions that are suitable for direct and indirect plant regeneration	K4
CO5	Analyze the plants for its biochemical components	K4
K1 – Remember; **K2** – Understand; **K3** – Apply; **K4** – Analyze; **K5** – Evaluate		

Part	Content	Hrs
Part 1	**Taxonomy of Angiosperms** 1. Terminologies related to taxonomy. 2. Identification of taxonomic features from plant parts 3. Desection of flower parts 4. Identification and description of families belongs to Polypetalae (Nympheaceae, Portulaceae, Zygophyllaceae, Oxalidaceae, Tiliaceae, Lythraceae, Rhamnaceae, Sapindaceae, Combretaceae, Cactaceae) 5. Identification and description of families belongs to Gamopetalae (Sapotaceae, Oleaceae, Plumbaginaceae, Boraginaceae, Pedaliaceae, Bignoniaceae, and Verbenaceae). 6. Identification and description of families belongs to Monochlamydeae (Moraceae, Loranthaceae, Nyctaginaceae) 7. Identification and description of families for Monocots (Commelinaceae, Liliaceae, Orchidaceae, Poaceae and Cyperaceae)	45

Part 2	8. Preparation of artificial keys at family, generic and species level by locating key characters. 9. Field identification of plants 10. Economic importance of all the families given in the theory and important crop plants 11. Herbarium techniques 12. Preparation of herbarium sheets — 50 minimum. 13. Botanical tour to any vegetation rich places. 14. Identification of plants using software's and mobile apps.	
Part 3	**Plant Biochemistry:** 1. Estimation of Carbohydrates (Anthrone method) 2. Estimation of Proteins (Lowry & Bradford). 3. Quantification of total free amino acids. 4. Estimation of free fatty acids. 5. Estimation of total phenolics (Folin-Ciocalteu reagent method). 6. Estimation of flavonoids by colorimetric method 7. Plant extraction by soxhelt apparatus. 8. Phytochemical screening of plant extracts 9. Separation of proteins by Sodium Dodecyl Sulfate Polyacrylamide Gelelectrophoresis (SDS-PAGE) (Demonstration) 10. Determination of enzyme activities - catalase, ascorbic acid oxidase and polyphenoloxidase.	**30**
Part 4	**Plant Biotechnology** 1. DNA Replication, protein targeting, structure of m - RNA charts 2. Isolation of genomic DNA from plants 3. Amplification of a plant gene using PCR 4. Synthesis of silver nano particles from plant extracts	
Part 5	7. Preparation of MS Medium 8. Shoot tip culture for plant regeneration 9. Induction of Callus from leaf 10. Production of shoot and root from callus 11. Production of somatic embryo from leaf 12. Anther culture for haploid plant production 13. Preparation of synthetic seeds 14. Hardening for *in-vitro* produced plantlet	**15**

PO/PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PSO1**	**PSO2**
CO1	H	M	H	L	H	L	M	L	H	H	M	H
CO2	H	H	H	H	H	H	M	M	L	H	M	H
CO3	H	H	H	H	M	H	M	M	H	L	H	H
CO4	H	H	H	M	H	H	H	H	M	H	H	H
CO5	H	M	H	H	H	M	H	H	H	H	H	H

H-High M- Medium L –Low

Course Designed by	Verified by HOD	Checked & Approved by
Name and Signature	Name and Signature	CDC & COE
Name: Dr. R. Rakkimuthu Signature:	Name: Dr. R. Rakkimuthu Signature:	Name: Mr. K.Srinivasan Signature:

Programme code	M.Sc.	Programme Title : Master of Science in Botany		
Course Code: 25PBY3E7		Title: Elective -III Forestry and Wood science	Batch	2025 -2027
			Semester	III
Hrs/Week:	6		Credits	4

Course Objectives

The main objectives of this course are to:

- Understand the importance of forests.
- Enable them to contribute meaningfully in the conservation of the forest.
- Make students aware of the current global problems in forestry related to humanintervention and the need of developing a sustainable way of life.
- Provide a platform to appreciate biodiversity and the importance of conservation strategies

Course outcomes (CO)

On the successful completion of the course, student will be able to:		
CO1	Recollect the importance of forests and wood science on every aspects	K1
CO2	Understand the unique features of forests types and to impart conservation strategy	K2
CO3	Apply the forest units in the manufacturing of value added products	K3
CO4	Review the laws for the protection of forest and its resources	K4
CO5	Analyze the physical, chemical and mechanical properties of commercial wood	K4
K1 – Remember; **K2** – Understand; **K3** – Apply; **K4** – Analyze; **K5** – Evaluate		

Unit	Content	Hrs
Unit I	General introduction to forests – natural and manmade; Classification of Indian Forest types (Champion and Seth 1968) tropical, temperate, evergreen, semi evergreen, deciduous; Monoculture, multipurpose, social and industrial – forest and gene conservation; **forest types in south India with special emphasis to TamilNadu.* IUCN red listed categories.	**17**
Unit II	Silviculture– regeneration of forests – clear felling, uniform shelter wood selection, coppice and conservation systems –silviculture of some of the economically important species *Azadirachta indica, Tectona grandis, Eucalyptus,* Mahogany (*Swietenia mahagoni*), *Dalbergia sissoo, Santalum album*, *Madhuca longifolia*, Rubber (*Hevea brasiliensis*), Sal (*Shorea robusta*), Iron wood (*Mesua ferrea*) and Padauk (*Pterocarpus* sp.). Barks – Nature and types.	**18**
Unit III	Social and agro forestry: Selection of species and role of multipurpose trees. Food, fodder and energy – avenue plantation – sacred groves – definition, status and importance –Forest laws- necessity, General principles, Indian forest act 1927 and their amendment—biological diversity act (2002 in force) - World Conservation Strategy (WCS) and National Biodiversity Strategy and Action Plan (NBSAP).	**18**
Unit IV	Forest Resources And Utilization Forest products- timber, pulp wood, secondary timbers, non-timber forest products (NTFPs). Definition and scope (brief outline) - gums, resins, fibers, oil seeds, nuts, rubber, canes and bamboos, medicinal plants, charcoal. Lac collection and marketing – Ethnic communities in medicinal plants conservation – role of NMPB, AYUSH in medicinal plant conservation* - Medicinal Plant Conservation Area (MPCA) sites.	**18**
Unit V	Nature and properties of wood: physical, chemical, mechanical and anatomy of wood. Durability of wood- wood seasoning and preservation; Defects and abnormalities of wood; types of commercial wood species of India. Wood deterioration- fungi, insects and other agents; Wood protection Practical methods	**19**

	for preserving and protection, Chemical processing of wood- Composite wood: adhesives-manufacture, properties and uses- manufacture and uses of plywood, fiber boards and particle boards.	

**Self study topics*

Power point Presentations, Group discussions, Seminar, Quiz and Assignment.

Text Books

1. Dhiman, A.K. 2003. Sacred plants and their medicinal uses. Daya publishing house, New Delhi.
2. Kocchar S.L. 2009. Economic botany in the tropics, Macmillan publishers, Chennai
3. Jain S.K. Mudgal V. 1999. A Handbook of Ethnobotany. BSMPS, Dehradun.
4. Avery, T.E. 1967. Forest Measurements. Mc Grand Hill Book Company, Newyork.
5. Ramprakash, 1986. Forest management. IBD Publishers, Debra Dun.
6. Chundawat, B.S. and Gautham, S.K. 1996. Text book of Agroforestry. Oxford and IBH publisher, New Delhi
7. Rao, K.R. and Juneja, J.D. 1971. A handbook for field identification of fifty important timbers of India. The Manager of Publications, Govt. of India, New Delhi.
8. WWF. 2007. Timber identification manual. TRAFFIC, New Delhi.
9. Singhi G.B. 1987. Forest Ecology of India, Publisher: Rawat.

Reference Book

1. Jain S.K., Philipps R.D. 1991. Medicinal Plants of India. Ref. Publ. Algonac, U.S.A. Vol. 2 1-849.
2. Saklani A., Jain S.K.1994. Cross Cultural Ethnobotany of Northeast India. Deep Publ. Delhi 1-453
3. Sagreiya, K.P. Forests and Forestry, 1997. National Book Trust India.
4. Mehta, T. 1981. A handbook of forest utilization. Periodical Expert Book Agency, Delhi. 298 p.
5. Rao, K.R. and Juneja, K.B.S. 1992. Field identification of 50 important timbers of India. ICFRE Publi. Dehradun 123 p.
6. Gupta, T. and Guleria, A. 1982. Non-wood forest products in India: Economic potential. Oxford and IBH Publication, New Delhi. 147 p.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. https://agritech.tnau.ac.in/forestry/forest_index.html
2. https://agritech.tnau.ac.in/forestry/timber_trees_index.html
3. https://www.slideshare.net/VivekSrivastava22/introduction-to-forestry
4. https://www.brainkart.com/article/Vegetation-types-of-India-and-Tamil-Nadu_38271/
5. https://www.pmfias.com/forests-natural-vegetation-of-india-classification-of-natural-vegetation-of-india/

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	M	H	M	M	H	H	L	H	M	L	H	M
CO2	H	H	M	M	H	H	M	L	L	H	M	H
CO3	M	H	M	H	M	H	M	H	H	H	H	H
CO4	M	M	H	M	H	L	L	L	M	M	H	M
CO5	M	H	L	H	M	L	H	M	H	M	H	M

H - High M- Medium L -Low

Course Designed by	Verified by HOD	Checked & Approved by
Name and Signature	Name and Signature	CDC & COE
Name: Dr. A. M. Anandakumar Signature:	Name: Dr. R. Rakkimuthu Signature:	Name: Mr. K.Srinivasan Signature:

Programme code	M.Sc.	Programme Title : Master of Science in Botany		
Course Code: 25PBY3E6		Title: Elective – III Herbal Technology	Batch	2025 -2027
			Semester	III
Hrs/Week:	6		Credits	4

Course Objectives

The main objectives of this course are to:

- Understand the concept, the life style and traditional practices of plants
- Assess the various investigation methods to collect ethnobotanical knowledge of tribals
- Apply methods to transform ethnobotanical knowledge into value added products

Course outcomes (CO)

On the successful completion of the course, student will be able to:		
CO1	Recollect the importance of herbal technology and traditional system of medicine	K1
CO2	Understand various plant based drugs from ayurvedha, unani, homeopathy, siddha etc.	K2
CO3	Apply the knowledge to medicinal plant cultivation for sustainable supply	K3
CO4	Analyze the various steps in manufacturing of plant based drugs.	K4
CO5	Assess the methods to transform ethnobotanical knowledge into value added products.	K5
K1 – Remember; **K2** – Understand; **K3** – Apply; **K4** – Analyze; **K5** – Evaluate		

Unit	Content	Hrs
Unit I	History, definitions and scope of herbals – traditional medicinal systems: ayurvedha, unani, homeopathy, siddha, naturopathy and yoga. Definition of drug – classification of natural drugs, (alphabetical, morphological, pharmacological, chemical and chemo taxonomical).	**17**
Unit II	Cultivation and collection of natural drugs – Detailed study of the following medicinal plants: *Plantago ovata, Hypericum perforatum, Digitalis purpurea, Terminalia chebula, Saraca indica, Olea europoea, Strychnos nux –vomica, Withania somnifera* and *Coleus forskohlii*-women entrepreneurship development – marketing cultivated medicinal plants – National Medicinal Plants Board of India.	**19**
Unit III	General methods of phytochemical and biological screening – Natural sources – Extraction – Purification and isolation of plant constituents – Alkaloids – glycosides – Volatile oils – Study of some herbal formulation techniques as drug cosmetics.	**18**
Unit IV	Ethnobotany – definition – traditional and folklore medicines – native medicine – major tribes of south india and their ethnobotanical and ethnobiological heritage – ethno medicines –ethnobotany and conservation of plants with special reference to india	**18**
Unit V	Mythology and conservation of ecosystems – conservation of selected plant species: sacred groves, forestry and unique ecosystems and their ethnobiological values, plants and animals in art ,tradition and ethnography, ethnobotanical field methods.	18

**Self study topics*

Power point Presentations, Group discussions, Seminar, Quiz and Assignment.

Text Books:

1. John JothiPrakash, E. 2003. Medicinal Botany and Pharmacognosy. JPR Publication, Vallioor, Tirunelveli.
2. Kokate, C.K. Gokhale, S.B., and Purohit, A.P. 2003. Pharmacognosy. NiraliPrakashan, Pune.
3. Kumar, N.C. 1993. An Introduction to Medical Botany and Pharmacognosy.
4. Kumaresan, V. and Annie Regland, 2004. Taxonomy of Angiosperms systematic Botany, Economic Botany, Botany &Ethnobotany.
5. Prajapathi, Purohit, Sharma and Kumar, 2003. A Hand book of Medicinal plants.Agrobios Publications, Jodhpur.

Reference Books:

1. Anonymous, 2004. Cultivation of Selected Medicinal Plants. National MedicinalPlants Board, Govt. of India, New Delhi.
2. Bhattacharjee, S.K., 2004. Hand Book of Medicinal plants. Pointer Publishers, Jaipur.
3. Biswas, P.K. 2006. Encyclopedia of Medicinal plants (Vol. I-VII). Dominant Publishers, New Delhi.
4. Chaudhuri, A.B. 2007. Endangered Medicinal Plants. Daya Publishing House, New Delhi.
5. Chopra, R.N. 1980. Glossary of Indian Medicinal plants. CSIR, New Delhi.
6. Handa, S. S. and V. K. Kapoor, 1993. Pharmacognosy. VallabhPrakashan. New Delhi.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. https://www.slideshare.net/SudheerKandibanda/traditional-system-of-medication-tsm
2. https://www.biologydiscussion.com/essay/essay-on-traditional-herbal-medicines/2059
3. https://www.biologydiscussion.com/medicinal-plants/medicinal-plants-and-treatment-of-disease/25149
4. https://www.biologydiscussion.com/botany/ethno-botany-definitions-development-and-importance/7158

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	H	H	M	H	H	H	L	H	M	M	H	H
CO2	H	H	L -	M	H	M	L	H	H	M	H	M
CO3	M	M	M	H	H	M	L	H	H	L	H	M
CO4	H	M	H	H	M	H	L	H	M	M	H	H
CO5	H	M	H	H	M	M	H	M	H	M	H	M

H - High M- Medium L –Low

Course Designed by	Verified by HOD	Checked & Approved by
Name and Signature	Name and Signature	CDC & COE
Name: Dr. A. M. Anandakumar Signature:	Name: Dr. R. Rakkimuthu Signature:	Name: Mr. K.Srinivasan Signature:

Programme code	M.Sc.	Programme Title : Master of Science in Botany		
Course Code: 25PBY413		Title: Core — XIII Research Methodology	Batch	2025 -2027
			Semester	IV
Hrs/Week:	6		Credits	4

Course Objectives

The main objectives of this course are to:

- Understand the concepts and types involved in research
- Provide the student with a conceptual overview of statistical methods with emphasison applications commonly used analysis research experiment value.
- Gain the knowledge about the graphical representation of data, estimation, elementary probability and statistical inference will be covered.

Course Outcomes (CO)

On the successful completion of the course, student will be able to:		
CO1	Remember the basic knowledge on research	K1
CO2	Get the idea in the developing strong hypothesis and methodology for research	K2
CO3	Acquire knowledge on basic concepts in Biostatistics	K3
CO4	Evaluate scientific findings through various statistical tools	K4
CO5	Execute the basic research activities using biophysical instruments	K4
	K1 – Remember; **K2** – Understand; **K3** – Apply; **K4** – Analyze; **K5** -Evaluate	

Unit	Content	Hrs
Unit I	**Research Methodology:** Research- introduction, objectives, types (fundamental, applied, qualitative and quantitative) and significance –selecting research problem –framing of hypothesis –research design – needs and feature of a good design – Basic principles of experimental designs.	**17**
Unit II	Literature collection and citation: bibliography – bibliometrics (scientometrics): definition- laws – citations and bibliography - *biblioscapeplagiarism – project proposal writing – dissertation writing –paper presentation (oral/poster) – E-learning tools- monograph – introduction and writing- monograph for *Aloe vera* and *Ocimum sanctum* –Standard operating procedure (SOP) for labs NABL – introduction and preparation – Research Institutions – National and International..	**18**
Unit III	Bio statistics – definition – basic principles – variables – collection of data, sample, population and sampling techniques – primary and secondary data – tabulation and presentation of data – measures of central tendency – mean, mode, median and geometric mean – measures of dispersion – range, standard deviation and standard error –hypothesis testing – test of significance – test in large and small sample – t-test, f-test and chi square test – correlation and regression analysis.	**19**
Unit IV	Tools and applications of Excel and SPSS: measures of central tendency and dispersion – measures of significance – analysis of variance (ANOVA-single factor) – multivariate analysis – probability of distribution (binomial, poisson and normal) –cluster analysis.	**18**
Unit V	Basic principles and applications of pH meter, UV-visible spectrophotometer, centrifuge, lyophilizer, chromatography- TLC, Gas chromatography with mass spectrum (GC/MS), and HPLC, - Scanning electron microscopy Transmission Electron Microscopy - Agarose gel Electrophoresis – Polyacrylamide Gel Electrophoresis.	**18**

**Self study topics*

Power point Presentations, Seminar, Assignment, group discussions and demonstrations

Text Books

1. Kothari, C.R. and GauravGarg, 2014. Research Methodology: Methods and Techniques (3rd revised edition). *New Age International publisher, New Delhi.*
2. Gurumani, N 2010, An introduction to Biostatistics, , MJB publisher
3. Veerabala Rastogi, 2009. Fundamentals of Biostatistics, Ane Books India
4. Mount, D. W. 2004. *Bioinformatics*: Sequence and genome analysis. *Cold Spring Harbour Laboratory Press.*

Reference Books

1. Jayaraman, J. 2011. Laboratory Manual of Biochemistry, New Age International Private Limited.
2. Sadasivam, S. and Manickam, A. 2008. Biochemical Methods. New Age International Publishers, New Delhi.
3. Prasad and Prasad, 2000. Micro technique, EMKAY Publications.
4. Harborne, 1998. Phytochemical methods, Springer Netherlands
5. M.H. Cordon and R. Macrae, 1987. Instrumental analysis in the Biological Science, Blackie and Son Limited, London.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. https://www.youtube.com/watch?v=w_Ujkt83i18
2. https://www.youtube.com/watch?v=8iFfzYVuCuM
3. https://www.youtube.com/watch?v=XEMyDu_VoeQ
4. https://www.youtube.com/watch?v=1Q6_LRZwZrc
5. https://www.youtube.com/watch?v=Bku1p481z80

Journals:

1. Journal of Mixed Methods Research.
2. Journal of Research Methods and Methodological Issues.

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	H	H	M	H	H	H	H	M	H	M	H	H
CO2	H	H	L	H	H	M	H	H	H	H	H	H
CO3	H	H	M	H	H	H	H	M	H	M	H	H
CO4	H	H	M	H	H	H	H	M	H	M	H	H
CO5	H	H	H	H	H	H	L	H	M	H	H	H

H-High M- Medium L –Low

Course Designed by	Verified by HOD	Checked & Approved by
Name and Signature	Name and Signature	CDC & COE
Name: Dr. R. Rakkimuthu Signature:	Name: Dr. R. Rakkimuthu Signature:	Name: Mr. K.Srinivasan Signature:

Programme code	M.Sc.	Programme Title : Master of Science in Botany		
Course Code: 25PBY414		Title : Core – XIV Bioinformatics and Cyber security	Batch	2025 -2027
			Semester	IV
Hrs/Week:	6		Credits	4

Course Objective

The main objectives of this course are to:

- Develop inter disciplinary skills in the application of computers in Botany to learnabout the biological databases and machine learning techniques.
- Analyze the structure and functions of protein and nucleic acids using *in silico* toolsand to apply the acquired programming knowledge in drug design for phytomedicines

Course Outcomes (CO)

On the successful completion of the course, student will be able to:		
CO1	Apprehend the ideas on molecular biology	K1
CO2	Apply various tools for genomic and proteomic studies	K2
CO3	Figure out the characteristics of biomolecules *insilico*	K3
CO4	Know the importance of Bioinformatics in Biology for the welfare of society	K4
CO5	Keep in mind the threats to cyber security and related social issues	K5
K1 – Remember; **K2** – Understand; **K3** – Apply; **K4** – Analyze; **K5** – Evaluate		

Unit	Content	Hrs
Unit I	**Bioinformatics:** Definition and Scope. Biological databases – Primary and secondary. Genomics: Definition – Genbank, DDBJ –molecular file formats. Biological information portal: NCBI and EMB net. BLAST- An overview of BLAST tools available with NCBI – conserved domains – CpG islands.	**18**
`Unit II	Gene prediction methods (Homology and *ab initio*) FASTA and PDB. Pair wise and multiple sequence alignment, scoring matrices (PAM and BLOSUM). Molecular phylogeny (Cladistics and phonetic methods) CLUSTAL and PHYLIP.	**17**
Unit III	Proteomics: Definition, Levels of protein structure, Protein secondary structure prediction (SOPMA and JPRED). Molecular visualization tool – Rasmol and Swiss PDB Viewer. Protein modeling methods – Comparative and *De novo* methods. Model refinement and evaluation of model. Over view of SWISS PROT. Outline of computer aided drug designing. **Systems biology – concept and applications.*	**19**
Unit IV	**Cybersecurity:** Overview of cyber security – confidentiality, integrity and availability – Threats – malicious software (viruses, Trojans, rootkits, worms, botnets) – memory exploits (buffer overflow, heap overflow. Integer overflow, format string) – cryptography – authentication – password system – windows security.	**18**
Unit V	Network security – network intrusion detection and prevention systems – firewalls – software security – vulnerability auditing, penetration testing, sandboxing, control flow integrity – web security – user authentication – legal and ethical issues – cyber crime, **intellectual property rights, copyright, patent, trade secret, hacking and intrusion, privacy, identity threat*.	**18**

**Self study topics* (Study material for cyber security is available in college website in the form of e-book.

Power point Presentations, Group discussions, Seminar, Assignment and online demonstration

Text Books

1. Arthur Conklin W.M., and Greg White, 2016. Principles of computer security. TMH., McGraw-Hill Education; 4 edition
2. Rastogi, S. C., N. Mendiratta, and P. Rastogi, 2008. Bioinformatics - Methods and applications, Genomics, Proteomics and Drug discovery, PHI Learningpvt Ltd., New Delhi.
3. Baxevanis and Quellette, 1998. Bioinformatics. A practical guide to analysis of genes and proteins.
4. Arthur M. Lesk, 2002. Introduction to Bioinformatics. Published by Oxford University Press.

Reference Books

1. Stuart M. Brown, 2000. Bioinformatics: A biologist's guide to biocomputing and the internet, Eaton publishers.
2. T. K. Attwood and Parry-Smith, 1999. Introduction to Bioinformatics, Pearson Education India Publishers.
3. S. Sundararajan and R. Balaji, 2002. Introduction to Bioinformatics. Himalaya Publishing House.
4. Chwan-Hwa (John) Wu, J. David Irwin, 2016. Computer networks and cyber security. CRC press.
5. Matt Bishop, 2018. Computer security art and science, second edn., Pearson/PHI. Publisher: Addison-Wesley Professional

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. https://www.slideshare.net/biinoida/bioinformatics
2. https://www.slideshare.net/pubudu/genomics
3. https://www.youtube.com/watch?v=vnW9kH0agcE
4. https://www.youtube.com/watch?v=5teoROLvijg
5. https://www.slideshare.net/vidhyakalaivani29/protein-structure-visualization-toolsrasmol

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	H	L	H	M	H	M	M	L	L	L	H	M
CO2	H	M	M	M	M	M	M	H	L	L	H	M
CO3	H	M	H	H	M	H	H	H	L	M	H	M
CO4	H	M	H	M	H	M	H	H	M	M	H	M
CO5	H	M	M	M	H	M	L	M	H	H	H	M

H-High M- Medium L –Low

Course Designed by	Verified by HOD	Checked & Approved by
Name and Signature	Name and Signature	CDC & COE
Name: Dr. A. M. Anandakumar Signature:	Name: Dr. R. Rakkimuthu Signature:	Name: Mr. K.Srinivasan Signature:

Programme code	M.Sc.	Programme Title: Master of Science in Botany		
Course Code: 25PBY415		Title: Core – XV Laboratory course- IV (Research Methodology and Bioinformatics & Cyber security)	Batch	2025 -2027
			Semester	IV
Hrs/Week:	6		Credits	4

Course Objectives

The main objectives of this course are to:

- Write research proposal and dissertation in good manaer
- Provide hands on experience on biomolecular *insilico* analysisand to enrich theresearch analysis and interpretation skills

Course Outcomes (CO)

On the successful completion of the course, student will be able to:		
CO1	Apply plan, design and execute the dissemination of scientific knowledge	K3
CO2	Evaluate knowledge on Chromatgraphy,pH meter, SDS-PAGE and spectrophotometer	K4
CO3	Validate the experimental results using biological tools	K5
CO4	Apply the skills to write the research proposals	K3
CO5	Analyze the bimolecules using the Bioinformatics tools	K4
K3 – Apply; **K4** – Analyze; **K5** – Evaluate		

Unit	Content	Hrs
Part 1	**Research Methodology** 1. Research writing a. How to write a research proposal? b. How to write a research report? c. Dissertation writing 2. Bibliometrics 3. Citation index & Citation 4. Bibliography and biblioscape 5. Collection, analysis and graphical representation of data 6. Measures of central tendency — mean, median and mode 7. Measures of dispersion: range, standard deviation, coefficient of variation correlation 8. Test of significance — Chi-square test and Student‘t’ test. 9. Statistical calculations and chart preparation in MS-Excel and SPSS **Instrumentation** 1. Separation of plant pigments by TLC 2. Separation of plant pigments by Column Chromatography. 3. Electrophoretic separation of Nucleic acid /protein 4. Measurement of pH from fruit juice. 5. Separation of sugar/Amino acid by paper chromatography 6. Verification of Beer law using spectrophotometer	**45**

Part 2	**Bioinformatics & Cyber Security** 1. Observation and analysis of biological databases 2. Data mining -sequence and structure retrieval 3. FASTA format 4. Pair wise alignment using BLAST 5. Multiple sequence alignment using CLUSTAL X 6. Construction of phylogenetic tree using CLUSTAL W and PHYLIP 7. Gene finding using Gen Mark Hmm. 8. Conserved domain search 9. Motifs search 10. CpG islands 11. Protein primary structure prediction using PROTPARAM 12. Protein secondary structure prediction using GOR 13. Protein translation using TRANSLATE 14. Protein structure visualization with Rasmol and Swiss PDB Viewer	**45**

Power point presentations, group discussions, online demonstration and field visit

PO/PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PSO1**	**PSO2**
CO1	H	M	H	L	H	M	M	M	M	H	M	H
CO2	H	M	H	H	H	M	H	H	H	H	H	H
CO3	H	M	H	M	H	H	M	M	H	H	M	H
CO4	H	H	M	H	H	M	M	M	M	M	H	H
CO5	M	L	M	L	L	M	L	L	L	H	M	M

igh M- Medium L -Low

Course Designed by	Verified by HOD	Checked & Approved by
Name and Signature	Name and Signature	CDC & COE
Name: Dr. R. Rakkimuthu Signature:	Name: Dr. R. Rakkimuthu Signature:	Name: Mr. K.Srinivasan Signature:

Programme code	M.Sc.	Programme Title : Master of Science in Botany		
Course Code:	25PBY416	Title : Pharmaceutical Botany	Batch	2025 -2027
			Semester	IV
Hrs/Week:	6		Credits	2

Course Objectives

1. To introduce the scope and importance of medicinal plants in pharmaceutical sciences and their contribution to drug discovery.
2. To classify medicinal plants based on their bioactive compounds (alkaloids, glycosides, tannins, flavonoids, etc.) and explain their pharmacological significance.
3. To explain the principles of phytochemical extraction, isolation, and purification of bioactive compounds using techniques like Soxhlet extraction, maceration, and percolation.

Course Outcomes (CO)

On the successful completion of the course, student will be able to:		
CO1	Describe the scope and importance of plants in pharmaceuticals and classify medicinal plants based on their active compounds.	K1
CO2	Explain the identification and authentication of medicinal plants and herbarium preparation methods.	K2
CO3	Apply standard techniques for extraction, isolation, and phytochemical analysis of bioactive compounds.	K3
CO4	Evaluate the stability, formulation, and quality control of herbal drugs based on regulatory guidelines.	K5
CO5	Formulate and design herbal dosage forms such as syrups, ointments, and tablets using GMP standards.	K5
K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate		

Unit	Content	Hrs
Unit I	**Introduction to Pharmaceutical Botany:** Scope and importance of plants in pharmaceuticals-Classification of medicinal plants based on active compounds (alkaloids, glycosides, tannins, flavonoids, etc.)- Identification and authentication of medicinal plants-Herbarium preparation and standardization of crude drugs	**10**
Unit II	**Phytochemical Extraction and Analysis:** Principles of extraction techniques (Soxhlet extraction, maceration, percolation)-Methods for isolation and purification of bioactive compounds-Phytochemical screening tests for alkaloids, flavonoids, tannins, and steroids-Applications of chromatography (TLC, HPLC, and GC-MS) in phytochemical analysis	**10**
Unit III	**Drug Development** :Principles of herbal drug formulation and development-Stability studies and shelf-life assessment-Preparation of herbal tablets, capsules, syrups, and ointments-Good Manufacturing Practices (GMP) for herbal medicines	**10**
Unit IV	**Pharmacological and Toxicological Studies:** Basics of pharmacokinetics and pharmacodynamics-standardization and quality control of herbal medicines-*In-vitro, in-vivo* and *in-silico* screening of medicinal plant extracts-Toxicity testing and safety evaluation (LD50/IC50, Ames test)	**15**

Unit V	**Lab Experiments:** 1. Macroscopic and microscopic examination of selected medicinal plants 2. Organoleptic evaluation of crude drugs 3. Extraction of alkaloids from plant material 4. Qualitative phytochemical screening of medicinal plants 5. Thin Layer Chromatography (TLC) of plant extracts 6. Antioxidant activity using DPPH assay 7. Preparation of herbal gel/ointment for wound healing 8. Formulation of a herbal syrup for cough relief 9. Tablet formulation using herbal extracts 10. Stability testing of herbal formulations 11. Calculation of IC50 Value	**45**

Power point Presentations, Group discussions, Seminar ,Quiz, Assignment, Case study

Text Books

1. Youngken, H. W. (1921). *Pharmaceutical Botany: A Text-Book for Students of Pharmacy and Science.* J.B. Lippincott Company.
2. Trease, G. E., & Evans, W. C. (2009). *Trease and Evans' Pharmacognosy* (16th ed.). Saunders Elsevier.
3. Kokate, C. K., Purohit, A. P., & Gokhale, S. B. (2019). *Pharmacognosy* (53rd ed.). Nirali Prakashan.

Reference Books

1. Egbuna, C., Ifemeje, J. C., Udedi, S., Kumar, S., Kurhekar, J. V., & Sharif, N. (2021). *Phytochemistry (3-Volume Set).* CRC Press.
2. Egbuna, C., & Kumar, S. (2021). *Poisonous Plants and Phytochemicals in Drug Discovery.* Wiley.

Programme code	M.Sc.	Programme Title : Master of Science in Botany		
Course Code:	25PBY4E1	Title : Elective –IV Ethno Botany	Batch	2025 -2027
			Semester	IV
Hrs/Week:	6		Credits	4

Course Objective

The main objectives of this course are:

- To conserve the indigenous knowledge of the region and create awareness in theyoung generation.
- To develop new products for food, herbal, and pharmaceutical companies and assist in managing biological resources

Course Outcomes (CO)

On the successful completion of the course, student will be able to:		
CO1	Understand the ethnic knowledge of tribes	K2
CO2	Be familiar with the methodology and procedure for collecting information from ethinic communities	K2
CO3	Apply and use of different plants for human welfare	K3
CO4	Evaluate the medicinal and economic importance of plants used by indigenous communities	K5
CO5	Understand and analyze about the ethinic plants for modern drug manufacture	K2 ,K4
K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate		

Unit	Content	Hrs
Unit I	**Ethno botany**: Introduction -concept, scope and objectives - its significance in state level, national and global level- Landmarks in history of ethnobiology- relation between geology, phyto geography and ethnobotany.	**17**
Unit II	**Methodology of Ethno botany** : Field work - Herbarium - Ancient Literature - Temples and sacred places- Plants used by the tribal: Food plants - intoxicants and beverages - Resins and oils and miscellaneous uses- Indigenous societies and interactions with plants- a global view-Relationship between man and plants- for benefit of developmental strategies-mutually destructive approaches.	**19**
Unit III	**Ethno botany Practices** : Linkage of ethnobotany with other sciences and disciplines in biology- food and nutrition, medicine, sociological and cultural practices, religions and social costumes and economic relations, archaeology, history and politics- Plants and Tribal medicine: Significance of the following plants in ethno botanical practices (along with their habitat and morphology) *Azadiractha indica* - *Ocimum sanctum* - *Vitex negundo*. *Gloriosa superba* - *Tribulus terrestris* – *Pongamia pinnata* - *Cassia auriculata* – *Indigofera tinctoria*.	**18**

Unit IV	**Ethno botany in Modern Medicine**: Role of ethnobotany in modern medicine with special example *Morinda citrifolia* - *Trichopus zeylanicus*. Major tribes of south India and their ethnobotanical and ethno- biological heritage- Naikas, Shola Naikas, Thodas, Kothas, Kurumbas, Irulas, Malayali and KattuNaikas	**18**
Unit V	**Applications and Conservation of Ethnobotany**: Ethnobotany and conservation of plants with special reference to India- Mythology and conservation of ecosystems - conservation of selected medicinal plant species: scared groves, forestry and unique ecosystems, and their ethnobiological values - plants and animals in art, tradition and ethnography: methodologies in ethno-botanical research - Ethnobotany as a source of drug.	**18**

**Self study topics*

Power point Presentations, Group discussions, Seminar ,Quiz, Assignment, Case study

Text Books

1. Das, A.P. and Pandey, A.K. (2007). Advances in Ethnobotany. Bishen Singh and Mahendra Pal Singh, Dehradun.

2. Sahu, T.R. (2007). Indigenous Knowledge: An application. Scientific Publishers. Jodhpur.

3. Gary J Martin, 2008. Ethnobotany A Methods manual, Earth scan, London.

Reference Books

1. Jain, S.K. (1995). Manual of Ethnobotany, Scientific Publishers, Jodhpur.

2. 3. Cotton, C.M. (1997). Ethnobotany – Principles and Applications. John Wiley and Sons – Chichester.

4. Jain, S.K. (ed.) (1989). Methods and Approaches in Ethnobotany. Society of Ethnobotanists, Lucknow, India.

Related Online Contents [MOOC,SWAYAM,NPTEL,Websitesetc.]

1. https://www.biologydiscussion.com/botany/ethno-botany-definitions-development-and-importance/7158
2. https://www.studocu.com/en-us/document/university-of-central-florida/culinary-botany-across-the-cultures/ethnobotany-chapter-1-lecture-notes-1/11828890

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	H	H	H	L	M	M	M	L	M	H	M	M
CO2	H	M	H	L	M	L	M	L	M	H	L	M
CO3	H	H	H	L	M	L	M	L	M	H	M	H
CO4	H	H	H	L	M	L	M	L	M	H	M	H
CO5	H	H	M	L	M	L	M	L	L	H	M	H

H-High M- Medium L –Low

Course Designed by	Verified by HOD	Checked & Approved by
Name and Signature	Name and Signature	CDC & COE
Name: Dr. A.M. Ananda kumar Signature:	Name: Dr. R. Rakkimuthu Signature:	Name: Mr. K.Srinivasan Signature:

Programme code	M.Sc.	Programme Title : Master of Science in Botany		
Course Code: 25PBY4E8		Title: Elective-IV Pharmacognosy	Batch	2025-2027
			Semester	IV
Hrs/Week:	6		Credits	4

Course Objectives

The main objectives of this course are to:

- Enrich knowledge on some important medicinal plants and their usage.
- Afford information on extraction, separation, identification and evaluation techniquesof plant derived drugs.
- Provide the scientific temper to find a suitable job in relevant industries or to becomea potential entrepreneur by using medicinal plants in efficient commercialization way.

Course outcomes (CO)

On the successful completion of the course, student will be able to:		
CO1	Recall the knowledge about modern concept and scope of Pharmacognosy.	K1
CO2	Identify their professional role in the healthcare system	K2
CO3	Design methods of standardization for herbal drug or formulations	K3
CO4	Analyze herbal extracts for the identification of phytoconstituents	K4
CO5	Analyze various pharrmacognostic parameters of crude drugs	K4
K1 – Remember; **K2** – Understand; **K3** – Apply; **K4** – Analyze; **K5** – Evaluate		

Unit	Content	Hrs
Unit I	Pharmacognosy– definition and scope – drug adulteration, drug evaluation, organoleptic, microscopic, chemical, physical and biological evaluation – phytochemical investigations – standardization and quality control of herbal drugs.	**17**
Unit II	Types of Plant drug and their Pharmacognostic study – root drugs; *Glycyrrhiza* and lpecac, *Raulvolfia*, Satavari, *Withania* – rhizome drugs; Ginger – leaf drugs –*Andrographis, Clitoria, Senna* – bark drugs: *Terminalia arjuna,Holorrhena* – flower drugs: Saffron – Seed drugs: *Piperlongum*, *Mucuna* – Fruit drugs: Cumin, Amla, Senna pods – Whole plant drugs: *Catheranthus roseus.*	**19**
Unit III	Medicinal Principles and powder analysis of Curcuma, cloves, senna, Fennel and cinnamon – large scale Industrial preparation of Crude Drugs – import and export potentials of Crude Drugs	**18**
Unit IV	Nutraceuticals and cosmeceuticals – Ayurvedic pharmacy- principles, formulations of drugs-Natural pesticides- Pyrethrum, Neem, Derris, Tobacco – Immuno-modulatory medicinal plants.	**18**
Unit V	Perfumes and flavorings agents- peppermint oil, Lemon oil, Orange oil, Lemon grass oil and Sandal wood. Pharmaceutical aids- honey. Starch, Kaolin, Pectin, Olive oil, Lanolin, Bees wax, Sodium alginate, Agar, and Gelatin.	**18**

*****Self study topics*

Power point Presentations, Group discussions, Seminar, Quiz and Assignment.

Text Books:

1. John JothiPrakash, E. 2003. Medicinal Botany and Pharmacognosy. JPR Publication, Vallioor, Tirunelveli.
2. Kokate, C.K. Gokhale, S.B., and Purohit, A.P. 2003. Pharmacognosy. Nirali Prakashan, Pune.
3. Kumar, N.C. 1993. An Introduction to Medical Botany and Pharmacognosy.
4. Prajapathi, Purohit, Sharma and Kumar, 2003. A Hand book of Medicinal plants.Agrobios Publications, Jodhpur.

Reference Books:

1. Horborne. J.B. 1983.Phyto chemical methods.Chapman and Hall. London.
2. Biren Shah and A.k. Seth 2010.Textbook of pharamcognosy and Phytochemistry. 8th Edn. Reed Elsevier India Pvt. Ltd.
3. Pharmacopoeia of India. Govt. of India.Ministry of health 1955 and 1966.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. https://www.biologydiscussion.com/botany/pharmacognosy/short-notes-on-pharmacognosy/42921
2. https://www.slideshare.net/SudheerKandibanda/introduction-to-pharmacognosy-and-scope-of-pharmacognosy
3. https://www.youtube.com/watch?v=bwC2vmLmLKQ

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	H	M	H	H	M	M	M	L	M	M	M	H
CO2	H	M	H	H	H	M	M	L	M	M	M	H
CO3	H	H	H	L	M	M	M	M	M	M	M	H
CO4	H	M	H	L	M	M	M	M	M	M	M	H
CO5	H	M	M	L	M	M	M	M	M	M	M	H

H-High M- Medium L –Low

Course Designed by	Verified by HOD	Checked & Approved by
Name and Signature	Name and Signature	CDC & COE
Name: Dr. P. Sathishkumar Signature:	Name: Dr. R. Rakkimuthu Signature:	Name: Mr. K.Srinivasan Signature:

ADVANCED LEARNER COURSE

Programme code	M.Sc.	Programme Title : Master of Science in Botany		
Course Code:25PBYAL1		Title : Plant Ecology, tissue culture and Phytochemical techniques	Batch	2025 -2027
			Semester	III
			Grade	

Course Objective

The primary goal of this course is to carry out research on the field of ecology,plant tissue culture and phytochemistry

Course Outcomes (CO)

On the successful completion of the course, student will be able to:		
CO1	Students will keep in mind the ecosystem concepts and functions	K1
CO2	Gain the knowledge on basic tissue culture techniques	K2
CO3	Demonstrate the various aspects of extraction, isolation and Characterization of secondary metabolites	K3
CO4	Know the methods of screening of secondary metabolites for various biological properties	K4
CO5	Apply the skills to work with various Instruments	K3
K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate		

Unit	Content
Unit I	**Ecology: P**rinciples of ecology - populations and their ecosystems, distribution, biotic communities and environmental relationships - density, frequency, abundance and relative indexes - quadrat method-Autecological studies - GCV and PCV of Plant communities - Soil analysis –Physical and chemical parameters
Unit II	**Plant tissue culture:** introduction to plant tissue culture - laboratory design and sterilization techniques - tissue culture media and preparation - concepts of tissue culture - initiation of plant tissue culture – micropropagation - callus culture – hardening methods
Unit III	**Phytochemistry:** Extraction of secondary metabolites **(**cold and hot**) –** Qualitative phytochemical analysis – alkaloids, flavonoids, glycosides, saponins, steroids, tannins, terpenoids, anthocyanins and phenols- Quantitative phytochemical analysis Alkaloids, flavonoids, glycosides, saponins, anthocyanins, and phenols.
Unit IV	Bioinstrumentation -AGE, Characterization of secondary metabolites and– TLC, Column chromatography, HPTLC, HPLC, LCMS/MS, GC/MS, UV, IR, ^{1}H -NMR
Unit V	**Biological studies of secondary metabolites:** Estimation of antioxidant content (enzymatic and non-enzymatic) - antimicrobial activity (disc diffusion and agar well method) – cytotoxicity assay (MTT Assay)

Reference

1. Odum, E.P., 1975. Fundamentals of ecology, W.B. Saunders & Co., Philadelphia, USA.
2. Sharma P. D., 2005. Ecology And Environment, Rastogi Publications, India.
3. Rakkimuthu R., 2015. Title of the thesis: "*In vitro* propagation, phytochemical screening and biological activityof *Cocculus hirsutus* (L.) Diels.
4. Sathishkumar, P.2010. Title of the thesis: Evaluation of populations of the folklore medicinal plant, *Acacia caesia*(L.) Willd. in the Western Ghats of India for ecomorphological and phytochemical traits.
5. Anandakumar, A.M. 2010. Title of the thesis:Ecological, morphological, genetic and phytochemical variations between the populations of the medicinal plant, *Acalypha fruticosa* Forssk. Inhabiting lower Western Ghats, India.

Text Book

1. Satyanarayanan U., 2007. Biotechnology.Books and Allied (P) Ltd., Kolkata.
2. Harborne, 1998. Phytochemical methods, Springer Netherlands
3. Prasad and Prasad, 2000. Micro technique, EMKAY Publications.
4. Sadasivam, S. and Manickam, A. 2008. Biochemical Methods. New Age International Publishers, New Delhi.

PO/PSO ——— CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	H	H	H	M	H	M	M	H	H	H	M	H
CO2	H	H	H	H	H	M	H	H	H	H	H	H
CO3	H	H	H	M	H	H	M	M	H	H	M	H
CO4	H	H	H	H	H	M	H	H	H	H	H	H
CO5	H	H	H	M	H	H	M	M	H	H	M	H

H-High; M-Medium; L-Low

Course Designed by	Verified by HOD	Checked & Approved by
Name and Signature	Name and Signature	CDC & COE
Name: Dr. R. Rakkimuthu Signature:	Name: Dr. R. Rakkimuthu Signature:	Name: Mr.K. Srinivasan Signature:

VALUE ADDED COURSE

Programme Title : Value added course			
Course code:25PBYVAC		**Title : Botanical Aesthetics**	**Credits 2**
Hrs/Week:	**2**		

Course Objective

To equip the students with good Entrepreneurs

Course Outcomes (CO)

CO1	Recall fundamental concepts of Paludarium, Terrarium, and Bonsai, including their history, significance, and ecological importance.	K1
CO2	Explain the differences between Paludarium, Terrarium, and Bonsai, their plant species selection, and essential maintenance techniques.	K2
CO3	Demonstrate the practical skills needed to construct and maintain Paludarium, Terrarium, and Bonsai, including substrate preparation, plant arrangement, and shaping techniques.	K3
CO4	Evaluate the factors influencing the sustainability of these miniature ecosystems and troubleshoot common issues related to their maintenance.	K4
CO5	Understand business opportunities in Paludarium, Terrarium, and Bonsai cultivation, and analyze market trends, entrepreneurial prospects, and commercial viability.	K2,K4

Unit	Content	Hrs
Unit I	Introduction to Miniature Ecosystems, History, Importance in horticulture, interior design and ecological balance. Paludarium (The Living Wetland), Definition, Essential tools for setup and maintenance, Selection of plant species based on ecological compatibility, Substrate selection and preparation.	**8**
Unit II	Terrarium (The Self-Sustaining Mini Forest), Understanding Terrariums - Open vs. Closed Terrariums, Selection of plants (ferns, mosses, succulents, air plants), Role of humidity and ventilation, Step-by-Step Construction - Layering: Gravel, charcoal, soil, and moss, Decorative elements: Rocks, driftwood, mini figurines, Creating a sustainable microclimate, Maintenance and Common Issues.	**8**
Unit III	Bonsai (The Art of Miniature Trees) Introduction to Bonsai**,** History and cultural significance, Types of Bonsai: Formal upright, informal upright, cascade, windswept, Selection and Training of Bonsai Plants**,** Soil preparation, pot selection, and root pruning, Techniques: Wiring, defoliation, and shaping, Seasonal maintenance and repotting.	**8**
Unit IV	Hands on training - Bonsai making, Setting Up a Paludarium and Terrarium: Students create their own Paludarium / Terrarium / Bonsai Business opportunities in Paludarium, Terrarium, and Bonsai cultivation	**6**

Power point Presentations, Group discussions, Seminar, Quiz, Assignment and Field visit

Text Books:

1. **Smith, P. (2018).** *Terrariums: Gardens Under Glass*. Timber Press.
2. **Lesniewicz, P. (2019).** *Bonsai: The Complete Guide to Cultivation and Care*. Cassell Illustrated.
3. **Hodgson, L. (2017).** *The House Plant Expert: Terrariums and Paludariums*. Expert Books.
4. **Tomlinson, H. (2009).** *Bonsai: Techniques, Styles, Display Ideas*. DK Publishing.
5. **Ward, J. (2021).** *The New Terrarium: Creating Beautiful Displays for Plants and Nature*. Clarkson Potter.

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	H	M	M	M	H	H	H	M	M	H	M	H
CO2	H	M	H	M	H	H	H	M	H	H	M	H
CO3	H	M	H	M	M	H	M	M	H	H	M	H
CO4	H	M	H	M	H	H	H	M	H	H	M	H
CO5	H	H	H	M	H	M	M	M	M	H	M	H

H-High M- Medium L –Low

Course Designed by	Verified by HOD	Checked and Approved by
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Name: Dr. P. Sathishkumar Signature:	Name: Dr. R. Rakkimuthu Signature:	Name: Mr. K.Srinivasan Signature:

CERTIFICATE COURSE	
FIRST YEAR	**Plant Tissue culture**
SECOND YEAR	**Mushroom Cultivation**

CERTIFICATE COURSE				
Course Code: 25PBYCF1		**Title : Introduction To Plant Tissue Culture**	**Batch**	**2025 -2027**
			Semester	**III**
Hrs/Week:	**4**		**Credits**	**2**

Course Objective

The main objectives of this course are to understand the:

- Principles and culture techniques of cells, callus, organs, pollen, anthers, embryos,and protoplasts.
- Applications in clonal propagation and research in breeding, physiology, and pathology.

Course Outcomes (CO)

On the successful completion of the course, student will be able to:		
CO1	Recall or remember the principles and culture techniques of cells, callus, organs, pollen, anthers, embryos, and protoplasts.	K1
CO2	Understand the techniques used in plant growth and regeneration under *in vitro* conditions.	K2
CO3	Apply clonal propagation and research techniques in plant breeding, physiology, and pathology.	K3
CO4	Analyze the conditions that are suitable for direct and indirect plant regeneration.	K4
CO5	Compare the performance of *in vitro* raised plantlets with those of *in vivo* raised plants.	K5
K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate		

Unit	Content	Hrs
Unit I	**TISSUE CULTURE MEDIUM PREPARATION** Introduction to plant tissue culture, lab facilities and operations, tissue culture media: preparation and handling, establishing aseptic cultures	**11**
Unit II	**PLANT REGENERATION** Role of plant growth regulators, micropropagation via axillary and adventitious shoot proliferation; organogenesis, Somatic embryogenesis.	**11**
Unit III	**TECHNIQUES IN PLANT TISSUE CULTURE** Double haploid production by androgenesis and gynogenesis; triploid production by endosperm culture production of virus free plants by meristem, shoot-tip culture; Cell suspension cultures; protoplast isolation and regeneration.	**12**

Unit IV	**FUNDAMENTALS OF PLANT TISSUE CULTURE** Totipotency of plant cells, Introduction to plant tissue culture, explant selection and medium composition and plant growth regulators, *In vitro* culture: physical, genetic, chemical and genotypic factors. Assessment of growth and development *in vitro*. Problems in plant tissue culture (Recalcitrance, Contamination, Phenolic Browning, and Seasonal Variation).	**13**
Unit V	Somatic hybridization and cybridization; Protoclonal, Somaclonal variation for crop improvement; Synthetic seed technology and *Cryopreservation*. Hardening and acclimatization of tissue culture plants in Green house.	**13**

**Self study topics*

Power point Presentations, Group discussions, Seminar, Quiz, Assignment, Field study

Text books:

1. Bhojwani, S.S. and Razdan, M.K. 2004. Plant Tissue Culture: Theory and Practice. Revised Edition, Elsevier Publication, Amsterdam.
2. Glick, B.R. and Pasternak, J.J. 1998. Molecular Biotechnology. 2nd ed, ASM Press, Washington, USA
3. Srivastava, P.S. 1998. Plant Tissue Culture and Molecular Biology. N.R. Book Distributors, New Delhi.

Reference Books:

1. Dixon, R.A. and Gonzales, R.A. 1994.Plant cell culture: A Practical approach, 2nd ed. Oxford University Press, UK.
2. George, E.F. 1999. Plant Propagation by Tissue Culture: Volume 1 & 2. Exegetics Limited, Worcester, UK.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. https://nptel.ac.in/courses/102/103/102103016/
2. http://ugcmoocs.inflibnet.ac.in/ugcmoocs/spoc.php?coordinator=574
3. https://www.youtube.com/watch?v=bi755vQVNx8

PO/PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PSO1**	**PSO2**
CO1	H	M	M	H	H	M	M	M	M	H	M	M
CO2	H	M	M	M	H	H	H	M	H	H	M	H
CO3	H	M	H	M	M	H	M	M	H	H	M	M
CO4	H	M	H	M	H	H	H	M	H	H	M	H
CO5	M	H	H	M	H	M	M	M	M	H	M	H

igh M- Medium L –Low

Course Designed by	Verified by HOD	Checked and Approved by
Name and Signature	Name and Signature	CDC & COE
Name: Dr. R. Rakkimuthu Signature:	Name: Dr. R. Rakkimuthu Signature:	Name: Mr. K.Srinivasan Signature:

CERTIFICATE COURSE				
Course Code: 25PBYCF2		**Title : Mushroom Cultivation**	**Batch**	**2025 -2027**
			Semester	**III**
Hrs/Week:	**4**		**Credits**	**4**

Course Objective

The main objectives of this course are to enable the students to:

- Understand the structure and occurrence of mushrooms
- Teach how to identify mushrooms
- Study the cultivation technique of various edible mushrooms
- Know the uses of mushroom and their economic importance
- Establish mushroom cultivation as business enterprise

Course Outcomes (CO)

On the successful completion of the course, student will be able to:		
CO1	Obtain an in-depth knowledge on structure and various types of edible and non-edible mushrooms	K1,K2
CO2	Understand the difference between edible and poisonous mushrooms	K3
CO3	Knowledge on identification and cultivation of different varieties of edible mushroom	K3, K4
CO4	Understand the utility of different edible and non-edible mushrooms.	K5
CO5	Knowledge on the production and marketing strategies for mushrooms	K6
K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate		

Unit	Content	Hrs
Unit I	**Mushroom Taxonomy** Introduction - history and scope of mushroom cultivation. General characters of mushrooms: Thallus structure - mode of nutrition – reproduction -distribution. Morphology of mushrooms: Stipe – pileus – gills – annulus and their variations. Structure and keys for identification of poisonous mushrooms – *Amanita muscaria*, *Psilocybe mexicana* - *Lycoperdon gigantium*. Medicinal Mushroom – *Cordyceps, Ganoderma lucidum* and *Lentinus edodes.*	**11**
Unit II	**Mushroom centre** Infrastructure of mushroom centre: Layout of traditional and greenhouse method - Methods of mushroom cultivation - maintenance of sanitation in mushroom plants. Site size and area - spawning room and cropping room and their importance - composting unit. Formulation of compost- IARI, IIHR and ICAR formulae.	**10**
Unit III	**Cultivation of edible Mushrooms** Cultivation of button - oyster and Paddy straw mushrooms: Substrates: types, processing, sterilization, preparation for cultivation. Preparation of compost- formulations - supplements - methods of compost preparation (long method and short method) - pasteurization of compost. Filling of compost in trays. Spawning methods: Casing - crop management after spawning - maintenance of temperature and relative humidity - harvesting and packing.	**13**

Unit IV	**Mushroom harvesting** Post-harvest management - Harvest - preservation of mushrooms, storage methods, quality assurance of mushrooms. Bacterial diseases of mushrooms, pests and nematodes infestation on edible mushrooms and mushroom beds. Principles and methods of pest management - chemical control. Integrated pest management. Influence of abiotic factors affecting mushroom production.	**13**
Unit V	**Value added products and marketing** Production of various mushroom based foods for marketing - pickles, jams, chips, soup, cutlet, vegetable curry, samosa and omelet. *Mushroom recipes - mushroom curry - mushroom pulao - mushroom pickles - mushroom fry - mushroom kuruma - mushroom briyani*. Developing small scale industry, special training for developing small scale industry -Government schemes - large scale industry requirement - cost benefit ratio - marketing in India and abroad, export value.	**13**

` **Self study topics*

Power point Presentations, Group discussions, Seminar, Quiz, Assignment, Field study

Text books:

1. Tiwari., S.C. and Pandey, K. 2018. Mushroom cultivation. Mittal publisher, New Delhi.
2. Marimuthu, T., Krishnamoorthy, A.S., Sivaprakasam, K. and Jayarajan. R. 1991. Oyster Mushrooms, Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore.
3. Tripathi, D.P. 2005. Mushroom Cultivation, Oxford & IBH Publishing Co. Pvt.Ltd., New Delhi.
4. Pathak, V.N. 2011. Mushroom Production and Processing Technology. 1st Edition. Agrobios (India). ISBN-10: 8177540068.

Reference Books:

1. Chang, S.T and Wiles, G. 2004. Mushrooms. CRC press, London, 2004.
2. Diego, C.Z. and Pando-Gimenez, A. 2017. Edible and medicinal mushrooms: Technology and Application. Wiley-Blackwell Publishers.
3. NIIR. 2005. Hand book on Mushroom Cultivation and Processing. Asia Pacific Business Press, New Delhi.
4. Pandey, B.P. 2001.College Botany – Volume I. 4th ed. S. Chand & Company Limited, New Delhi, 2001.
5. Singh, O.R. and Singh, U.C. 2005. Modern Mushroom Cultivation. Agrobios ((India), Jodhpur.

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	H	M	M	M	H	H	H	M	M	H	M	H
CO2	H	M	H	M	H	H	H	M	H	H	M	H
CO3	H	M	H	M	M	H	M	M	H	H	M	H
CO4	H	M	H	M	H	H	H	M	H	H	M	H
CO5	H	H	H	M	H	M	M	M	M	H	M	H

H-High M- Medium L –Low

Course Designed by	Verified by HOD	Checked and Approved by
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