KONGUNADU ARTS AND SCIENCE COLLEGE

(AUTONOMOUS)

COIMBATORE – 641 029

DEPARTMENT OF BOTANY (PG)

CURRICULUM AND SCHEME OF EXAMINATIONS (CBCS)

(2026 – 2027 onwards)

KONGUNADU ARTS AND SCIENCE COLLEGE
(AUTONOMOUS)
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DEPARTMENT OF BOTANY

VISION

- Disseminate knowledge and feasible strategies for obtaining sustainable benefits from plants and their utility to the society.

MISSION

- Designing the curriculum by frequently updating the syllabi according to the need.
- Preparing the students with more aptitude, skill and leadership quality by educating them.
- Make the students as entrepreneurs in the plant based industries.
- Identification and encouragement to turn the students into eminent Scientists/ Laurels.

PROGRAMME OUTCOMES (PO)

PO 1

- This programme aids an excellent opportunities for students to develop demonstrative knowledge, understanding skills, qualities and other attributes in range of plant diversity in terms of structure, function, evolution and their environmental relationships.

PO2

- Plant diversity conservation strategies such as tissue culture techniques, in situ and ex situ methods motivate students to create interest towards nature and its protection of plant heritage.

PO3

- Contribution and importance of medicinal plants instill a sense of care and concern over the improved production of our supply on medicine, food and other plant products for the betterment of man's holistic development and welfare.

PO4

- Explore the therapeutic aspects of medicinal plants by traditional indigenous approaches and perspectives on treating ailments

PO5

- Contribution and importance of medicinal plants instill a sense of care and concern over the improved production of out supply on medicine, food and other plant products for the betterment of man's holistic development and welfare.

PO6

- Students can acquire acquainted knowledge on basic scientific phenomena, fundamental principles and applications of various mathematical tools and physical principles in relevant biological situations.

PO7

- Students will be able to understand the potentials and impact of biotechnological innovations by implementing modern appropriate techniques and practical exposures in the field of Plant Molecular Biology, Plant Biotechnology and Nanobiology.

PO8

- Demonstrate knowledge and understanding of concepts and principles in recent research approaches and to manage projects in multidisciplinary environments.

PROGRAMME SPECIFIC OUTCOMES (PSO)

PSO1

- Students can understand the range of plant and microbial diversity in terms of morphology and internal structural organization, function and environmental relationships from primitive to highly evolved plant groups to improvise the existing plant resources for acquiring economic and ecological benefits.

PSO2

- Students can extemporize on the importance of ethics, environmental principles and responsibilities relevant to biodiversity conservation and the sustainability of plants, management of natural bioresources, therapeutic aspects of medicinal plants and perspectives on horticulture and landscaping techniques intended to facilitate experiential learning in plant research and applications.

PSO3

- Students can understand and acquire knowledge on identification, distribution, analyze and apply knowledge of fundamental plant processes to solve problems in agriculture, conservation and management of natural bioresources, cultivation practices, controlling measures of disease, plant breeding and exploring their therapeutic values economically, culturally and aesthetically.

PSO4

- Provide excellent opportunities for students to develop demonstrative knowledge, understanding skills, perform procedure and hands-on training experiences, qualities and other attributes in the range of cellular and molecular organization and related techniques, internal structures of plants, ontogenesis and evolution in terms of phylogenetic trends.

PSO5

- Students can acquire knowledge on basic scientific phenomena, fundamental principles and applications of various mathematical tools, physical and chemical principles, computational analyses, instrumentation skills, learning of experimental design, and methods of research in relevant biological situations through molecular biology, biotechnology and nanobiology, analysis and interpretation of data and development of reports to provide valid conclusions.

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Programme Name: M.Sc. Botany

Curriculum and Scheme of Examination under CBCS

(Applicable to the students admitted during the Academic Year 2026-2027 and onwards)

Semester	Subject Code	Title of the Paper	Instruction hours /cycle	Exam Marks			Duration of Exam (hours)	Credits
				CIA	ESE	Total		
I	26PBO101	Core Paper 1 – Plant Diversity I	7	25	75	100	3	5
	26PBO102	Core Paper 2 – Plant Diversity II	7	25	75	100	3	5
	26PBO103	Core Paper 3 – Microbiology and Plant Pathology	6	25	75	100	3	4
	26PBO1CL	Core Practical 1	5	40	60	100	4	3
	26PBO1E1	Major Elective – 1	5	25	75	100	3	5
		Total	**30**	-	-	**500**	-	**22**
II	26PBO204	Core Paper 4 – Anatomy, Embryology of Angiosperms and Microtechniques	7	25	75	100	3	5
	26PBO205	Core Paper 5 – Cell Biology, Genetics and Plant Breeding	7	25	75	100	3	5
	26PBO206	Core Paper 6 – Bioinstrumentation, Research Methodology and Biostatistics	6	25	75	100	3	4
	26PBO2CM	Core Practical 2	5	40	60	100	4	3
	26PBO2E2	Major Elective – 2	5	25	75	100	3	5
		Total	**30**	-	-	**500**	-	**22**
III	26PBO307	Core Paper 7 – Taxonomy and Biosystematics	6	25	75	100	3	4
	26PBO308	Core Paper 8 – Biophysics and Biochemistry	7	25	75	100	3	5
	26PBO309	Core Paper 9 – Plant Physiology	6	25	75	100	3	4
	26PBO3CN	Core Practical 3	5	40	60	100	4	3
	26PBO3N1	Non-Major Elective – 1	4	25	75	100	3	4
	-	Extra Departmental Course (EDC)	2	100	-	100	3	2
	26PBO3IT	Internship Training****	**Grade**					
		Total	**30**	-	-	**600**	-	**22**
IV	26PBO410	Core Paper 10 – Ecology, Bioenergetics and Natural Resource Management	7	25	75	100	3	5
	26PBO411	Core Paper 11 – Plant Biotechnology	7	25	75	100	3	4
	26PBO412	Core Paper 12 – Bioinformatics	7	25	75	100	3	4
	26PBO4CO	Core Practical 4	5	40	60	100	4	2
	26PGI4N2	Non-Major Elective – 2	4	100	-	100	3	4
	26PBO4Z1	Project & Viva – Voce	-	20	80	100	-	5
		Total	**30**	-	-	**600**	-	**24**
		Grand Total		-	-	**2200**	-	**90**

Note:

CBCS – Choice Based Credit System
CIA – Continuous Internal Assessment
ESE – End of Semester Examinations

**** - The students shall undergo Internship training / field work for a minimum period of 14 working days at the end of the **Second semester** during summer vacation and submit the report in the **Third semester** which will be evaluated for 100 marks by the concerned guide and followed by an Internal Viva voce by the respective faculty or HOD as decided by the department. According to their marks, the grades will be awarded as given below.

Marks %	Grade
85-100	O
70-84	D
60-69	A
50-59	B
<40	U (Reappear)

Major Elective Papers

(4 papers are to be chosen from the following 9 papers)

1. **Forest Resources and Conservation**
2. **Seed Technology**
3. **Food Science and Nutrition**
4. **Molecular Biology**
5. **Horticulture**
6. **Algal Technology**
7. **Bioinoculant and Solid Waste Management**
8. **Biotechnology and Nanobiology**
9. **Industrial Botany**

Non-Major Elective Papers

(2 papers are to be chosen from the following 5 papers)

1. **Herbal Medicine**
2. **Applied Microbiology**
3. **Limnology**
4. **Advancements in Industry 4.0**
5. **Fundamentals of Information Security** #

To be offered by the respective department

Sub. Code and Title of the Extra Department Course (EDC):

26PBO3X1- EDC Paper 1: APPLIED HORTICULTURE

Note: In core subjects, number of papers both theory and practical are included wherever applicable. However, the total credits and marks for core subjects remain the same as stated below.

Tally Table:

Part	Subject	No. of Subjects	Total Marks	Credits
I	Core - Theory / Practical / Project	17	1700	70
	Major Elective Papers	2	200	10
	EDC Paper	1	100	2
	Non - Major Elective Paper	2	200	8
	Grand Total	**22**	**2200**	**90**

- 100 % CIA for Fundamentals of Information Security and EDC.
- The students should complete any **MOOC course available for Online learning platforms like SWAYAM, NPTEL, IIT Bombay Spoken Tutorial, e-Pathshala etc.,** before the completion of the 3rd semester and the course completion certificate should be submitted through the HoD to the Controller of Examinations. Appropriate credits will be given to the candidates who have successfully completed.
- **Onsite Training** preferably relevant to the course may be undertaken as per the discretion of the faculty or HoD.
- Extra credits shall be awarded for innovative products/ individual paper presentations and publications in reputed national/ international proceedings and in indexed journals by the PG students for their original research contributions.
- Product development through Technology Readiness Levels:
  - Phase 1 Level (TRL 1-3) : Basic research: 1 credits
  - Phase 2 Level (TRL 4 -6) : Development and validation : 2 credits
  - Phase 3 Level (TRL 7-9) : Deployment : 3 credits
- National / International level paper presentation in conferences and publications of full papers in reputed Scopus/ web of Science indexed journals
  - National Level : 1 credit/ paper
  - International Level : 2 credits/ paper
  - Open access Journals are not included
- Extra credits shall be awarded to students who prefer to opt any course out of their programme on self learning mode. No internal components. 100% ESE.

Teaching Pedagogy

Smart ClassRoom/Powerpoint presentation/Seminar/Quiz/Discussion/Flipped Classroom/Peer Learning/Experimental Learning/Blended learning

Flipped Classroom

Preamble:

- Under flipped classroom model, students review foundational content before class, with class time dedicated to practice, discussion, and problem – solving where the role of the teachers will be facilitating discussions and enabling students to embark on a holistic learning perspectives

Work instructions:

- One flipped session / unit is made mandatory and the course In-charge shall identify and specify the topic to be covered in the flipped session in the lesson plan.
- Detailed session plans must be intimated to all students at least one week in advance.
- Curated content such as LORs, video lectures, animations, and other relevant digital content shall be provided to students in advance to facilitate effective preparation for the flipped classroom session.

Peer Learning

Preamble:

- Peer Assisted learning enables students to learn from each other sharing knowledge in a collaborative learning environment.
- Development of leadership skills and student engagement through student to student academic support.
- Reduce drop out/failure rates of the students and create a supportive academic culture where a high performing or trained student assists peers academically.

Work Instructions:

- Course In-charge shall supervise the programme by periodically reviewing its implementation, conducting review meetings, and monitoring the progress reports.
- Course In-charge shall identify 5 to 6 fast learners based on their academic performance in internal and external examinations.
- Course In-charge shall also identify students who require additional academic support and assign 4 to 5 such students to each fast learner to facilitate peer learning.
- This team will operate remedial classes on a peer learning mode as per the following:
  a) One session / week / course and each session shall be for 30 minutes in duration, with follow-up learning activities.
  b) The faculty In-charge shall review attendance records and monitor the academic progress of the students.

Blended learning

Preamble:

- Blended learning integrates traditional in class instruction with digital tools exposing students to a myriad options for learning from subject experts across the globe
- It is provided with online learning sessions on recorded videos, lecture captured sessions (included under guided library hours), digital resources, and guided sessions facilitated by internal faculty members and external experts through Zoom meets etc.,

Work Instructions:

- For every course, students will be motivated to attend additional webinar/online courses through any interactive learning tools such as, telepresence systems, podcasts, interactive videos etc. with minimum of 2 sessions/course and maximum of 3 sessions/course.

Extra Credit Courses

Semester	Subject Code	Title of the Paper	Instruction hours /cycle	Exam Marks			Duration of Exam (hours)	Credits
				CIA	ESE	Total		
II	**26PBO0J1**	**JOC - Floriculture and Landscaping**	4	-	100	**100**	3	**2**
	26PBO0J2	**JOC - Food Processing and Preservation**	4	-	100	**100**	3	**2**

Components of Continuous Internal Assessment

Components		Marks	Total
Theory			
CIA I	75	(75+75=150/10) converted to 15	25
CIA II	75		
Objective Capacity testing*/Seminar		5	
Attendance		5	
Practical			
CIA Practical		25	40
Observation Notebook		10	
Attendance		5	
Project			
Review		15	20
Regularity		5	

*** Objective Capacity Testing:**

- For the first assessment, questions shall be set from 2 ½ units (25 questions) and evaluation for 5 marks. The assessment shall be conducted through any authentic online platform, one week prior to the commencement of I CIA theory examinations.

- For the second assessment, questions shall be set from 2 ½ units (25 questions) and evaluation for 5 marks. The assessment shall be conducted through any authentic online platform, one week prior to the commencement of II CIA theory examinations.

- The average of the first and second assessment scores shall be considered for the final **5 marks** allocation.

BLOOM'S TAXONOMY BASED ASSESSMENT PATTERN

K1 - Remembering; **K2 -** Understanding; **K3 -** Applying; **K4 -** Analyzing; **K5 -** Evaluating

1. Theory Examination: CIA I & II and ESE: 75 Marks

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

2. Practical Examination:

Knowledge Level	Section	Marks	Total
K3 ⇕ K5	Experiments	50	60
	Record Work	10	

3. Project Viva Voce:

Knowledge Level	Section	Marks	Total
K3 ⇕ K5	Project Report	60	80
	Viva - voce	20	

KONGUNADU ARTS AND SCIENCE COLLEGE (AUTONOMOUS)
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THE MODALITIES FOR THE CONDUCT OF 100% CIA EXAMINATIONS

PREAMBLE

As per the recommendations of the Curriculum Development Cell in its meeting held on 27.08.2021, and decision taken in the General Board of Studies meeting held on 16.03.2022, the courses **Cyber Security and Information Security** were introduced in the III semester for all the UG programmes and in the even semester for the PG programme respectively for the students admitted from the academic year 2022-2023 and onwards. Also, it was unanimously decided to conduct 100 % CIA examinations (No End of Semester Examinations) for these courses. The name of the Courses Cyber Security and Information Security are renamed as **Basics of Cyber Security** and **Fundamentals of Information Security** as per the decision taken in the General Board of Studies meeting held on 26.03.2026 for the students to be admitted from the academic year 2026-2027 & onwards. As per the recommendations of the Curriculum Development Cell in its meeting held on 07.03.2022, it was approved in the BOS meeting held on 19.03.2022 to conduct 100% CIA Examinations for the **Extra Departmental Courses** offered in the UG and PG Programmes for the students admitted from the academic year 2022-2023 and onwards. The cited decisions had been approved by the Academic council in its meeting held on 18.04.2022. As per the recommendations of the Curriculum Development Cell in its meeting held on 27.02.2024, and decision taken in the General Board of Studies meeting held on 02.05.2024, the course **Basics of IPR** was introduced in the VI semester for all the UG programmes for the students admitted from the academic year 2024-2025 and onwards and decided to conduct 100 % CIA examinations (NO End of Semester Examinations) for the course.

Hence, the modalities is recommended for the following:

(i) Conduct of I & II CIA Examinations

(ii) Question Paper Pattern

(iii) CIA Examination Mark Breakup

(iv) Attendance Calculation

CONDUCT OF I & II CIA EXAMINATIONS

1. The CIA Examinations I & II for the above said courses must be conducted along with the other courses under centralized system.
2. The students must appear I & II CIA Examinations compulsorily, since **End of Semester Examinations will NOT be conducted** for the above said courses.
3. If any of the student (s) could not appear for CIA Examinations for the above said courses, with reasons mentioned in the College Calendar, re-examination shall be conducted as per the existing procedures.

QUESTION PAPER PATTERN

The following question paper pattern will be followed for the above said courses:

Section A - Multiple Choice	(10 × 1 = 10 Marks)
Section B - Either or Type	(5 × 5 = 25 Marks)
Section C - Either or Type	(5 × 8 = 40 Marks)

Maximum Marks : 75 Duration : 3 Hours

CIA EXAMINATION MARK BREAKUP

The CIA Examination mark breakup for the courses **Basics of Cyber Security, Fundamentals of Information Security and Basics of IPR** is given below:

S.No.	Distribution Component	Marks
1	CIA I – 75 Marks Converted to 30	30
2	CIA II – 75 Marks Converted to 30	30
3	Seminar/Objective Capacity Testing	10
4	Seminar/Objective Capacity Testing	10
5	Attendance	05
6	Any Case Study related to Cyber Security (as a Group)	15
	Total	**100**

The CIA Examination mark breakup for the **Extra Departmental Courses** offered for UG/PG Programmes is given below:

S.No.	Distribution Component	Marks
1	CIA I – 75 Marks Converted to 40	40
2	CIA II – 75 Marks Converted to 40	40
3	Seminar/Objective Capacity Testing	05
4	Seminar/Objective Capacity Testing	05
5	Attendance	05
6	Others (Group Discussion, Flipped Class room, etc.,)	05
	Total	**100**

ATTENDANCE CALCULATION

1. Separate attendance register must be maintained for **Basics of Cyber Security, Fundamentals of Information Security and Basics of IPR** in the Department and the final consolidated Attendance must be submitted to the COE along with the assessment Marks.
2. The attendance must be calculated by using the following formula:
   Attendance percentage = Number of Classes attended / Number of Classes conducted × 100
3. The students should be allowed to write the CIA examinations as per the existing norms related to attendance. The staff in charge of the respective courses have the responsibility to calculate the attendance percentage and submit the same to the Coordinator of the CIA Examination Committee during the I CIA and II CIA Examinations.
4. If the staff in charge finds that students have not put up enough attendance during the I CIA Examinations, he/she shall counsel the student(s) appropriately so that at the end of the course they have sufficient Attendance.

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MODALITIES FOR THE CONDUCT OF OPEN BOOK EXAMINATION SYSTEM FOR THE COURSES BASICS OF CYBER SECURITY AND FUNDAMENTALS OF INFORMATION SECURITY FOR ALL UG AND PG PROGRAMMES RESPECTIVELY

PREAMBLE

The Curriculum Development Cell (CDC) meeting was convened on 16.10.2025 and recommended to implement an open book examination system for the courses, Basics of Cyber Security and Fundamentals Information Security for all UG and PG programmes to improvise conceptual understanding skills, promote deep learning, enhance assessment quality and strengthen comprehensive skills, for the students to be admitted from the academic year 2026-2027 and onwards.

1.Purpose

To provide guidelines for conducting open book examinations that encourage critical thinking, application of knowledge, and analytical skills.

2.Scope

Applicable to Basics of Cyber Security and Fundamentals of Information Security courses for the undergraduate and postgraduate programmes respectively.

3. Examination Guidelines

Question Paper Design

- Questions should be Focused on higher-order thinking (analysis & evaluation)
- Avoid direct recall questions

Communication to Students and Staff Members

- Inform students in advance about the format, rules, and allowed resources.

- ❖ Provide sample questions to familiarize them with the OBE style.
- ❖ All the Staff members should be familiar about the prescribed Books of the Basics of Cyber Security and Fundamentals of Information Security.
- ❖ Students are permitted to carry the prescribed Books (in original or xerox copy) duly signed by the respective staff in charge of courses to the examination Hall.
- ❖ Invigilators of the respective examination halls should permit the students with the prescribed book (in original or xerox copy) and not to allow the students with other than the prescribed Books.

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THE MODALITIES FOR THE CONDUCT OF 100% CIA PRACTICAL EXAMINATIONS (For EDC Courses)

CONDUCT OF 100% CIA PRACTICAL EXAMINATIONS

1. The Students shall appear for **TWO** CIA practical examinations which are evaluated as 100% internal examinations.
2. The students must appear **TWO** CIA practical examinations compulsorily, since End of Semester examinations will NOT be conducted for the above said course.
3. If any of the student(s) could not appear for CIA Examinations, as per reasons mentioned in the College Calendar, re-examination shall be conducted as per the existing procedures and norms.

The CIA Practical Examination mark breakup for the Extra Departmental Courses (EDC) offered for the UG & PG Programme is given below:

S.No.	Component Distribution	Marks
1.	CIA Practical I – 60 marks converted to 30	30
2.	CIA Practical II – 60 marks converted to 30	30
3.	Continuous assessment of practical (Observation to be submitted*) (15 Experiments/Programs x 2 = 30 marks)	30
4.	Record	05
5.	Attendance	05
	Total	**100**

* In case a student is absent for an Experiment/Program conducted on a particular day, the student will not be allowed to compensate that Experiment/Program and will be awarded zero for that particular Experiment/Program and shall be marked absent. In case any student has an attendance lack; the concerned faculty handling the course in consultation with HoD may permit the student who has an attendance lack to compensate one or two Experiment/Programs as the case may be to enable them to become eligible with mandate of 75% attendance to appear for the Continuous Internal Practical Examinations. However the compensated Experiment/Programs will not be awarded any marks whatsoever.

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MODALITIES FOR THE CONDUCT OF 100% CIA FOR THE ONE CREDIT SELF- STUDY COURSE AND THE MARK DISTRIBUTION PATTERN FOR THE PART III THEORY PAPER OF APPLICABLE COURSE

PREAMBLE

The Curriculum Development Cell (CDC) meeting was convened on 16.10.2025 and recommended to have one credit Self Study Course for applicable programmes in both UG & PG programme in the V and II semester respectively for the students to be admitted from the academic year 2026-2027 and onwards.

In order to foster independent learning, enhance academic flexibility, and encourage students to explore knowledge, the institution introduces the One Credit Self Study Course. This initiative is designed to provide students with an opportunity to pursue structured self-learning during the regular programme of study.

The one credit Self Study Course for applicable UG & PG programme in the V and II semester respectively, for the students admitted from the academic year 2026-2027 and onwards.

1. CIA COMPONENTS FOR ONE CREDIT COURSE

CIA shall be conducted by the department concerned.

CIA I	50 (Converted to 10)	20	25
CIA II	50 (Converted to 10)		
Case Study		5	

QUESTION PAPER PATTERN

Duration : 2 Hours

Knowledge Level	Section	Marks	Description	Total
K1 Q1 to Q6	A (Answer all)	6 x 1 = 6	MCQ	50
K2 – K4 Q7 to Q 10	B (Either or pattern)	4 x 5= 20	Short Answers	
K2 – K5 Q11 to Q 13	C (Either or pattern)	3 x 8 = 24	Descriptive / Detailed	

2. PART III THEORY APPLICABLE COURSE

(CIA : 20 MARKS, ESE : 55 MARKS)

CIA: 20 Marks

CIA I	55	(55+55) Converted to 10	20
CIA II	55		
Objective Capacity Testing /Seminar		5	
Attendance		5	

ESE : 55 Marks

QUESTION PAPER PATTERN

Knowledge Level	Section	Marks	Description	Total
K1 Q1 to 10	A (Answer all)	10 x 1 = 10	MCQ	55
K2 – K4 Q11 to 15	B (Either or pattern)	5 x 3 = 15	Short Answers	
K2 – K5 Q16 to 20	C (Either or pattern)	5 x 6 = 30	Descriptive / Detailed	

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MODALITIES FOR THE AWARD OF APPROPRIATE EXTRA CREDIT TO THE STUDENTS WHO PREFER TO OPT ANY COURSE OUT OF THEIR PROGRAMME ON SELF LEARNING MODE

PREAMBLE

The Curriculum Development Cell (CDC) meeting was convened on 16.10.2025 and recommended to motivate the students to opt any course(s) other than their core programme of study (theory papers only) through self-learning mode and extra credits can be awarded on their successful completion. However, such students availing this option shall not opt for any of the 100% CIA courses. This skill set will broaden intellectual horizons, foster holistic and integrative learning and equip diverse skill sets. This is applicable for the students to be admitted from the academic year 2026-2027 and onwards.

1. **Semester Restriction:**

   Students may choose the courses offered only within their current semester. Courses beyond the semester in which they are enrolled shall not be permitted.

2. **Course Type:**

   Only **theory courses** may be opted under this provision. Practical courses, Extra Departmental Courses (EDC), and courses assessed entirely through Continuous Internal Assessment (CIA) shall not be eligible.

3. **Evaluation Method:**

   A **100% End of Semester Examination (ESE)** shall be conducted for the chosen course.

4. **Marks & Scheme:**

   The ESE shall be conducted in accordance with the marks prescribed for the particular course in the approved scheme, along with its corresponding credit allocation.

5. **Conversion of Marks:**

The marks obtained by the student in the ESE shall be converted to a scale of **100 marks** for uniformity.

6. **Award of Credits:**

The credits allotted to the course in the scheme shall be transferred to the student as **Extra Credit**, provided the student secures the prescribed pass mark in the ESE.

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26PBO101

Programme Code: 05		**M.Sc., BOTANY**			
Core Paper 1: PLANT DIVERSITY - I					
Batch 2026-2027	**Semester I**	**Hours / Week 7**	**Total Hours 105**	**Credits 5**	**Skill Development**

COURSE OBJECTIVES

- To obtain knowledge on diverse groups of Thallophytes.
- To impart insight knowledge on the diversity, structural organization and reproduction of algae, fungi and lichens.
- To acquire knowledge on the life cycle patterns of Thallophytes and their significance.

COURSE OUTCOMES

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

K1	CO1	Grasp the basic concepts of lower life forms.
↑	CO2	Understand the diversity in habits, habitats and organization of various groups of lower plants.
↕	CO3	Explore knowledge on the modes of nutrition and fructifications in fungi
↓	CO4	Apply the inherit knowledge on the exploitation of useful products from lower forms for the betterment of human welfare.
K5	CO5	Evaluate the structural organization and life cycle patterns of various lichens.

SYLLABUS

UNIT I **(21 HOURS)**

Phycology: History, Detailed study of habit, habitat and distribution of algae. Systems of classification in algae, Classification of algae by Fritsch (1945). General characters - thallus organization, algal pigments, reproduction and life cycle patterns in algae. Thallus organization, reproduction and life cycles of Cyanophyceae, Chlorophyceae and Xanthophyceae.

UNIT II **(21 HOURS)**

Phycology: Thallus organization, reproduction and life cycle patterns of Bacillariophyceae, Phaeophyceae and Rhodophyceae. Recent insights of algal phylogeny and evolution. Ecological and economical aspects of algae. Algae as pollution indicators*. Algal blooms. Centers of algal research in India. Contribution of Indian Phycologists, Application of Machine learning (ML) techniques in Algae.

UNIT III **(21 HOURS)**

Mycology: History, General features, occurrence and distribution, mode of nutrition, range of thallus organization, reproduction and types of fructifications and types of spores, fungal taxonomy, classification of fungi by Alexopoulos and Mims (1979). Thallus organization, reproduction and life cycle patterns of Myxomycetes and Oomycetes.

26PBO101

UNIT IV **(21 HOURS)**

Mycology: Thallus organization, reproduction and life cycle patterns of Zygomycetes, Ascomycetes, Basidiomycetes and Deuteromycetes. Homothallism and heterothallism. Fungi as symbionts- recent insights of fungal phylogeny and evolution. Ecological and economic importance of fungi.

UNITV **(21 HOURS)**

Lichenology: History, General features, distribution, classification and structural organization of Lichen thallus. Nature of dual organisms, Interrelationships of phycobionts and mycobionts in lichen thallus organization. Structure, reproduction and life cycle patterns of Ascolichen, Basidiolichen and Deuterolichens. Ecological and economic aspects of lichens. Lichens as pollution indicators.

*** Self Study**

TEXT BOOKS

1. F.E. Fritsch, (2011). The structure and reproduction of the Algae Vol. I & II. recently reprinted on 2011–2018 by Cambridge University Press
2. Constantine J. Alexopoulos, Charles W. Mims, and Meredith Blackwell (reprint, 2018). Introductory Mycology, 4th Edition. Wiley India Pvt. Ltd. Noida.
3. O.P.Sharma, Fundamentals of Algae (2024/2026) 3rd Edition, McGraw Hill Education (India) Publisher, New Delhi.
4. Gangulee, Das and Kar. (2001). College Botany Vol. I & II. New central Book agency Pvt. Ltd. Calcutta.
5. V. Singh, P.C. Pandey and D.K. Jain. (2012). A Text book of Botany. Rastogi Publication. Meerut, India.

REFERENCE BOOKS

1. E.A. Bessey, (1971). Morphology and Taxonomy of Fungi. Hafner Publication Company, New York. 2021 Hardbound Edition: Published by Scientific Publishers (India) under the imprint United Book Prints.

2. K.S. Bilgrams, and R.N. Verma, (2011). Physiology of Fungi (3rd Revised and Enlarged Edition). published by Scientific Publishers.

3. J.W. Deacon (2006). Fungal Biology (4th Edition). Wiley-Blackwell, Hoboken, New Jersey, United States.

4. John Webster and Roland W.S. Weber (2007). Introduction to Fungi (3rd Edition). Cambridge University Press.

5. A.C. Dutta, (2020 reprint) Botany, Oxford University Press, New Delhi

6. H.C. Dube, (2008). An Introduction to Fungi, Vikas Publishing Pvt. Ltd. Delhi

7. Vashishta, B.R., Sinha, A.K. and Singh, V.P. (2014). Botany for Degree Students: Algae (Revised Ed.). S. Chand & Company Ltd., New Delhi. (Reprinted 2024).

26PBO101

WEB RESOURCES:

1. https://entri.app/blog/wp-content/uploads/2022/05/phycology.pdf
2. https://cpur.in/iqac/naac-documents/other/Consolidate/Thallus%20organizations%20&%20reproduction%20in%20algae.pdf
3. https://www.scribd.com/document/470977925/Algae-Classification-Fritsch-pdf
4. https://biosci.sierracollege.edu/materials/4/lecture_notes/b4ln_fungi.pdf
5. https://microbenotes.com/classification-of-fungi/
6. https://www.researchgate.net/profile/Tarek-Abdelghany/publication/326205285_Mycology/links/5b9179db299bf147391f8bb9/Mycology.pdf
7. https://www.rlsycollegebettiah.ac.in/wp-content/uploads/2023/02/file_63e39a790ec90.pdf
8. https://www.rlsycollegebettiah.ac.in/wp-content/uploads/2023/02/file_63e39af70e978.pdf
9. https://www.biologydiscussion.com/fungi/biology-notes-on-homothallism-fungi/63765
10. https://library.uniq.edu.iq/storage/books/file/Introduction%20to%20Fungi/1666526490Introduction%20to%20Fungi.pdf

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	H	H	S	M
CO2	S	M	H	M	H
CO3	H	S	H	S	S
CO4	H	H	M	S	M
CO5	S	S	H	M	H

S - Strong **H** - High **M** - Medium **L** - Low

Content Prepared by (Based on Inputs) Dr. P. Revathi Signature of the Course in-charge	 Signature of the HoD

26PBO102

Programme Code: 05		**M.Sc., BOTANY**			
Core Paper 2: PLANT DIVERSITY – II					
Batch 2026-2027	**Semester I**	**Hours / Week 7**	**Total Hours 105**	**Credits 5**	**Skill Development**

COURSE OBJECTIVES

- To impart insight knowledge on the structural organizations and life cycle patterns of Bryophytes, Pteridophytes and Gymnosperms.
- To understand the basic concepts of evolutionary trends in Cryptogams and Phanerogams.
- To learn the preserved vestiges of various plant life forms of the geological past.

COURSE OUTCOMES

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

K1 ↕ K5	CO1	Gain knowledge on ecological and phylogenetical aspects of Bryophytes.
	CO2	Understand the general distribution and characters of Pteridophytes.
	CO3	Apply knowledge on vascular organization and evolution of Pteridophytes.
	CO4	Distinguish various diagnostic features and distribution of Gymnosperms.
	CO5	Analyze the acquired knowledge on diversity of plant species and apply to the field level.

SYLLABUS

UNIT I **(21 HOURS)**

Bryophytes: General features and distribution. Classification of Bryophytes (Smith, 1955). General characters of Hepaticopsida, Anthoceropsida and Bryopsida. Structure and evolution of gametophyte and sporophyte. Ecological and economic importance of Byrophytes*. Fossil Bryophytes.

UNIT II **(21 HOURS)**

Pteridophytes: General features and distribution of Pteridophytes. Classification of Pteridophytes by Sporne (1966). General characters of Psilotopsida, Lycopsida, Sphenopsida and Pteropsida.

UNIT III **(21 HOURS)**

Reproduction methods in Pteridophytes. Origin and evolution. Vascular organization and stelar evolution in Pteridophytes. Heterospory and origin of seed habits. Evolution of sorus. Ecological and economic importance of Pteridophytes.

UNIT IV **(21 HOURS)**

Gymnosperms: General characters, distribution and origin of Gymnosperms. Classification of Gymnosperms by Sporne (1965). General structure and inter-relationships of Pteridospermales, Bennettitales, Pentoxylales, Ginkgoales, Cycadales, Coniferales and Gnetales. Angiospermic characters of Gnetales. Economic importance of Gymnosperms

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UNIT V **(21 HOURS)**

Paleobotany: Introduction and Contribution of Birbal Sahni to Paleobotany. Economic importance of fossils - fossils for fuel and as industrial raw materials. Study of organ genera: *Sphenophyllum, Calamostachys,Pentoxylon* and *Medullosa*

*** Self study**

TEXT BOOKS

1. Gangulee, Das & Kar. (2001. College Botany Vol I & II. New central Book agency Pvt. Ltd. Calcutta.
2. B.P. Pandey, (1990). (6th Ed.). A Textbook of Botany Vol. II. S. Chand & Co. Ltd., New Delhi.
3. P.C. Vasistha, (1971). Botany for Degree students. S. Chand & Co. Ltd., New Delhi.
4. B.P. Pandey, College Botany, Volume II. Including Pteridophytes, Gymnosperms, Paleobotany and Angiosperms. S. Chand & Co Ltd.
5. A.V.S.S. Sambamurty (2020). A Textbook of Bryophytes, Pteridophytes, Gymnosperms and Paleobotany. Dreamtech Press Publisher. New Delhi.

REFERENCE BOOKS

1. K.R. Sporne, (1966). The morphology of Pteridophytes. Bal Bergen Boeken, London.
2. K.R. Sporne, (1967). The morphology of Gymnosperms. Bal Bergen Boeken, London.
3. C.D. Arnold, (1947). An introduction to Paleobotany. McGraw Hill Publications, New York.
4. A.C.Seward, (1991). Fossil plants. Today and Tomorrow Publishers, New Delhi.
5. Chittaranjan Mohanty (2018). Text Book of Bryophytes, Pteridophytes, Gymnosperms and Paleobotany. Kalyani Publications, New Delhi.
6. Anupama Krishna (2011). Botany for Degree Students: Bryophyta. S. Chand Publishing, New Delhi.
7. O.P. Sharma (2012). Pteridophyta. Tata McGraw-Hill Publication, Uttar Pradesh.
8. S. P. Bhatnagar, Alok Moitra (1996). Gymnosperms. New Age International, New Delhi.
9.

WEB RESOURCES

1. http://easybiology.com.botany.pterodophytes
2. http://biology discussion.com.botany.pterodophytes
3. https://www.sciencedirect.com › topics › paleobotany
4. https://www.sciencedirect.com › topics › materials-science

PBO6

26PBO102

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	H	M	S	H
CO2	H	S	H	H	M
CO3	S	H	M	S	S
CO4	H	M	H	H	M
CO5	S	S	H	H	M

S - Strong **H** - High **M** - Medium **L** - Low

Content Prepared by (Based on Inputs) Dr. D. Moorthy Signature of the Course in-charge	Signature of the HoD

26PBO103

Programme Code: 05	**M.Sc., BOTANY**				
Core Paper 3: MICROBIOLOGY AND PLANT PATHOLOGY					
Batch 2026-2027	**Semester I**	**Hours / Week 6**	**Total Hours 90**	**Credits 4**	**Skill Development**

COURSE OBJECTIVES

- To disseminate knowledge on pathogenic group of organisms.
- To gain knowledge on disease management.
- To analyze the quality of water.

COURSE OUTCOMES

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

K1 ↕ K5	CO1	Recognize evolutionary relationships of microorganisms through various classifications.
	CO2	Understand the techniques of isolation and culture of microorganisms.
	CO3	Apply recent technologies and methods for the cultivation of microorganisms.
	CO4	Acquire knowledge on various plant diseases and their control measures
	CO5	Implement the plant disease management techniques in the fields.

SYLLABUS

UNIT I **(18 HOURS)**

Introduction to Microbiology: Historical account, scope of microbiology, major groups and classification - five kingdom concept and three domain system. Prokaryotic and eukaryotic organisms. **Bacteria**: morphology, classification (Bergey's manual), ultrastructure, chemical composition of cell wall. Bacterial reproduction - conjugation, transformation and transduction. Culture methods - pour plate, spread plate, streak plate and gram staining. Bacterial growth curve.

UNIT II **(18 HOURS)**

Viruses: Classification of plant viruses (outline only). General morphology and symmetrical structures of viruses. Morphology of bacteriophages (T - types). Ultrastructure of TMV and HIV. Viral replication - lytic and lysogenic cycles in T-even phages. Isolation and purification of plant viruses.

UNIT III **(18 HOURS)**

Fermentation: Aerobic and anaerobic fermentation*. Industrial production of antibiotics - penicillin; enzyme - amylase, organic acid - lactic acid, biofuel - ethanol. Biopolymer - PHB; microbial cell - Baker's yeast. Waste water treatment, detection of coliform bacteria - membrane filtration technique, multiple tube fermentation test. Milk microbiology - chemical composition of milk, microbes in milk.

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UNIT IV **(18 HOURS)**

Plant Pathology: History of Plant Pathology – Effect of pathogens on plant physiological functions. Classification and factors responsible for plant diseases, concepts in epidemiology - Koch's postulates - host parasite interactions, genetic basis of disease resistance and pathogenicity – structural and biochemical defense mechanism in hosts, dissemination of diseases - integrated disease management.

UNIT V **(18 HOURS)**

Common plant diseases of India - symptoms, causal organisms and control measures of Red rust of tea, Red rot of sugarcane, *Fusarium* wilt of cotton, black rust of wheat, bacterial blight disease of paddy, bacterial soft rot of carrot, bunchy top of banana, Yellow Vein Mosaic Disease in bhendi, Mycoplasma – little leaf of brinjal, nematode - root knot diseases in tomato, general principles of plant quarantine - sanitary and phytosanitary issues.

***Self study**

TEXT BOOKS

1. M.J. Pelczar, E.C.S. Chan and N.R. Krieg (2025). 'Microbiology' 7th edition, EWP Publishers / MedTech Science Press
2. R.C. Dubey and D.K. Maheshari (2023). A Text Book of Microbiology' S. Chand and Company Limited, New Delhi.
3. L.M. Prescott, J.P. Harley and D.A. Klein, (2019). Microbiology (11th ed.), McGraw-Hill Education, USA.
4. K.S. Bilgrami and H.C. Dube, (2018). A Text Book of Modern Plant Pathology, Vikas Publishing House Pvt. Ltd., New Delhi.
5. R.S. Mehrota and A. Aggarwal (2017). Plant Pathology, McGraw - Hill Education, New Delhi.
6. K.R. Aneja, P. Jain and R. Aneja (2018). A Text Book of Basic and Applied Microbiology. New Age International Publishers, New Delhi.
7. A.N. Glazer and H. Nikaido. (2007). Microbial Biotechnology (2nd ed.), Cambridge University Press, UK.

REFERENCE BOOKS

1. S.B. Sullia and S. Shantharam, (2016). General Microbiology, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
2. J.M. Jay, M.J. Loessner, D.A. Golden (2012). Modern Food Microbiology, Springer, USA.
3. G. Reed, (1983). Prescott & Dunn's Industrial Microbiology (4th ed.), AVI Publishing co., Westport, USA.
4. H.B.Schegel, (1993). General Microbiology (7th ed.), Cambridge University Press, UK.
5. R.S. Singh, (2017). Plant diseases (8th ed.) Oxford and IBH Publishing Co., New Delhi.
6. P.C. Trivedi, S. Pandey and S. Bhadauria (2010). Text Book of Microbiology. Pointer Publishers, Jaipur, India.

26PBO103

WEB RESOURCES

1. https://mis.alagappauniversity.ac.in/siteAdmin/dde-admin/uploads/2/PG_M.Sc._Zoology_350%2023_Microbiology.pdf
2. https://kahedu.edu.in/naac/C-3/Additional%20documents/E-content/1457.pdf
3. https://mis.alagappauniversity.ac.in/siteAdmin/dde-admin/uploads/3/PG_M.Sc._Botony_34631%20MICROBIOLOGY%20AND%20PLANT%20PATHOLOGY.pdf

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	M	L	S	H
CO2	H	H	S	M	S
CO3	H	M	H	H	M
CO4	S	H	M	H	H
CO5	H	M	S	H	H

S - Strong **H** - High **M** - Medium **L** - Low

Content Prepared by (Based on Inputs) Dr. K. Karthika Signature of the Course in-charge	 Signature of the HoD

26PBO1CL

Programme Code: 05	**M.Sc., BOTANY**				
Core Practical 1: PLANT DIVERSITY- I & II, MICROBIOLOGY AND PLANT PATHOLOGY					
Batch	**Semester**	**Hours / Week**	**Total Hours**	**Credits**	**Skill Development**
2026-2027	**I**	**5**	**75**	**3**	

COURSE OBJECTIVES

- To understand the diversity and distribution of lower life forms.
- To gain hands-on experience with techniques like culturing and pathogen isolation.
- To understand the pathogenic organisms causing various diseases.

COURSE OUTCOMES

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

K3 ↕ K5	CO1	Acquire and analyze inter-relationships between various lower life forms
	CO2	Examine variations in structural organization and reproduction of Cryptogams and Phanerogams
	CO3	Acquire requisite skill in the use and care of basic microbiological equipment; performance of basic laboratory procedures in microbiology Analyze techniques used for cultivation of microorganisms
	CO4	Identify and classify microorganisms using various microbial techniques. Gain knowledge on microbial diversity in different environments.
	CO5	Understand the types of plant diseases and identify the various symptoms of plant disease caused by casual organism.

SYLLABUS

I. PLANT DIVERSITY - I

Study of morphology, anatomy, vegetative and reproductive organs using clear whole mounts / sections of the following genera.

Algae

Cyanophyceae : *Spirulina, Lyngbya, Anabaena, Nostoc* and *Scytonema.*
Chlorophyceae : *Volvox, Ulothrix, Cladophora, Pithophora, Oedogonium, Codium, Caulerpa* and *Chara.*
Xanthophyceae : *Vaucheria*
Bacillariophyceae : *Diatoms*
Phaeophyceae : *Ectocarpus, Dictyota, Padina, Sargassum* and *Turbinaria*
Rhodophyceae : *Gelidium, Amphiroa, Gracilaria* and *Polysiphonia.*

Fungi

Myxomycetes : *Plasmodiophora.*
Oomycetes : *Albugo* and *Phytophthora.*
Zygomycetes : *Rhizopus.*
Ascomycetes : *Saccharomyces, Penicillium* and *Aspergillus.*
Basidiomycetes : *Agaricus* and *Puccinia.*
Deuteromycetes : *Colletotrichum* and *Cercospora.*

Lichens: Morphology of Crustose, Foliose and Fruticose Lichens. Structure and reproduction of *Usnea.*

26PBO1CL

II. PLANT DIVERSITY - II

Study of morphology, anatomy, vegetative and reproductive organs using clear whole mounts / sections of the following genera.

Bryophytes:

Marchantiales : *Marchantia* and *Lunularia*
Anthocerotales : *Anthoceros*
Sphagnidae : *Sphagnum*
Bryidae : *Funaria*

Pteridophytes:

Psilotopsida : *Psilotum*
Lycopsia : *Lycopodium* and *Selaginella*
Sphenopsida : *Equisetum*
Pteropsida : *Pteris* and *Adiantum*

Gymnosperms: *Cycas, Pinus, Cupressus*, *Podocarpus, Araucaria*, and *Gnetum.*

Fossils: Study of organ genera: *Sphenophyllum, Calamostachys, Pentoxylon* and *Medullosa,*

Field Trip: Three days field visit - Observations of species habits in their natural habitats and collection of specimens.

III. MICROBIOLOGY AND PLANT PATHOLOGY

1. Culture of microbes using serial dilution and pure culture techniques.
2. Isolation of microbes by pour plate, spread plate and streak plate methods.
3. Hydrogen sulphide test.
4. Methylene blue reductase test for milk.
5. Mobility by hanging drop method.
6. Isolation of fungal pathogens from soil.
7. Lab level production of wine.
8. Differential staining of bacteria using Gram stain.
9. Antimicrobial assay - disc - diffusion / agar well method.
10. Book photographs/diagrams: morphology - bacteria, viruses, media, serial dilution methods and any tools used in microbiology.
11. Books / Photographs/ diagrams of plant diseases mentioned in theory

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	H	H	M	H
CO2	H	S	H	H	S
CO3	H	M	S	H	M
CO4	S	M	M	H	S
CO5	S	H	S	S	H

S - Strong **H** - High **M** - Medium **L** - Low

Content Prepared by (Based on Inputs) Dr. D. Moorthy Signature of the Course in-charge	 Signature of the HoD

26PBO1CL

KONGUNADU ARTS AND SCIENCE COLLEGE (Autonomous)
COIMBATORE - 641 029
PG MODEL QUESTION PAPER (PRACTICALS)
End of Semester Examination Question Paper Pattern
(For the candidates admitted from the academic year 2026-2027 onwards)

Time: 4 Hours **Max. Marks: 60 Marks**

BREAK UP OF MARKS

Core Practical 1: PLANT DIVERSITY- I & II, MICROBIOLOGY AND PLANT PATHOLOGY

I.	Algal mixture	(3 × 2)	06 Marks
II.	Identify the given specimen to its class specify their general character	(2 × 4)	08 Marks
III.	Micro preparation	(4 × 3)	12 Marks
IV.	Microbiology experiment	(2 × 5)	10 Marks
V.	Plant Pathology	(2 × 2)	04 Marks
VI.	Spot at sight	(5 × 2)	10 Marks
		RECORD	**10 Marks**
		TOTAL	**60 Marks**

Content Prepared by (Based on Inputs) Dr. D. Moorthy Signature of the Course in-charge	 Signature of the HoD

26PBO204

Programme Code: 05	**M.Sc., BOTANY**				
Core Paper: 4 –ANATOMY, EMBRYOLOGY OF ANGIOSPERMS AND MICROTECHNIQUES					
Batch	**Semester**	**Hours / Week**	**Total Hours**	**Credits**	**Skill Development**
2026-2027	**II**	**7**	**105**	**5**	

COURSE OBJECTIVES

- To acquire knowledge about complex vascular tissues.
- To familiarize with the internal organization of plant tissues
- To obtain inherited knowledge on development of male and female gametophytes and their functions
- To understand the histochemical techniques involved in permanent micro slides.

COURSE OUTCOMES

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

K1 ↕ K5	CO1	Recognize various histochemical techniques involved in anatomy and embryology.
	CO2	Understand phylogenetic relationship of vascular tissues.
	CO3	Explore the embryological features of plants
	CO4	Analyze the techniques of parthenocarpy and polyembryony for the improvement of economically important crop species.
	CO5	Determine knowledge on the principles and concepts of histochemical staining techniques

SYLLABUS

UNIT I **(21 HOURS)**

Tissues – Meristems - process of differentiation of cells, simple and complex tissue, Primary xylem and its components, Secondary xylem – arrangement of vessels, wood parenchyma and its types, xylem rays, Dendrochronology – Growth rings, anomalies in ring growth, cross dating and skeleton plots, Reaction wood - Compression wood and tension wood, Primary and Secondary phloem and its components, Differences and Phylogenetic trends of xylem and phloem.

UNIT II **(21 HOURS)**

Normal secondary growth in dicot stem*. Vascular cambium - origin, types - storied and non storied cambium, cork cambium, Rhytidome, lenticel, wound healing activity, seasonality in cambial activity. Anomalous secondary growth in dicot and monocot stem in *Aristolochia*, *Boerhaavia, Piper* and *Draceana*. Nodal anatomy- unilacunar node, trilacunar node and multilacunar node and its phylogenetic evolution. Kranz anatomy - anatomical features of CAM plants and leaf abscission.

UNIT III **(21 HOURS)**

Development of anther, types of tapetum, role of tapetum in pollen wall development, pollen wall morphogenesis, Pollen sterility, pollen-stigma compatibility, megasporogenesis, female gametophyte and nutrition of embryo sac.

UNIT IV **(21 HOURS)**

Fertilization, control of fertilization, development of dicot and monocot embryo. Endosperm development, types of endosperm, haustoria of endosperm. Apomixis. Polyembryony - types and causes. Seed formation, dormancy and germination. Experimental embryology (embryo rescue and anther culture) and parthenocarpy.

26PBO204

UNIT V **(21 HOURS)**

Microtechniques: Fixing and killing of plant tissues – Chemical and physical fixative reagents, Methods of tissue processing – Dehydration, clearing and infiltration, embedding, sectioning, Microtome – Types of microtome and knives, Single and double staining, mounting, labeling and storage of slides. Histochemical staining (Starch, Protein, Lipid, Polyphenol, Tannin, Suberin and Lignin) techniques, Special techniques – Smear, Squash and Maceration.

*** Self study**

TEXT BOOKS

1. S.S. Bhojwani and S.P. Bhatnager, (1997). The embryology of Angiosperms. Vikas Publishers House, Chennai.
2. A. Fahn, Plant Anotamy. (1985) Pergman press, London.
3. B.P. Pandey, (2004) Plant Anatomy, S.Chand and Company Ltd., New Delhi.
4. B.P. Pandey, (1995) Embryology of Angiosperms, S.Chand and Company Ltd., New Delhi.
5. M.K. Prasad and M.Krishna Prasad (2000) Outline of Microtechnigue, EMKAY Publications
6. Marimuthu, R (2011) Microscopy and Microtechniques MJP- Publishers – Chennai

REFERENCE BOOKS

1. K. Esau, (1991). Anatomy of seed plants. (7th Ed.). Wely Eastern Ha, Chennai.
2. A.J. Eames and Mac Daniels. (1976). An introduction to plant Anatomy. Tata Mac Graw Hill, New Delhi.
3. B.M.Johri, K.B. Ambegaokar and P.S. Srivastava. (1992). Vol. I. Embryology of Angiosperms. Springer - Verlac, New York.
4. P. Maheswari, P. (2006). Introduction to embryology and Angiosperms. Tata Mac Graw Hill, New Delhi.
5. S. N. Pandey and A. Chadha, (2000). Embryology, Vikas Publishing House, New Delhi.
6. J.A. Kierman, (1999). Histochemical methods. Butterworth Publishing London
7. A. Fahn. (1989) Plant Anatomy, Peragaman Press, Oxford, NewYork.
8. P. Maheswari, (1950). An Introduction to Embryology of Angiosperms. Mc Graw Hill, Newyork
9. Steven Razin (2005) Plant Microtechniques and Microscopy- Oxford University

WEB RESOURCES

1. https://www.slideshare.net/slideshow/simple-and-complex-tissue-permanent-tissue/242947986
2. https://nsuniv.ac.in/wp-content/uploads/2025/03/Meristematic-and-permanent-tissues.pdf
3. https://cmpcollege.ac.in/wp-content/uploads/2020/04/e-study-module-complex-tissue.pdf
4. https://uou.ac.in/sites/default/files/slm/MSCBOT-508.pdf
5. https://www.slideshare.net/slideshow/anatomy-of-angiosperms-lenticels-and-rhytidome/250509289

6. https://www.slideshare.net/slideshow/anomalous-secondary-growth-in-plants-with-special-reference-to-bignonia-boerhavi
7. https://www.biologydiscussion.com/plants/anomalous-structures/anomalous-structures-in-plants-with-diagrams/14073

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	M	H	M	H
CO2	H	H	S	S	H
CO3	M	H	H	M	S
CO4	H	S	H	S	M
CO5	S	H	H	S	H

S - Strong **H** - High **M** - Medium **L** - Low

Content Prepared by (Based on Inputs) Dr. M. Parveen Signature of the Course in-charge	Signature of the HoD

26PBO205

Programme Code: 05	**M.Sc., BOTANY**				
Core Paper 5: CELL BIOLOGY, GENETICS AND PLANT BREEDING					
Batch 2026-2027	**Semester II**	**Hours / Week 7**	**Total Hours 105**	**Credits 5**	**Skill Development**

COURSE OBJECTIVES

- To identify and describe the structures and functions of major eukaryotic cell organelles.
- To explain the hierarchical organization of DNA packaging, from nucleosomes to compacted chromosomes.
- To study about the principles of Mendelian's and non-Mendelian's inheritance
- To assess the methods of plant breeding and crop improvement

COURSE OUTCOMES

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

K1 ↕ K5	CO1	Understand chromosome structure and variations and identify types of chromosomal abnormalities
	CO2	Explain basic concepts of cell signaling pathways and components of signaling mechanisms
	CO3	Identify the sex-linked disease among the population
	CO4	Implement knowledge on the concepts of mutation for the development of new plant varieties
	CO5	Describe various molecular breeding techniques for genetic improvement of crops

SYLLABUS

UNIT I **(21 HOURS)**

Structure and functions of cell organelles, Structure and organization of the nucleus, Chromatin organization and Nucleosome model, Chromosome organization, Special types of chromosomes: Polytene, Lampbrush and B chromosomes, Chromosomal aberrations: Numerical (euploidy, aneuploidy) and Structural (translocation, inversion, deletion, duplication), Genome organization in plants, Cell cycle and Cell division (Mitosis & Meiosis).

UNIT II **(21 HOURS)**

Gene Structure and Organization: Molecular structure and components of the gene, Regulatory elements. **Genetic Code:** Properties and Wobble hypothesis. Gene Expression and Regulation: Overview of transcription and translation. Gene regulation in prokaryotes (The Operon concept - lac operon) and eukaryotes (Transcriptional and post-transcriptional control). **Cell Signaling:** Concept, importance and Types of signaling. **Components of Signaling pathways:** Ligands, Receptors, Secondary messengers, and Downstream effectors. Plant Signaling: Signal perception and transduction in plants (basic pathways).

UNIT III **(21 HOURS)**

Genetics: Mendelism - Basic principles, Gene Interaction, Quantitative inheritance, Sex determination: Mechanism (Genetical, Metabolical, Hormonal and Environmental sex

determination), Sex linked inheritance - X linked, Y linked and XY linked, Sex influenced and sex-limited characters, Cytoplasmic inheritance: Plastid inheritance, Cytoplasmic male sterility, Mitochondrial inheritance and Inheritance in haploid organisms.

UNIT IV **(21 HOURS)**

Mutation: Detection of mutation - Lethal mutation and Visible mutation. Molecular basis of mutation, Physical and chemical mutagens. Biochemical genetics: Biochemical mutation in Bacteria and *Neurospora*. Population genetics: Gene pool, gene frequencies, Hardy-Weinburg law, factors affecting gene frequencies. Chromosome mapping – Two point and three point test cross, Interference and Coincidence.

UNIT V **(21 HOURS)**

Plant Breeding: Introduction, History, Major objectives- Principles - important achievements of plant breeding, self- and cross-pollinated crops - pure line selection and mass selection methods; Line breeding, pedigree, clonal selection. Incompatibility - male sterility. Mutation breeding - methods, limitation and crop improvement. Modern trends in plant breeding*.

*** Self study**

TEXT BOOKS

1. P.S. Verma and V.K. Agarwal, (1998). Cytology. (1st Ed.). S. Chand & Pvt.Ltd., New Delhi.
2. Veerbala Rastogi. (2004). A Text book of Genetics. Kedarnach & Ramnath, Meerut.
3. B.D. Singh, (2014). Plant Breeding Principles and Methods. (Reprtd.) Kalyani Publisher, New Delhi.
4. P.S. Verma and V.K. Agarwal. 2004. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology. ISBN: 9788121924429
5. P.S. Verma, V.K. Agarwal and S. Chand. 2005. Cell and Molecular Biology. S. Chand & Company Ltd. (An ISO 9001: 2000 Company) Head Office: 7361, RAM NAGAR, NEW DELHI - 110 055.
6. Singh, S.K. (2012). Fundamentals of Cell Biology. Campus Books International, New Delhi
7. C.B. Power. (2016). Cell Biology. Himalaya Publishing house, Mumbai.

REFERENCE BOOKS

1. De Robertis. (1975). Cell Biology. (6th Ed.) Saunders Philadelphia
2. E.J. Gardener, Peter Suns tad, D. (1975). (5th Ed.). Principles of Genetics. John Wiley & Sons Inc.
3. M.W. Strick Berger, (1997). Genetics. (2nd Ed.) MacMillan, New York.
4. P.K. Gupta, (1985 - 91). Genetics. (2nd Ed.). Rastogi Publications.
5. R.W. Allard, (1960). Principles of Plant Breeding. John Wiley & Sons Inc.
6. R.S. Shukla and P. S. Chandel. (1996). Cytogenetics - Evolution and lant Breeding. S. Chand & Pvt. Ltd. New Delhi.

WEB RESOURCES

1. https://www.slideshare.net/slideshow/gene-structure-and-genetic-code/141549721
2. https://www.slideshare.net/slideshow/structure-and-organization-of-chromatin/68259011
3. https://www.slideshare.net/slideshow/gene-regulation-in-prokaryotes-and-eukaryotes/121173735
4. https://patnawomenscollege.in/upload/e-content/cell%20signaling-class.pdf
5. https://microbenotes.com/cell-signaling/
6. https://egyankosh.ac.in/bitstream/123456789/91330/1/Unit-11.pdf
7. https://www.slideshare.net/slideshow/cytoplasmic-inheritance/39069774
8. https://www.slideshare.net/slideshow/mutation-its-detection/232282326
9. https://www.rvskvv.net/images/II-Year-II-Sem_Principles_Plant-Breeding_ANGRAU_20.04.2020.pdf

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	H	H	S	M
CO2	S	M	H	H	S
CO3	H	S	H	M	H
CO4	H	H	S	S	H
CO5	M	S	S	H	M

S - Strong **H** - High **M** - Medium **L** – Low

Content Prepared by (Based on Inputs) Dr. R. Rekka Signature of the Course in-charge	 Signature of the HoD

26PBO206

Programme Code: 05	**M.Sc., BOTANY**				
Core Paper 6: BIOINSTRUMENTATION, RESEARCH METHODOLOGY AND BIOSTATISTICS					
Batch 2026-2027	**Semester II**	**Hours / Week 6**	**Total Hours 90**	**Credits 4**	**Skill Development**

COURSE OBJECTIVES

- To seed the basic knowledge about instruments
- To make students understand the applications of instruments in Botany
- To train the students handle and maintain instruments
- To understand basic concepts of research and its methodologies
- To gain proficiency in using statistical software for data analysis.

COURSE OUTCOMES

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

K1 ↕ K5	CO1	Inculcate the working principles of biological instruments
	CO2	Acquire knowledge on separation and identification of compounds based on chromatographic techniques
	CO3	Know basic principle for the separation of DNA, RNA and protein molecules
	CO4	Understand research methodology and apply skills in scientific writing, thesis preparation, and manuscript submission, with awareness of publication ethics, plagiarism, and research presentation
	CO5	Apply basic biostatistical methods, including descriptive statistics, hypothesis testing, correlation, regression, and use of SPSS and R for data analysis

SYLLABUS

UNIT I **(18 HOURS)**

Principle, Working Mechanism, Types and Applications: pH meter, Micrometry, Microscopy – light (compound, stereoscopic, dark field, phase contrast and fluorescence) and electron (TEM and SEM), Centrifugation, Autoclave and Laminar air flow chamber. Colorimetry*, UV-visible spectrophotometry, Flourimetry and Flame photometry. Biophotometer and Microplate reader.

UNIT II **(18 HOURS)**

Principle, Working Mechanism and Applications: Thin layer chromatography (TLC)*, Column chromatography, Ion exchange chromatography, Molecular exclusion chromatography, Affinity chromatography, High performance liquid chromatography (HPLC) and Gas chromatography (GC), Infrared spectroscopy (IR), Mass spectroscopy (MS), Nuclear Magnetic Resonance spectroscopy (NMR) and Lyophilization.

UNIT III **(18 HOURS)**

Principle, Working Mechanism and Applications: Distillation and its types, Soxhlet and Clevenger apparatus, Sonicator, Rotary vacuum evaporator and Magnetic stirrer, Agarose gel electrophoresis (AGE), Polyacrylamide gel electrophoresis (PAGE). PCR and its types and Gel documentation system.

26PBO206

UNIT IV **(18 HOURS)**

Research Methodology: Introduction, Process and Elements of Research and its Criteria, Types of Research - Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical, Structure and Preparation of thesis, Reference management Software, Manuscript types, Scientific paper writing, Submission and Proof Correction, Ethical issues in publications– Plagiarism and software for detection of Plagiarism and Journal Impact Factor. Presentation of research findings in conferences, Preparation of grant proposals, Major research funding agencies in India

UNIT V **(18 HOURS)**

Biostatistics: Descriptive statistics: Mean, median and mode for continuous and discontinuous variables. Measures of dispersion: standard deviation and standard error Probability: Definition of probability, Binomial distribution, Normal distribution, Poisson's distribution. Hypothesis testing**:** Chi-square test for goodness of fit; Null hypothesis, level of Significance - Degrees of Freedom. Student 't' test, ANOVA. Basic introduction to Multivariate Analysis of Variance (MANOVA). Correlation and regression: types and methods of study of correlation. Regression and types. Box plot and Principal Component Analysis (PCA), Statistical packages (SPSS & R)

***Self study**

TEXT BOOKS

1. K.R. Sharma, (2002). Research methodology. National publishing house, Jaipur and NewDelhi.
2. B.K. Sharma, (2005). Instrumental Methods of Chemical analysis. 24th Revised Edition, Goel Publishing House, Meerut.
3. John. G. Webster. (2007). Bioinstrumentation. Wiley Student Edition, India
4. L. Veerakumari, (2009). Bioinstrumentation. MJP Publishers, New Delhi, India
5. M.H. Fulekar and Bhawana Pandey. (2013). Bioinstrumentation. International Publishing House Pvt Ltd.
6. R. Kumar, (2014). Research Methodology: A step by step guide for Beginners. SAGE Publications India Pvt. Ltd., New Delhi.
7. B.K. Sharma (2014). Instrumental Method of Chemical Analysis. Krishna Prakashan Media (P) Ltd (ISBN: 978-8182836730)
8. N. Arumugam and V. Kumaresan (2015, Reprint). Biophysics and Bioinstrumentation. Saras Publication.
9. Suresh Sharma (2016). Essentials of Research Methodology and Biostatistics—A Comprehensive Guide for Health Care Professionals. Elsevier India (ISBN: 9788131246481)
10. C.R. Kothari, and G. Garg, (2018). Research methodology – methods and techniques (4th Edition). New Age International Publishers, Kochi
11. Ranjit Kumar, (2018). Research Methodology: A step by step guide for Beginners (5th Edition). SAGE Publications India Pvt. Ltd., New Delhi.
12. S.P. Gupta, (2001). Statistical Methods. Sultan Chand & Sons, Educational Publishers, New Delhi.
13. Jerrold H. Zar (2006). Biostatistical Analysis,Dorling Kindersely (India) Pvt. Ltd., New Delhi

REFERENCE BOOKS

1. John G. Webster (2004). Bioinstrumentation. John Wiley & Sons. ISBN: 0471452572, 9780471452577.
2. Clifford D Ferris. (1978). Introduction to Bioinstrumentation. Humana Press.
3. Connor and Peter wood ford. (1979). Writing scientific papers in English. Pitman Medical Publishing Company, London.
4. Richard Normann. (1988). Principles of Bioinstrumentation. Wiley Publications.
5. Skoog and Leary. (1992). Principles of Instrumental analysis, 4th Edition. Saunder's College Publishing, New York.
6. R.A. Day, (1994). How to write and publish a scientific paper. Cambridge University Press, London.
7. Holme and Peck. (1998). Analytical Biochemistry, 3rd Edition, Pearson Education Ltd, Essex, England
8. K. Wilson and J. Walker (2000). Principles and Techniques of Practical Biochemistry, 5th edition, Cambridge University Press, Cambridge.
9. John Denis Enderle. (2006). Bioinstrumentation. Morgan & Claypool Publishers.
10. John G. Webster (2008). Bioinstrumentation. Wiley India Edition. India
11. M.J. Reilly, (2018). Bioinstrumentation. CBS Publishers and Distributors Pvt Ltd, India.
12. I.D. Khan and A. Khanum. (1994). Fundamentals of Biostatistics. Mc Graw Hill, New Delhi.
13. Vasantha Pattabhi and N. Gautham. (2004). Bistatistics. Narosa Publishing House, Chennai.
14.

WEB RESOURCES

1. https://microbenotes.com/ph-meter-principle-parts-procedure-types-uses-examples/
2. https://testbook.com/physics/micrometer
3. https://microbenotes.com/light-microscope/
4. https://shorturl.at/qMo6m
5. https://microbenotes.com/centrifuge-principle-parts-types-uses-examples/
6. https://microbenotes.com/laminar-flow-hood/
7. https://www.testronixinstruments.com/blog/laminar-air-flow/?srsltid=AfmBOorw3jmrjp0bHPODsiOGNspYE8ryDx0sH4T_69OWJ8l0gwAiR-Xh
8. https://vietnamcleanroom.com/en/post/laminar-air-flow-855.htm
9. https://microbenotes.com/uv-vis-spectroscopy/
10. https://shorturl.at/wofDJ
11. https://microbenotes.com/fluorimetry/
12. https://aelabgroup.com/fluorometer-principles-types-applications-fluorescence-measurement/
13. https://www.excedr.com/blog/what-is-a-microplate-reader
14. https://microbenotes.com/chromatography-principle-types-and-applications/
15. https://www.gcea.de/en/artikel/distillation
16. https://microbenotes.com/agarose-gel-electrophoresis/
17. https://microbenotes.com/polyacrylamide-gel-electrophoresis-page/
18. https://microbenotes.com/pcr-principle-enzymes-steps-types-uses/
19. https://medicallabnotes.com/gel-documentation-system-introduction-principle-components-and-uses/

20. https://shorturl.at/Kz1dF
21. https://shorturl.at/Dvam6
22. https://clarivate.com/academia-government/essays/impact-factor/
23. https://researchguides.uic.edu/if/impact
24. https://pmc.ncbi.nlm.nih.gov/articles/PMC10589106/
25. https://www.sciencedirect.com/science/article/pii/S2211419X20300367
26. https://shorturl.at/wZoOq
27. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://uou.ac.in/sites/default/files/slm/MSCBOT-606.pdf
28. https://gurunanakcollege.edu.in/files/commerce-management/STATISTICS-UNIT-3.pdf
29. https://gurunanakcollege.edu.in/files/commerce-management/STATISTICS-UNIT-3.pdf

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	H	S	M	L
CO2	H	M	H	H	H
CO3	S	M	H	S	S
CO4	S	S	S	H	M
CO5	S	S	M	H	M

S - Strong **H** - High **M** - Medium **L** – Low

Content Prepared by (Based on Inputs) Dr. G. Dhandapani Signature of the Course in-charge	 Signature of the HoD

PBO23

26PBO2CM

Programme Code: 05	**M.Sc., BOTANY**				
Core Practical 2: ANATOMY, EMBRYOLOGY OF ANGIOSPERMS, MICROTECHNIQUES, CELL BIOLOGY, GENETICS, PLANT BREEDING, BIOINSTRUMENTATION, RESEARCH METHODOLOGY AND BIOSTATISTICS					
Batch	**Semester**	**Hours / Week**	**Total Hours**	**Credits**	**Skill Development**
2026-2027	**II**	**5**	**75**	**3**	

COURSE OBJECTIVES

- To obtain insight knowledge on variations in the internal structural organization among plants and impart inherent knowledge on the basic techniques and modern concepts of microtome
- To understand genetic analysis at gene, genome and population level
- To utilize the applications of instruments for biochemical studies
- To know the fundamentals of hypothesis testing, tests of significance and apply appropriate parametric tests and interpret the findings.

COURSE OUTCOMES

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

K3	CO1	Understand the primary and secondary structure of plants.
↕	CO2	Examine different stages of mitosis and meiosis cell division in plant cell
↕	CO3	Handle instruments for biochemical practical's
↕	CO4	Utilize protocols for research process
K5	CO5	Equip with the skills to analyze biological data using statistical methods, interpret results and involve hands-on experience with statistical software like SPSS & R

SYLLABUS

I. ANATOMY

- Identification using permanent slides / photographs
    - Study of shoot apex of *Hydrilla*
    - To study and Observe KRANZ Anatomy of leaf by sectioning - Mulberry and Sugar cane leaf
    - Observation of cambial types -Identification using permanent slides / photographs
    - Structure of tracheids and vessels
    - Types of wall thickening
    - Arrangement of vessels in secondary xylem
    - Types of wood parenchyma
    - Types of wood
    - Types of vascular cambium
    - Nodal anatomy
- Sectioning and observation of nodal types.Nodal anatomy (Unilacunar, Trilacunar, Multilacunar)

- Study of anomalous secondary growth of the following: Anomalous secondary thickening – Dicot – *Boerhavia, Aristolochia, Bignonia* and *Piper betel*; Monocot – *Dracaena.*

EMBRYOLOGY OF ANGIOSPERMS

1. Dissection and observation T.S of Anther by using flower buds
2. With the help of permanent slides to study
    - Stages in development of microsporangium and male gametophyte.
    - Configurations of ovules, 2, 4 nucleate embryo sac, mature embryo sac.
    - Types of endosperm.
3. Dissection and observation of embryo stages (globular, cordate and Torpedo stage).

MICROTECHNIQUES

- Maceration of wood and observation of the components of xylem elements and secondary thickenings
- Free hand and microtome sectioning preparation of semipermanent slide (Submission of 5 slides for evaluation).
- Histochemical staining for starch, protein, lipid, polyphenol, tannin, suberin, lignin etc.

II. CELL BIOLOGY, GENETICS AND PLANT BREEDING

1. Ultra structure of nucleus, chromosome and its special types (Electron Microscopic Photographs/Models).
2. Study of mitosis and meiosis with different materials.
3. Squash preparation from pre-treated root tips/Flower bud (Colchicine /Paradichlorobenzene/Aesculin) for study of aberrations
4. Simple problem in genetics- Gene interaction, Polygenic inheritance. Sex determination, Sex linked inheritance, Sex limited genes, Sex influenced genes.
5. Construction of chromosome maps using three-point test cross data.
6. Training in hybridization techniques using potted plants

IV. BIOINSTRUMENTATION

1. Haemocytometer
2. pH meter
3. UV - visible spectrophotometer
4. Centrifuge
5. Soxhlet apparatus
6. Clevenger apparatus
7. Lyophilizer (Demo)
8. HPLC (Demo)

RESEARCH METHODOLOGY

1. Prepare the structure of manuscripts
2. Reference management tool – Mendeley & Zotero
3. Plagiarism management tool - Dupli Checker and Plagiarism Checker
4. Prepare the proposal format of ANRF and DBT schemes

PBO25

BIOSTATISTICS

1. Probability distribution: binomial, Poisson and normal.
2. Test the significance of a given data using Chi-square test, t-test and ANOVA.
3. Analysis of a set of data for correlation and regression.
4. Statistical packages (SPSS & R)

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	M	H	S	H
CO2	H	S	M	H	S
CO3	H	M	S	H	M
CO4	S	H	S	S	H
CO5	H	S	H	H	S

S - Strong **H** - High **M** - Medium **L** – Low

Content prepared by (Based on Inputs) Dr. G. Dhandapani Signature of the Course in-charge	 Signature of the HoD

26PBO2CM

KONGUNADU ARTS AND SCIENCE COLLEGE (Autonomous)
COIMBATORE - 641 029
PG MODEL QUESTION PAPER (PRACTICALS)
End of Semester Examination Question Paper Pattern
(For the candidates admitted from the academic year 2026-2027 onwards)

Time: 4 Hours **Max. Marks: 60 Marks**

BREAK UP OF MARKS

Core Practical: 2 – ANATOMY, EMBRYOLOGY OF ANGIOSPERMS, MICROTECHNIQUES, CELL BIOLOGY, GENETICS, PLANT BREEDING, BIOINSTRUMENTATION, RESEARCH METHODOLOGY AND BIOSTATISTICS

I	Anatomical Sectioning	1 × 4	**04 Marks**
II	Embryo mounting	2 × 1	**02 Marks**
III	Maceration technique	2 × 1	**02 Marks**
IV	Histochemical staining	1 × 2	**02 Marks**
V	Any Two Stages of Mitosis/Meiosis	2 × 2	**04 Marks**
VI	Genetics Problem	2 × 2.5	**05 Marks**
VII	Bioinstrumentation experiment	1 x 6	**06 Marks**
VIII	Research Methodology Experiment	1 x 6	**06 Marks**
VIII	Biostatistics Problem	2 ×2	**04 Marks**
IX	**Spot at Sight**	5 × 2	**10 Marks**
	Submission of Permanent Slides		**05 Marks**
	Record		**10 Marks**
	TOTAL		**60 Marks**

Content prepared by (Based on Inputs) Dr. G. Dhandapani Signature of the Course in-charge	 Signature of the HoD

PBO27

26PBO307

Programme Code: 05		**M.Sc., BOTANY**			
Core Paper 7: TAXONOMY AND BIOSYSTEMATICS					
Batch 2026-2027	**Semester III**	**Hours / Week 6**	**Total Hours 90**	**Credits 4**	**Skill Development**

COURSE OBJECTIVES

- To study about the classification and nomenclature of Angiosperms.
- To understand the theory and practices involved in plant systematics.
- To learn the striking affinities of different plant families.

COURSE OUTCOMES

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

K1	CO1	Acquire knowledge on principles and objectives of ICN and APG
↕	CO2	Differentiate various systems of classifications based on natural and phylogenetic characters of flowering plants
	CO3	Explore proficiency skills using keys for identification of any unknown plant species
	CO4	Apply basics of biosystematics in various fields of plant sciences
K5	CO5	Evaluate modern advances of taxonomical tools for plant identification

SYLLABUS

UNIT I **(18 HOURS)**

Historical account of the classification of angiosperms up to the present day. Natural System of classification - Bentham and Hooker (1862-1883), Phylogenetic System of Classification - Bessey (1915) and Hutchinson (1954-1960), Modern System of Classification- Cronquist (1981) and APG IV (2016) - merits and demerits. ICN- history, principles, typification, principles of priority and their limitations, effective and valid publication, author citation, retention, choice and rejection of names, names of hybrids.

UNIT II **(18 HOURS)**

Herbarium technique and its potential role in teaching and research. Taxonomic tools - flora, monograph, revisions, icons and journals. Taxonomic keys - dichotomous keys and their uses. Botanic gardens. Botanical Survey of India (BSI). IUCN RET List categories and criteria, 2012. RET species - India and Tamil Nadu. Sources of taxonomic information - embryology, cytology, chemotaxonomy. Taxonomic databases (COL, NCBI Taxonomy, TROPICOS, IPNI and POWO). Plant species identification using Plant.id, Flora Incognita, Plantora and PictureThis.

UNIT III **(18 HOURS)**

Description and Economic importance of the following families - Menispermaceae, Polygalaceae, Portulacaceae, Oxalidaceae, Tiliaceae, Meliaceae, Vitaceae, Sapindaceae, Rosaceae, Combretaceae, Lythraceae, Passifloraceae and Aizoaceae.

26PBO307

UNIT IV **(18 HOURS)**

Description and economic importance of the following families - Oleaceae, Asclepiadaceae, Convolvulaceae, Boraginaceae, Bignoniaceae, Pedaliaceae, Nyctaginaceae, Loranthaceae, Moraceae, Orchidaceae, Commelinaceae, Araceae and Cyperaceae.

UNIT V **(18 HOURS)**

Systematics – Aims, Scope and Categories. Turreson's work. Population concept. Species and genus concept. Numerical taxonomy, molecular taxonomy (RFLP, RAPD and DNA Bar coding). Evolutionary trends in angiosperms*.

*** Self Study**

TEXT BOOKS

1. O.P. Sharma, (1986). Plant taxonomy -Rastogi Publications, New Delhi.
2. V.V. Sivarajan, (1986). Introduction to principles of plant taxonomy. Oxford & IBH Pvt. Company.
3. N.S. Subramaniam, (1997). Modern plant taxonomy. Vikas Publishing House, New Delhi.
4. B.K. Verma, (2010). Introduction to Taxonomy of Angiosperms, Prentice-Hall of India Pvt. Ltd., Delhi
5. O.P. Sharma, (2017). Plant Taxonomy. Mc Graw Hill Education, New York.
6. N.B. Saxena and Shamindra Saxena (2019). Pragati Prakashan, Meerut.

REFERENCE BOOKS

1. H.M. Lawrence, (1951). Taxonomy of vascular plants. Macmillan & Co.
2. S.K. Jain and R.R. Rao. (1977). A hand book of field and herbarium methods. Today & Tomorrow Pvt. Ltd.
3. H.N. Henry and Chandra Bose. (1982). An aid to the International code of Botanical nomenclature. BSI, Calcutta.
4. V.N. Naik, (1984). Taxonomy of Angiosperms. TATA Mc Graw Hill, New Delhi.
5. S.S.R. Bennet, (1986). An introduction to plant nomenclature. International Book Distribution India.
6. B.P. Pandey, B.P. (1997). Taxonomy of angiosperms. Chand & Co. Ltd., New Delhi.
7. R.Vasudevan Nair, (1997). Taxonomy ofangiosperms. APH Publishing Corporation, New Delhi.
8. Gurcharan Singh. (2004). Plant systematic - theory and practices. Oxford and IBH Publishers, New Delhi.

WEB RESOURCES

1. https://www.biologydiscussion.com/plants/classifications/system-of-plant-classification-3-types/30330
2. https://www.biologydiscussion.com/plant-taxonomy/nomenclature-plant-taxonomy/icbninternational-code-of-botanical-nomenclature/30308
3. https://gcwgandhinagar.com/econtent/document/15880653311BOTTC0201_Single%20Access%20Keys.pdf
4. https://portals.iucn.org/library/sites/library/files/documents/RL-2001-001.pdf
5. https://plants.sdsu.edu/plantsystematics/studentresources/Struwe_50MajorTempPlantFamilies2016.pdf
6. https://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/botany/15._plant_systematics-iii/biosystematics/et/5905_et_21-biosystematics-et.pdf

PBO29

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	H	M	S	S
CO2	H	S	H	M	S
CO3	S	S	M	H	H
CO4	S	H	H	H	M
CO5	S	H	M	H	S

S - Strong **H** - High **M** - Medium **L** - Low

Content Prepared by (Based on Inputs) Dr. V. Aravindhan Signature of the Course in-charge	Signature of the HoD

26PBO308

Programme Code: 05		M.Sc., BOTANY			
Core Paper 8: BIOPHYSICS AND BIOCHEMISTRY					
Batch	**Semester**	**Hours / Week**	**Total Hours**	**Credits**	**Employability**
2026-2027	**III**	**7**	**105**	**5**	

COURSE OBJECTIVES

- To understand the role of electrons in absorption of light and to impart knowledge on bioenergetics of living organisms
- To know the biological importance of the macromolecules
- To learn about the hormones and vitamins and their roles

COURSE OUTCOMES

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

K1	CO1	Acquire knowledge on electromagnetic spectrum.
↕	CO2	Learn on energy production in cell
↕	CO3	Impart knowledge on types and functions of carbohydrates and lipids
↕	CO4	Gain knowledge on key macro molecules and carry instructions for the functioning of the cell
K5	CO5	Understand the importance of enzymes and their mode of action

SYLLABUS

UNIT I **(21 HOURS)**

Electromagnetic radiation - Nature, absorption spectrum and action spectrum, law of absorption, interaction with matter, role of electrons in absorption, interaction of light, Excitation, de-excitation and path of de-excited electrons. Bioluminescence, Fluorescence and Phosphorescence.

UNIT II **(21 HOURS)**

Bioenergetics - Energy and work, laws of Thermodynamics. Energy transductions in biological systems - Redox couple, redox potential, ATP bioenergetics, NADP/NAPH redox couple, mitochondrial bioenergetics and chloroplast bioenergetics.

UNIT III **(21 HOURS)**

Carbohydrates: Introduction to carbohydrates – classification and properties - monosaccharides, oligosaccharides and polysaccharides. Linear/ open chain and ring forms of monosaccharides. Isomerism, structural and functional polysaccharides. Biosynthesis of carbohydrate and their regulation. **Lipids:** Classification and properties - simple, complex and derived lipids - fatty acids - types - nomenclature - isomerism - Biosynthesis of fatty acids, fatty acid oxidation (α and β - oxidation)

UNIT IV **(21 HOURS)**

Aminoacids: General structure - optical isomerism - classification (based on side chain and polarity) - properties - nonprotein aminoacids- Biosynthesis of aminoacids. **Proteins:** Introduction - structure and configuration of proteins - different bonding systems - classification of proteins based on chemical nature and solubility - properties - denaturation. **Nucleic acids**: Nitrogenous bases- purine and pyrimidine biosynthesis, DNA and RNA-structure and types. Biosynthesis of nucleotides

26PBO308

UNIT V **(21 HOURS)**

Enzymes: Introduction to enzymes – classification, chemical nature and properties, theories of enzyme action, enzyme inhibitors and factors affecting enzyme activity, Michael - Menton's constant, coenzyme - FAD, NAD **Vitamins:** Classification* - chemical structure and biochemical properties of vitamins A, D, E and K and B complex.

***Self study**

TEXT BOOKS

1. M. Daniel, (1989). Basic Biophysics for Biologists, Agro-Botanical Publishers, Bikaner, India.
2. H.S. Srivastava, (1999). Elements of Biochemistry. Rastogi publications, Meerut.
3. P. Asokan, (2002). Analytical Biochemistry (Biochemical Techniques). Chinna Publications, Chennai.
4. S. Palanisamy, (2008). Principles of biophysics, Palani Paramount Publications
5. S. Thiraviyaraj, (2009). Biophysics. Saras Publications, Nagercoil, Tamil Nadu.
6. K.L. Janin, Sunjay Jain and Nitin Jain, (2009). Fundamentals of Biochemistry, S.Chand and Company Ltd, New Delhi.

REFERENCE BOOKS

1. L. Albert, Lehninger (1984). Principles of Biochemistry. ICAR, Delhi.
2. J.H.Weel, (1990). General Biochemistry. Wiley Eastern Ltd.
3. Zubay, (1995). Biochemistry, Brown Publishers.
4. Voet and Voet, (2000). Fundamentals of Biochemistry, John Wiley, New York.
5. K. Wilson and J. Walker, (2000). Principles and Techniques of Practical Biochemistry, 5th edition, Cambridge University Press, Cambridge.
6. L. Stryer, (2002). Biochemistry,W.H. Freeman.
7. V. Satyanarayana, (2005). Essentials of Biochemistry. Arunabha Sen & Allied Pvt., Ltd
8. P. Narayanan, (2007). Essentials of Biophysics. Second Edition. New Age International Publishers

WEB RESOURCES

1. https://www.sciencedirect.com/topics/earth-and-planetary-sciences/electromagnetic-spectra
2. https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/bioluminescence
3. https://www.ncbi.nlm.nih.gov/books/NBK210011/
4. https://www.bio.ens.psl.eu/~mthomas/L3/intro_biologie/2-sucres-lipides-acides-nucleiques.pdf
5. https://archive.nptel.ac.in/content/storage2/courses/104103071/pdf/mod13.pdf

PBO32

26PBO308

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	M	S	S	M
CO2	L	H	M	H	H
CO3	S	H	S	M	S
CO4	S	M	M	S	L
CO5	S	H	M	S	H

S - Strong **H** - High **M** - Medium **L** – Low

Content Prepared by (Based on Inputs) Dr. R. Thirugnanasampandan Signature of the Course in-charge	Signature of the HoD

PBO33

26PBO309

Programme Code: 05		**M.Sc., BOTANY**			
Core Paper 9: PLANT PHYSIOLOGY					
Batch 2026-2027	**Semester III**	**Hours / Week 6**	**Total Hours 90**	**Credits 4**	**Skill Development**

COURSE OBJECTIVES

- To study the basic physiological functions of plants.
- To learn about the metabolic pathways in plants.
- To understand the importance of phytohormones in the growth of plants.

COURSE OUTCOMES

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

K1	CO1	Acquire knowledge on plant - water relations in a plant cell
↕	CO2	Understand the significance of metabolic pathways in plants.
	CO3	Acquire knowledge in terms of pathways of photosynthesis, respiration and nitrogen metabolism in higher plants
	CO4	Assess stress resistance mechanism for the better yield of crops.
K5	CO5	Apply acquired knowledge on phytohormones and their applications in fruit ripening process.

SYLLABUS

UNIT I **(18 HOURS)**

Water relations - Structure and properties of water. Water transport - diffusion, osmosis and imbibition, water potential. Absorption of water, active and passive absorption. Water relations of plants – Structure and Physicochemical properties of water, soil and plant atmosphere, stomatal physiology and regulation.

UNIT II **(18 HOURS)**

Transpiration - types, mechanism and factors affecting transpiration. Ascent of sap* - theories, mechanism and factors influencing on ascent of sap. Mineral salt absorption - mechanism and types. Translocation of organic solutes - mechanism, phloem loading and unloading and factors affecting translocation.

UNIT III **(18 HOURS)**

Mechanism of photosynthesis - Light reaction, Carbon fixation in C_3 & C_4 plants. Outline of CAM pathway. Photorespiration, Respiration, Glycolysis, Krebs cycle & Pentose phosphate pathway, ATPase and Mechanism of ATP synthesis. Biological Nitrogen Fixation - Symbiotic & Non-Symbiotic.

UNIT IV **(18 HOURS)**

Stress physiology: Classification of stress Plant responses to biotic and abiotic stress factors. mechanisms of biotic and abiotic stress tolerance, HR and SAR, water deficit and drought resistance, salinity stress, metal toxicity, freezing and heat stress, oxidative stress. Seed dormancy- causes and methods to break seed dormancy physiology of seed germination - abscission - and senescence.

26PBO309

UNIT V **(18 HOURS)**

Phytohormones - Fruit ripening - Introduction, Climacteric and non-climacteric fruits, Role of ethylene in fruit ripening, symptoms of fruit ripening. Environmental control of fruit ripening. Circadian rhythms-Biological clock. Plant movements-nastic and Tropic movements, Photomorphogenesis - Phytochrome and Cryptochrome response in plants. Recent advances in plant physiology - Plant phenomics and metabolomics.

***Self study**

TEXT BOOKS

1. V. K. Jain. (1999). Fundamentals of Plant Physiology. S. Chand and Company Ltd, New Delhi.
2. V. Verma, (2001). Plant physiology. Emkay Publication, New Delhi.
3. S.N. Pandey and BK. Sinha. (2011). Plant Physiology. Vikas Publishing House Pvt Ltd., New Delhi.
4. S.K. Sinha, (2004). Modern Plant Physiology, Narosa Publishing House, New Delhi, Chennai.
5. S. Mukeuji S and AK. Ghosn, (1996). Plant Physiology. Tata McGraw – Hill Publishing Company Ltd., New Delhi.

REFERENCE BOOKS

1. R.E. Devlein, (1986). Plant Physiology. CBS Publishers and Distributors, New Delhi.
2. H.S. Srivastava, & N. Shankar. (2005). Plant physiology & Biochemistry. Rastogi publications, Meerut.
3. G. Ray Noggle and George J. Fritz. (2002). Introductory plant Physiology. Prentice Hall of India, Pvt., Ltd., New Delhi.
4. D. Hess, (1975). Plant Physiology. Narosa Publishing house, New Delhi.
5. E.J. Hewilt and C.V. Cutting, (1979). Nitrogen Metabolism in Plants. Academic Press London.

WEB RESOURCES

1. https://egyankosh.ac.in/bitstream/123456789/71729/1/Unit-1.pdf
2. http://eagri.org/eagri50/PPHY261/lec06.pdf
3. http://eagri.org/eagri50/PPHY261/lec04.pdf
4. http://eagri.org/eagri50/PPHY261/lec11.pdf
5. https://www.icar-crida.res.in/assets/img/Books/2011-12/Abiotic_Stress_in_Plants_-_Mechanisms_and_Adaptations_2011.pdf
6. https://www.slideshare.net/slideshow/circadian-rhythm-201419850/201419850
7. https://www.myprivatetutor.com/files/notes/fd07d87cb90d9a0675a48d18b7e2e513.pdf
8. https://bsapubs.onlinelibrary.wiley.com/doi/pdf/10.1002/j.1537-2197.1937.tb09056.x
9. https://www.youtube.com/watch?v=CncApryTEnk
10. https://www.youtube.com/watch?v=wBDC8gFuobo

PBO35

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	H	S	M	L
CO2	H	M	H	H	H
CO3	S	M	H	S	S
CO4	S	S	S	H	M
CO5	S	S	M	H	M

S - Strong **H** - High **M** - Medium **L** – Low

Content Prepared by (Based on Inputs) Dr. P. Sumathi Signature of the Course in-charge	Signature of the HoD

PBO36

26PBO3CN

Programme Code: 05	**M.Sc., BOTANY**				
Core Practical 3: TAXONOMY, BIOSYSTEMATICS, BIOPHYSICS, BIOCHEMISTRY AND PLANT PHYSIOLOGY					
Batch 2026-2027	**Semester III**	**Hours / Week 5**	**Total Hours 75**	**Credits 3**	**Skill Development**

COURSE OBJECTIVES

- To identify selected taxa using taxonomic keys.
- To learn the significance of EMR and spectrum.
- To quantify the biochemical contents, present in a given plant sample.
- To obtain knowledge on physiological functions of the plants.

COURSE OUTCOMES

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

K3 ↑	CO1	Acquire knowledge on identification of flowering plants using taxonomic keys and learn about the methods and preparation of herbarium.
	CO2	Provide knowledge on the concepts and principles of radioactive emissions.
	CO3	Apply principles and procedures for the estimation of macromolecules in plant sample.
	CO4	Study the physiological process of plants.
↓ K5	CO5	Handle instruments for biophysics and biochemical practical's.

SYLLABUS

I. TAXONOMY AND BIOSYSTEMATICS

1. Identification of plant specimens with reference to their families prescribed in the syllabus following Bentham & Hookers system of classification.
2. Identification of economically important products with reference to their plant name and family.
3. Technical description of plant parts, including floral parts L.S. of flower, floral diagram and floral formula with reference to the families mentioned in the theory.
4. Preparation of dichotomous keys.
5. Field visit to nearby floristic regions for the study of flora
6. Submission of 40 herbarium sheets (relevant to syllabi) with field note for internal and external valuation.

II. BIOPHYSICS

1. Nature of EMR and Spectrum (Demo)
2. Path of de-excitation - Fluorescence, Phosphorescence (Demo)

26PBO3CN

III. BIOCHEMISTRY

1. Preparation of molal, molar, normal and percentage solutions
2. Preparation of phosphate & citrate buffers
3. Estimation of carbohydrates, proteins, amino acids & lipids
4. Estimation of Vitamin C
5. Extraction & Quantification of total phenol, alkaloids and flavonoids
6. Total RNA isolation & analysis

IV. PLANT PHYSIOLOGY

1. Measurement of stomatal index and frequency.
2. Measurement of membrane permeability as affected by pH, chemicals and temperature.
3. Separation of photosynthetic pigments by TLC.
4. Estimation of photosynthetic pigments – Chlorophyll, Xanthophyll and Carotenoids.
5. Measurement of Hill reaction in the chloroplast suspension.
6. Measurement of the rate of photosynthesis under varying condition of CO_2 concentration.
7. Rate of respiration in flower buds/germinated seeds using simple Respiroscope.
8. Determine the rate of transpiration using Ganong's potometer.
9. Determination of water absorption and transpiration ratio.
10. Nitrogen fixation through nodule formation in leguminous plants (Demo).
11. Solution culture (Demo).

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	H	H	M	H
CO2	H	S	M	H	H
CO3	S	M	H	H	M
CO4	S	H	S	H	S
CO5	S	H	M	S	M

S - Strong **H** - High **M** - Medium **L** – Low

Content Prepared by (Based on Inputs) Dr. H. Abdul Kaffoor Signature of the Course in-charge	 Signature of the HoD

PBO38

26PBO3CN

KONGUNADU ARTS AND SCIENCE COLLEGE (Autonomous)
COIMBATORE - 641 029

PG MODEL QUESTION PAPER (PRACTICALS)
End of Semester Examination Question Paper Pattern
(For the candidates admitted from the academic year 2026-2027 onwards)

Time: 4 Hours **Max. Marks: 60 Marks**

BREAK UP OF MARKS

Core Practical: 3 – TAXONOMY, BIOSYSTEMATICS, BIOPHYSICS, BIOCHEMISTRY AND PLANT PHYSIOLOGY

I.	Specimen identification	04 Marks
II.	Identification of the family	06 Marks
III.	Key preparation	02 Marks
IV.	Explain the principle of Biophysics experiment	05 Marks
V.	Biochemistry Experiment	08 Marks
VI.	Plant Physiology Experiment	10 Marks
VII.	Spotters (5 ×2)	10 Marks
	HERBARIUM	05 Marks
	RECORD	10 Marks
	TOTAL	**60 Marks**

Content Prepared by (Based on Inputs) Dr. H. Abdul Kaffoor Signature of the Course in-charge	 Signature of the HoD

26PBO410

Programme Code: 05	**M.Sc., BOTANY**				
Core Paper 10: ECOLOGY, BIOENERGETICS AND NATURAL RESOURCE MANAGEMENT					
Batch	**Semester**	**Hours / Week**	**Total Hours**	**Credits**	**Skill Development**
2026-2027	**IV**	**7**	**105**	**5**	

COURSE OBJECTIVES

- To understand the structural and functional organization of the ecosystems.
- To know the causes of environmental deterioration and possible measures for their rejuvenation.
- To understand the natural calamities and disaster management.

COURSE OUTCOMES

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

K1	CO1	Gain knowledge on community concepts and their ecological niches
↕	CO2	Understand the principles and process of biogeochemical cycling between organisms and the environment
	CO3	Apply concepts of energy flow and dispersion in various ecosystems
	CO4	Monitor environmental hazards and their control measures
K5	CO5	Evaluate the changes in biodiversity and their management approaches through remote sensing techniques

SYLLABUS

UNIT I **(21 HOURS)**

Population and Community Ecology - Ecology - concepts and applications, biotic community concepts, characteristics and structure of population, ecological variants, and methods of studying plant communities. Ecological niches, edge effect and ecotone.

UNIT II **(21 HOURS)**

Ecosystem Ecology - Structural and functional characteristics of ecosystem, major ecosystems of world, biogeochemical cycle - cycling and reservoir pool, gaseous (nitrogen and carbon) and sedimentary pattern (sulphur and phosphorous) of cycling. Nutrient cycling and agricultural patterns in tropical and temperate regions. Plant indicators of conditions, uses and processes.

UNIT III **(21 HOURS)**

Bioenergetics - Energy dispersion, law of thermodynamics, concept and energy flow models, productivity concept, turn over - primary production processes in C_4 and CAM plants, adaptations in C_4 plants for efficient primary production. Productivity in different ecosystems, measurement of primary production. Carbon credits and Carbon currency

UNIT IV **(21 HOURS)**

Environmental Pollution and Education - Air, water, soil, noise and radiation pollution - causes and possible control measures*. Bioremediation, Climate change. Global warming, greenhouse effect, ozone depletion, Acid rain. Environmental education-principles, Environmental education programmes in India. Environmental

organizations and agencies, Man and Biosphere (MAB) and National and International organizations.

UNIT V **(21 HOURS)**

Natural Resource Conservation and Management - Biodiversity - International and National scenarios, importance. Ecological principles and applications in conservation of biodiversity. *ex situ* and *in situ* conservation of species. Biosphere reserves, sanctuaries, national parks, world hot spots. Remote sensing- principle, tools, concepts and applications-mapping of forest cover. Soil conservation - erosion and control. Water standards, quality and management. Water conservation and waste water reuse. Afforestation, deforestation and Social forestry.

***Self study**

TEXT BOOKS

1. P.D. Sharma, (2000). Ecology and Environment. Rastogi Publications, Meerut.
2. H.D. Kumar, (1994). General Ecology. Vikas Publishing Co. New Delhi.
3. P.S. Verma and Agarwal (2000). Environmental Biology (Principles of Ecology). S. Chand & Company, New Delhi
4. R.S. Ambashat and N.K. Ambashat, (2017). A Text Book of Plant Ecology, CBS Publishers and Distributors, India
5. Rafad S. Oliveria (2019). Plant Physiological Ecology, Springer Publication

REFERENCE BOOKS

1. E.P. Odum, (1971). Fundamentals of Ecology. N.B.Saunders Co. Ltd. Philadelphia.
2. Krebs, (1985). Ecology. C.J, Haper & Row, New York.
3. R.S. Ambasht, (1988). Text book of plant ecology. Lanka Publishers, Varanasi.
4. K.C. Misra, (1980). Manual of plant ecology. Oxford and IBH Publishing Co., New Delhi.
5. Alan Wellburm. (1988). Air pollution and acid rain - the biological impact. Longman Scientific and technical, Singapore.
6. C.K. Varshney, (1989). Water pollution and Management. S.P. Printers, Noida.
7. Weaver and Clements. (1929). Plant Ecology. Tata McGraw Hill Publishing Co. New Delhi.
8. R.K. Sinha and Dalbir Singh. (1997). Global Biodiversity. INA Shree Publishers, Jaipur.
9. Mason, C.F. Longman, (1981). Biology of Fresh Water. London.

WEB RESOURCES

1. https://www.slideshare.net/slideshow/introduction-to-ecology-78489110/78489110
2. https://gacbe.ac.in/pdf/ematerial/18BBO24C-U2.pdf
3. https://www.slideshare.net/slideshow/energy-flow-and-productivities/109386855
4. https://www.shivajicollege.ac.in/sPanel/uploads/econtent/2f2a10e0a4857e8bfedc7d8c93035cb1.pdf

PBO41

26PBO410

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	H	H	S	H
CO2	H	S	H	H	M
CO3	H	S	M	H	S
CO4	S	M	H	S	H
CO5	M	S	M	S	H

S - Strong **H** - High **M** - Medium **L** – Low

Content Prepared by (Based on Inputs) Dr. D. Moorthy Signature of the Course in-charge	Signature of the HoD

26PBO411

Programme Code: 05	**M.Sc., BOTANY**				
Core Paper 11: PLANT BIOTECHNOLOGY					
Batch 2026-2027	**Semester IV**	**Hours / Week 7**	**Total Hours 105**	**Credits 4**	**Skill Development**

COURSE OBJECTIVES

- To study the basic of plant genome and tissue culture techniques
- To equip students with theoretical knowledge regarding the techniques and applications of Plant Biotechnology and Genetic Engineering
- To help students to get a career in Industry/R&D/Academic

COURSE OUTCOMES

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

K1	CO1	Describe the genome organizations in plants
↕	CO2	Work on plant cell and tissue culture systems
	CO3	Explain the genetic transformation techniques in plants
	CO4	Utilize the applications of genetic transformation techniques in plants
K5	CO5	Analyze and evaluate the importance of metabolic engineering and molecular farming technology in plants

SYLLABUS

UNIT I **(21 HOURS)**

Introduction to Plant Biotechnology- Scope and importance. **Plant Cell and Tissue Culture:** Tissue culture media - MS, B5, Knudson C and Whites (composition and preparation), Plant growth regulators, Micropropagation-Nodal and Shoot tip culture, Callus culture, Cell culture - Single cell and suspension culture, Somatic embryogenesis and Artificial seeds, Protoplast culture - isolation, Somatic hybridization, Haploid production - Pollen culture. Somaclonal variation

UNIT II **(21 HOURS)**

Genome organization: Nucleus, Chloroplast and Mitochondria. Molecular Markers: AFLP and Microsatellites (SSR/STR). Model Plant: *Arabidopsis* and Tobacco. **Genetic transformation and vectors:** Methods of Gene Transfer: Indirect methods – Introduction, *Agrobacterium* mediated gene transfer – General characteristic features. Ti and Ri plasmids. Mechanism of T-DNA transfer. Binary and cointegrate vector systems.

UNIT III **(21 HOURS)**

Genetic transformation: Direct methods of gene transfer - Introduction, physical and chemical methods, Chloroplast transformation, Selectable and Reporter genes. Gene Silencing- Introduction, Hairpin RNAi plants, Small RNAs for crop management, Genome Editing - Introduction, CRISPR / Cas9 - basic principle, methodology and applications for crop improvement.

26PBO411

UNIT IV **(21 HOURS)**

Application of plant transformation: Nutraceuticals-Golden Rice and Flavr Savr, herbicide resistance- Glyphosate, Biotic stress resistance-bacteria, virus, fungi and insect. Abiotic stress resistance- drought, cold and salt*. Terminator technology and Marker free transgenics.

UNIT V **(21 HOURS)**

Plant molecular farming and metabolic engineering: Plantibodies, Biodegradable plastics and edible vaccines. Metabolic engineering for plant secondary metabolites - introduction, alkaloid, terpenoid and flavonoid biosynthesis.

***Self study**

TEXTBOOKS

1. H.S. Chawla, (2002). Introduction to Plant Biotechnology. 2nd Edition, Science Publishers, Inc., Enfield, NH, USA.
2. M.K. Razdan, (2003). Introduction to Plant Tissue Culture. 2nd Edition, Science Publishers, Inc., Enfield, NH, USA.
3. Kalyan Kumar De. (2004). An Introduction to Plant Tissue Culture.2008. New Central Book Agency, Kolkata.
4. R.C. Dubey, (2013). A text book of Biotechnology (Revised Edition), S. Chand & Company Ltd. New Delhi
5. C.B. Nirmala, G. Rajalskshmi and Chandra Karthick (2013). Plant Biotechnology. MJP Publishers.

REFERENCE BOOKS

1. Buchanan, Gruissem and Jones (2000). Biochemistry and Molecular Biology of Plants. John Wiley & Sons, UK.
2. H.S. Chawla, (2000). Introduction to Plant Biotechnology, Science Publishers.
3. Kirsi-Marja Oksman-Caldentey, (2002). Plant Biotechnology and Transgenic Plants. 1st Edition. CRC Press.
4. Paul Christou, Harry Klee, (2004). Handbook of Plant Biotechnology. John Wiley and Sons.
5. S.B. Primrose and R. Twyman, (2006). Principles of Gene Manipulation and Genomics. 7th Edition, Blackwell Publishing, Malden, MA, USA.
6. Slater, Scott and Fowler, (2008). Plant Biotechnology, 2nd Edition, Oxford University Press.
7. Neal Stewart, (2016). Plant Biotechnology and Genetics: Principles, Techniques, and Applications, 2nd Edition. Wiley Publications.
8. S. Umesha, (2019). Plant Biotechnology. CRC Press.
9. Online Resources: Latest Research and Review Articles.

WEB RESOURCES

1.https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/plant-tissue-culture.
2. https://pmc.ncbi.nlm.nih.gov/articles/PMC12120897/
3. https://www.maxapress.com/article/id/696eebbbfa6c580564ed5957
4.https://www.frontiersin.org/journals/plant-science/articles/10.3389/fpls.2023.1171154/full
5. https://pmc.ncbi.nlm.nih.gov/articles/PMC10214965/

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	H	M	H	S
CO2	S	S	H	S	M
CO3	H	M	S	H	H
CO4	H	H	S	M	S
CO5	H	S	S	S	M

S - Strong **H** - High **M** - Medium **L** – Low

Content Prepared by (Based on Inputs) Dr. R. Thirugnanasampandan Signature of the Course in-charge	 Signature of the HoD

26PBO412

Programme Code: 05		**M.Sc., BOTANY**			
Core Paper 12: BIOINFORMATICS					
Batch 2026-2027	**Semester IV**	**Hours / Week 7**	**Total Hours 105**	**Credits 4**	**Skill Development**

COURSE OBJECTIVES

- To understand the concepts of bioinformatics and its application in various fields of plant science
- To understand the structure of biological databases and their utilities.
- To impart knowledge on various tools of biological databases.

COURSE OUTCOME

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

K1 ↕ K5	CO1	Grasp knowledge on various biological databases.
	CO2	Impart knowledge on gene and its expression both in prokaryotes and eukaryotes.
	CO3	Obtain knowledge on the sequences of amino acids in protein molecules.
	CO4	Acquire knowledge on appropriate algorithms and to identify the similarities and dissimilarities existing between the genes of various organisms.
	CO5	Evaluate evolutionary relationships between organisms and biomolecular visualization tools.

SYLLABUS

UNIT I **(21 HOURS)**

Foundations of Bioinformatics and Gene Organization: Introduction to Bioinformatics, Phytoinformatics, Central Dogma of Molecular Biology. Gene Structure and Information content, Promoter sequences, Open Reading Frames (ORFs), Introns and Exons, Transcription factors, Gene Finding Methods and Tools.

UNIT II **(21 HOURS)**

Biological Databases and Protein Analysis: Classification of Biological Databases, including Sequence, Structural, Specialized, and Literature Databases. Concepts of Protein domains, Motifs, and Protein families. Fundamentals of protein structure and function prediction using computational approaches.

UNIT III **(21 HOURS)**

Omics Technologies in Plant Biology: **Genomics** - Definition, Basic principles, Workflow, and Types, including Structural, Functional, and Comparative Genomics, along with Epigenomics, Metagenomics, and Pharmacogenomics, and their applications. **Proteomics** - Definition, Principles, Methodology, and Types such as Expression, Functional, Structural, and Quantitative proteomics, and their applications. **Plant metabolomics** - Definition, Principles, workflow, Analytical techniques, and applications in crop improvement.

26PBO412

UNIT IV **(21 HOURS)**

Sequence Alignment: Definition, Types and Methods; Sequence similarity search using BLAST and FASTA; **Integrated Approaches in Bioinformatics**: Biomolecular visualization, Phylogenetic analysis and Computer Aided Drug Designing (CADD) and Molecular modeling. Applications of Bioinformatics in various fields*.

UNIT V **(21 HOURS)**

Tools and Databases: Introduction, Key Features and Applications of the Databases- TAIR (Arabidopsis), Oryzabase (Japan), RAP-DB (Rice Annotation Project Database), RGAP (Rice Genome Annotation Project), Phytozome (Plant Comparative Genomics), Sol Genomics Network (SGN), PRGdb (Plant Resistance Genes database), PlantCyc (Plant Metabolic Pathways Network (PMPN). **Tools:** MEGA (Phylogenetics), TBtools (Toolkit for Biologists), Integrated DNA Technologies (IDT), CRISPR-P, R/Phyton for Omics analysis. **Plant Promoter Databases:** PlantPAN 4.0 (Plant Promoter Analysis Navigator), PPDB (Plant Promoter Database) and PlantCARE.

*** Self study**

TEXT BOOKS

1. K. Mani and N. Vijayaraj. (2002). Bioinformatics for beginners. Kalaikathir Achakam, Coimbatore.
2. E. Dan, Krane and Michael L. Raymer. (2006). Fundamental concepts of bioinformatics. Dorling Kindersley (India) Pvt Ltd.
3. D. Mount, (2004). Bioinformatics: Sequence and Genome analysis. Cold Spring Harbor Laboratory Press. New York
4. A.M. Lesk, (2005). Introduction to Bioinformatics, Oxford University Press
5. U. Kumarasan and R. Sundaralingam, (2020). Bioinformatics, Saras Publication

REFERENCE BOOKS

1. Cold Spring Harbor. (2004). Bioinformatics - Sequence and Genome Analysis. (2nd Ed.) Laboratory Press,
2. Arthur M. Lesk. (2002). Introduction to Bioinformatics. Oxford University Press, UK.
3. David W. Mount. (2001). Bioinformatics-Sequence and Genome analysis. Cold Spring Harbor Laboratory Press.
4. D.R. Westhead, J.H. Parish and R.M. Twyman. (2003). Instant Notes in Bioinformatics.

WEB RESOURCES

1. https://shorturl.at/EsVB3
2. https://www.azolifesciences.com/article/Gene-Identification-Tools-in-Bioinformatics.aspx
3. https://www.news-medical.net/life-sciences/What-are-introns-and-exons.aspx
4. https://shorturl.at/9QJ4g
5. https://shorturl.at/HWOk2
6. https://shorturl.at/iS10n

7. https://bio.libretexts.org/Bookshelves/Cell_and_Molecular_Biology/Basic_Cell_and_Molecular_Biology_(Bergtrom)/03%3A_Details_of_Protein_Structure/3.06%3A_Protein_Domains_Motifs_and_Folds_in_Protein_Structure
8. https://pmc.ncbi.nlm.nih.gov/articles/PMC3717437/
9. https://microbenotes.com/genomics/
10. https://microbenotes.com/proteomics/
11. https://www.creative-proteomics.com/blog/plant-metabolomics-techniques.htm
12. https://pmc.ncbi.nlm.nih.gov/articles/PMC6969922/
13. https://www.researchgate.net/publication/354331738_Plant_Metabolomics_for_Crop_Improvement
14. https://microbenotes.com/local-global-multiple-sequence-alignment/
15. https://microbenotes.com/fasta-and-blast/
16. https://experiments.springernature.com/articles/10.1007/978-1-62703-646-7_5
17. https://shorturl.at/Z7eep
18. https://pmc.ncbi.nlm.nih.gov/articles/PMC10887528/
19. https://www.sciencedirect.com/science/article/pii/S0960982297700708
20. https://www.news-medical.net/health/What-is-Phylogenetic-Analysis.aspx
21. https://microbenotes.com/computer-aided-drug-design-cadd/
22. https://pmc.ncbi.nlm.nih.gov/articles/PMC5248982/
23. https://www.criver.com/products-services/discovery-services/chemistry/computer-aided-drug-design?region=3701
24. https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/molecular-modeling
25. https://bioinformaticshome.com/learn/tutorials/getting-started/bioinformatics-applications#gsc.tab=0
26. https://microbenotes.com/bioinformatics-introduction-and-applications/
27. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.mccollegeonline.co.in/attendence/classnotes/files/1586267373.pdf
28. https://www.geeksforgeeks.org/dbms/what-is-database/
29. https://www.arabidopsis.org/
30. https://library.iisc.ac.in/tair
31. https://academic.oup.com/nar/article/31/1/224/2401365
32. https://pmc.ncbi.nlm.nih.gov/articles/PMC1326027/
33. https://www.worldscientific.com/doi/10.1142/9789812814319_0144?srsltid=AfmBOormupe4XFR7-aZqrWyuuJmotz4DTBFYR3qHthJ35qruZLzoOnDX
34. https://rapdb.dna.naro.go.jp/
35. https://rice.uga.edu/
36. https://pubmed.ncbi.nlm.nih.gov/23299411/
37. https://www.biorxiv.org/content/10.64898/2026.01.16.699882v1
38. https://academic.oup.com/nar/article/53/D1/D1614/7903367
39. https://phytozome-next.jgi.doe.gov/
40. https://academic.oup.com/nar/article/40/D1/D1178/2903577
41. https://solgenomics.net/
42. https://academic.oup.com/nar/article/43/D1/D1036/2439072
43. https://www.prgdb.org/prgdb4/
44. https://prgdb.org/prgdb/
45. https://prgdb.org/prgdb/genes

46. https://plantcyc.org/
47. https://plantcyc.org/pmn-tools-overview/
48. https://www.megasoftware.net/
49. https://academic.oup.com/mbe/article/41/12/msae263/7930299
50. https://www.sciencedirect.com/science/article/pii/S1674205220301878
51. https://bio.tools/tbtools
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60. https://plantpan.itps.ncku.edu.tw/plantpan4/index.html
61. https://plantpan.itps.ncku.edu.tw/plantpan4/promoter_analysis.php
62. https://academic.oup.com/nar/article/52/D1/D1569/7332064
63. https://pmc.ncbi.nlm.nih.gov/articles/PMC2238996/
64. https://academic.oup.com/nar/article/42/D1/D1188/1043112
65. https://ppdb.agr.gifu-u.ac.jp/ppdb/cgi-bin/index.cgi
66. https://academic.oup.com/nar/article/30/1/325/1332250
67. https://bio.tools/plantcare

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	M	H	S	H
CO2	S	S	M	H	H
CO3	H	H	H	S	M
CO4	S	M	H	H	S
CO5	H	S	M	L	H

S - Strong **H** - High **M** - Medium **L** - Low

Content Prepared by (Based on Inputs) Dr. G. Dhandapani Signature of the Course in-charge	Signature of the HoD

26PBO4CO

Programme Code: 05	**M.Sc., BOTANY**				
Core Practical 4 - ECOLOGY, BIOENERGETICS, NATURAL RESOURCE MANAGEMENT, PLANT BIOTECHNOLOGY AND BIOINFORMATICS					
Batch 2026-2027	**Semester IV**	**Hours / Week 5**	**Total Hours 75**	**Credits 2**	**Skill Development**

COURSE OBJECTIVES

- To find out the dominant species in the particular environment.
- To learn the basic techniques of plant biotechnology.
- To use bioinformatic tools to analyze different protein or nucleotide sequences to reach meaningful conclusions.

COURSE OUTCOMES

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

K3	CO1	Analyze the physico chemical nature of the soil.
↕	CO2	Gain the hands on exposure on plant cell and tissue culture and molecular techniques
	CO3	Work on various aspects of plant biotechnology
	CO4	Students understood the skills to analyses biological data and use computational tools, software and databases
K5	CO5	Evaluate various techniques, algorithms and tools used for phylogenetic analysis.

SYLLABUS

LIST OF PRACTICALS

I. ECOLOGY, BIOENERGETICS AND NATURAL RESOURCE MANAGEMENT

1. To determine the quantitative characters in the community by using quadrat methods. **Analytical Characters:** a) Frequency b) Abundance c) Density d) Basal cover e) IVI.
2. **Synthetic characters:** Similarity Index (SI), Frequency Index Community Coefficient **(**FICC), Dominance Index, Diversity Index (Shannon's Diversity Index-SDI).
3. Raunkiaer's life form classes and percentage distribution of species in vegetation.
4. **Water analysis:** Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD) & Total Organic carbon (TOC).
5. Soil analysis - Physical - Bulk density, Water-holding capacity, Soil moisture. Chemical – Nitrate, Carbonate and Soil Respiration.
6. Field visit - Report preparation on vegetation types, conservation measures undertaken in biosphere reserves/ national parks/ sanctuaries etc.

II. PLANT BIOTECHNOLOGY

1. Preparation of MS medium and sterilization
2. Micropropagation-Nodal culture
3. Callus culture

4. Artificial seed preparation
5. Isolation of plant genomic DNA (gDNA) & analysis of gDNA by Agarose gel electrophoresis
6. Gene amplification by Polymerase Chain Reaction (PCR) technique & analysis of PCR product by Agarose gel electrophoresis

III. BIOINFORMATICS

1. Biological sequence data retrieval from Nucleic acid databases – NCBI.
2. 3-D Molecular visualization using RASMOL.
3. Protein secondary structure prediction using GOR IV & SOPMA.
4. Multiple sequence alignment using Clustal Omega (Clustal Ω) and phylogenetic analysis using ClustalX / ClustalW.
5. Prediction of exon–intron structures and gene organization using GENSCAN.
6. Primer designing tools – Primer 3 & IDT – Oligo analyzer.
7. Gene Annotation and Functional Analysis using TAIR (*Arabidopsis thaliana*).
8. Gene Information Retrieval and Functional Annotation using Oryzabase (*Oryza sativa* Database).
9. Metabolic Pathway Analysis using PlantCyc Database.
10. Promoter Analysis and Transcription Factor Binding Site Prediction using PlantPAN 4.0.
11. Cis-Regulatory Element Analysis of Plant Promoters using PlantCARE.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	H	S	M	S
CO2	S	M	H	S	H
CO3	H	H	M	H	H
CO4	H	S	S	M	S
CO5	S	H	M	S	S

S - Strong **H** - High **M** - Medium **L** – Low

Content Prepared by (Based on Inputs) Dr. P. Revathi Signature of the Course in-charge	 Signature of the HoD

PBO51

26PBO4CO

KONGUNADU ARTS AND SCIENCE COLLEGE (Autonomous)
COIMBATORE - 641 029

PG MODEL QUESTION PAPER (PRACTICALS)
End of Semester Examination Question Paper Pattern
(For the candidates admitted from the academic year 2026-2027 onwards)

Time: 4 Hours **Max. Marks: 60 Marks**

BREAK UP OF MARKS

Core Practical: 4 - ECOLOGY, BIOENERGETICS, NATURAL RESOURCE MANAGEMENT, PLANT BIOTECHNOLOGY AND BIOINFORMATICS

I.	Ecology Experiment	2 × 7	14 Marks
II.	Plant Biotechnology Experiment	2 × 6	12 Marks
III.	Bioinformatics Experiment	2 × 7	14 Marks
IV.	Spotters	5 × 2	10 Marks
	RECORD		**10 Marks**
	TOTAL		**60 Marks**

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PBO52

26PBO4Z1

Programme Code: 05	**M.Sc., BOTANY**				
PROJECT & VIVA – VOCE					
Batch 2026-2027	**Semester IV**	**Hours / Week -**	**Total Hours -**	**Credits 5**	**Skill Development**

COURSE OBJECTIVES

- To acquire inherent knowledge and exposures on relevant practical problems in various fields.
- To execute appropriate analytical skills and skills sets on selected problems.
- To impart insight knowledge on problem solving skills and their proper execution

COURSE OUTCOME

On successful completion of the project work, the students will be able to

K3	CO1	Apply theoretical knowledge in the real field of research
↕	CO2	Analyze the importance of tasks in collecting the data's
	CO3	Evaluate relationships existing between theories and experiments
	CO4	Provide problem solving skills on selected problems in any disciplines of plant sciences
K5	CO5	Execute appropriate statistical tools and interpretation of appropriate results

Individual project work will be allotted to individual students under the supervision and guidance of the Faculty members during IV Semester. Project works will be given based on the various fields of specialization of the supervisors under whom the students are allotted. They are allotted based on the lot system. The fields of specialization are Systematic Botany, Microbiology and Plant Pathology, Medicobotany & Ecology and Conservation Biology. The students shall do their projects under their supervisors and submit their dissertations at the end of IV Semester. Both the Internal and External Examiners shall jointly evaluate the project reports submitted by the students and marks will be awarded on the basis as mentioned below.

Guidelines for the Distribution of Marks:

CIA	Project Review	15	**20**
	Regularity	05	
ESE	Project Report Present	60	**80**
	Viva – Voce	20	
	Grand Total		**100**

PBO53

26PBO4Z1

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	H	S	M	S
CO2	S	M	H	S	H
CO3	H	H	M	H	H
CO4	S	H	S	S	H
CO5	S	H	S	H	H

S - Strong **H** - High **M** - Medium **L** - Low

Content Prepared by (Based on Inputs) Dr. K. Thenmozhi Signature of the Course in-charge	Signature of the HoD

MAJOR ELECTIVE PAPERS

PBO55

Programme Code: 05	M.Sc., BOTANY			
	Major Elective 1: FOREST RESOURCES AND CONSERVATION			
Batch 2026-2027	**Hours / Week 5**	**Total Hours 75**	**Credits 5**	**Skill Development**

COURSE OBJECTIVES

- To understand the importance and value of trees.
- To learn the revenue sources of forests.
- To grasp various products derived from forests for the betterment of human beings.

COURSE OUTCOMES

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

K1	CO1	Recognize the forest cover in India and their deterioration.
K2	CO2	Understand the significance of forest and climate change for the enhancement of environmental quality.
K3	CO3	Apply inherit knowledge on major and minor forest produce for the betterment of human welfare.
K4	CO4	Analyze forest based products and their varied applications.
K5	CO5	Implement acquired knowledge on conservation of bioresources.

SYLLABUS

UNIT I **(15 HOURS)**

Forest cover and national status. Factors for the deterioration of forest cover. Major forest types in India-Nature and Manmade (Miyawaki), Forest and climate, forest as carbon sink, forest and water, forest and soil, forest and air.

UNIT II **(15 HOURS)**

Major forest products- Timber, charcoal. Minor forest products resource of fibers and flosses, bamboos and canes, essential oils, including those from grasses, Tannins and dyes, gums, resins and oleo resins, drugs, spices, poisons and insecticides, edible products, minerals and miscellaneous products.

UNIT III **(15 HOURS)**

Forest industries- composite wood industries, match industry, Pulp and paper industry, furniture and other timber utilizing industries. Industries utilizing forest products resins.

UNIT IV **(15 HOURS)**

Conservation and plantation forestry - reserve forests, commercial forestry, social forestry, Joint forest management and tribology: agro forestry and energy plantations. Biomass conversion - technologies - pyrolysis* and gasification for thermal and electric applications.

UNIT V **(15 HOURS)**

Protection of Forest and Forest Law in India**:** Community based conservation approach, The Indian forest Act, 1927, The Forest (Conservation) Act, 1980 and The Forest (Conservation) Rules, 1981,2003, Laws Concerning Forest: Forest Right Act, 2006; International Laws and Policies Concerning Biodiversity; Gaps in Present Laws and Polices with respect to Biodiversity Conservation.

***Self study**

TEXT BOOKS

1. V.B. Sharma, (1998). Trees and Environment. APH Publishing Corporation, New Delhi.
2. K.P. Sagreiya, (1994). Forests and Forestry. National book Trust, India, New Delhi.
3. S.S Negi, (2002). Forest products and their utilization. International book distributions, 9/3 Rajpur Road, Dehradun.
4. Tribhawan Mehta, (1981). A hand book of Forest Utilization. Periodical Expert Book Agency. New Delhi.
5. P.K.R. Mair (1993). An Introduction to Agroforestry, Kluwar Academic Publishers, London.

REFERENCE BOOKS

1. N.S. Subrahmanyam and A.V.S.S. Sambamurty. (2004). Ecology. Narosa Publishing House. New Delhi.
2. P.D. Sharma (2004). Ecology and Environment. Rastogi Publications, Meerut.
3. Arvind Kumar. (2004). Biodiversity and Environment. APH Publishing Corporation, New Delhi.
4. M.P. Singh and Vinita Vishwakarma. (1997). Forest Environment and Biodiversity. Daya Publishing House, New Delhi.
5. L. Devereburton (2013). Introduction to Forestry Science. Delmar cengage Learning
6. Fergus L. Sinclair. (1995). Agroforestry: Science, Policy and Practice. Kluwar Academic Publishers, London
7. P.K.R. Nair, M.R. Rao and Buck, L.E (2004). Advances in Agroforestry. Kluwar Academic Publishers, London
8. L.G. Donald, P. Bettinger and S. Jacek (2012). Introduction to forestry and Natural Resources. Academic Press, Cambridge.

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3. https://uou.ac.in/sites/default/files/slm/FR-02.pdf

4. https://www.scribd.com/presentation/718632092/Forest-Based-Industries

5. https://www.ieabioenergy.com/wp-content/uploads/2013/10/Task-34-Booklet.pdf

6. https://www.drishtiias.com/to-the-points/Paper2/indian-forest-act-1927

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	S	H	H	M
CO2	S	H	H	M	H
CO3	H	M	S	M	S
CO4	S	S	H	H	M
CO5	H	M	S	M	S

S - Strong **H** - High **M** - Medium **L** – Low

Content Prepared by (Based on Inputs) Dr. H. Abdul Kaffoor Signature of the Course in-charge	Signature of the HoD

PBO58

Programme Code: 05	M.Sc., BOTANY			
	Major Elective: 2 - SEED TECHNOLOGY			
Batch 2026-2027	Hours / Week 5	Total Hours 75	Credits 5	Skill Development

COURSE OBJECTIVES

- To understand the principles of agronomy of seeds.
- To learn the methodology of seed germination, seed drying and seed treatments.
- To know the seed dormancy and their significance

COURSE OUTCOMES

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

K1 ↕ K5	CO1	Recognize seed borne diseases due to genetic constitution and storage of seeds.
	CO2	Study principles and practices of seed health testing and management of seed borne diseases
	CO3	Gain knowledge on principles and techniques of seed processing for quality upgradation and storage for maintenance of seed quality.
	CO4	Assess various feasible seed treatment and marketing strategies for various crop plants.
	CO5	Evaluate various methods of breaking seed dormancy.

SYLLABUS

UNIT I **(15 HOURS)**

Seed- Characteristics, importance, Differences between seed, grain and their production. Seed technology- Definition, objectives, Scope and importance. Indian Seed industry. Principles of seed production - Genetic principles – Deterioration of crop varieties and their control, Maintenance of genetic purity during seed production. Agronomic principles.

UNIT II **(15 HOURS)**

Seed germination test using paper, sand and soil seed viability - Tetrazolium test, Embryo excision method - Seed vigour Test - concept - direct and indirect vigour test. Seed health testing - objectives - Methods of seed health test for fungi, virus and insects.

UNIT III **(15 HOURS)**

Seed Production: Principles of seed production. Seed production in self and cross pollinated crops, methods of hybrid seed development, Seed production in India. Seed processing: Introduction, importance and principles of seed processing, Processing equipments', Methods of seed drying and storage. Determination of seed moisture methods, methods of maintaining safe seed moisture content. Seed quality enhancement techniques – importance- Seed fortification, Seed priming, seed coating and seed pelleting.

UNIT IV **(15 HOURS)**

Seed treatment - significance, - packaging, - certification, - storage and marketing- demand forecast, marketing structure, marketing organization, storage of seed, factors affecting seed marketing*

UNIT V **(15 HOURS)**

Seed dormancy - primary and secondary dormancies - significance - factors involved - methods to break dormancy.

***Self study**

TEXTBOOKS

1. Agrawal, RL. (2018). Seed Technology (Revised ed.). Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
2. Copeland LO and McDonald MB (2001). Principles of Seed Science and Technology (4th ed), Springer, New York
3. McDonald MB and Copeland LO. (2001). Principles of Seed Science and Technology (4th ed.). Springer, New York.
4. Justice OL and Bass LN. (1978). Principles and Practices of Seed Storage. Castle House Publ. Ltd., London.
5. Dahiya, BS & Rai KN (1998). Seed Technology. Kalyani publishers. Calcutta.
6. Dadlani M. and Yadava DK. (2023). Seed Science and Technology: Biology, Production, Quality. Springer, Singapore.

REFERENCE BOOKS

1. Khare D. and Bhale M.S. (2025). Seed Technology, Scientific Publishers Jodhpur, India.
2. Copeland LO and McDonald, MB (2001). Principles of Seed Science and Technology (4th ed) Springer, New York.
3. Agarwal PK and Dadlani M. (1987). Techniques in Seed Science and Technology, South Asian Publishers, New Delhi.
4. Nema NP. (1996). Principles of Seed Certification and Testing. Allied Publishers, New Delhi.
5. Tunwar NS and Singh SN. (2013). Indian Minimum Seed Certification Standards, Central Seed Certification Board, Ministry of Agriculture, Government of India, New Delhi.

WEB RESOURCES

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2. https://agri-bsc.kkwagh.edu.in/uploads/department_course/SEED_TECHNOLOGY_NOTES_2.pdf
3. https://www.scribd.com/document/843734701/SST-311-1-1-STUDY-MATERIAL-09-12-2020
4. https://agritech.tnau.ac.in/seed_certification/seed%20tech%20agri%20index/seedconcepts.html

PBO60

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	H	M	S	S
CO2	H	S	H	M	H
CO3	S	H	H	H	M
CO4	S	H	M	H	S
CO5	S	S	M	H	H

S - Strong **H** - High **M** - Medium **L** – Low

Content Prepared by (Based on Inputs) Dr. K. Karthika Signature of the Course in-charge	Signature of the HoD

PBO61

Programme Code: 05	M.Sc., BOTANY			
	Major Elective 3 - FOOD SCIENCE AND NUTRITION			
Batch	**Hours / Week**	**Total Hours**	**Credits**	**Skill Development**
2026-2027	**5**	**75**	**5**	

COURSE OBJECTIVES

- To learn the importance of different kinds of foods.
- To acquire knowledge on nutritive values of food.
- To create awareness about food adulterations

COURSE OUTCOMES

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

K1	CO1	Recognize various nutritive composition of cereals and cereal products.
↑	CO2	Understand processing practices of various foods based on their nutrients composition.
↕	CO3	Apply acquired knowledge on food processing technology in vegetables and fruits.
↓	CO4	Assess nutritive evaluation of spices and sugar based products.
K5	CO5	Evaluate the technologies employed for the processing of beverages.

SYLLABUS

UNIT I **(15 HOURS)**

Introduction of food science - classification according to function, food groups (ICMR) - Classification); Cereals and cereal products - composition, nutritive value and processing of Rice, Wheat, Maize; Fermented products- Bread- ingredients; Unfermented products - Cakes - Classes and ingredients.

UNIT II **(15 HOURS)**

Pulses- Nutrient values and processing and products of Black gram, Soya bean- Medicinal values of pulses. Nuts and Oilseeds- Coconut, Groundnut-Nutritive values, processing and products, role of nuts and oil & seed in cooking.

UNIT III **(15 HOURS)**

Vegetables- classification*-composition and nutritive values**,** - storage; Fungi as food- Mushroom - Algae - *Spirulina.* Role of vegetables in cookery. Fruits- classification, composition and nutritive values - storage of fruits- Enzymatic browning- Prevention - Non-enzymatic browning.

UNIT IV **(15 HOURS)**

Sugar - nutritive values, - properties, - sugar related products. - Role of sugar in cookery. Spices - General function of spices - Asafoetida, Clove, Garlic, Turmeric - role of spices in cookery

UNIT V

Beverages - classification - Coffee, Tea, Cocoa - processing, - adulterants; Fruit beverages - types. Food adulteration - types of adulterants. Food preservation - principles and methods.

***Self study**

TEXTBOOKS

1. Srilakshmi, B. (2003). Food Science . New Age International Publishers.
2. Swaminathan, M. (2006). Handbook of food and nutrients. The Bangalore printing & Publishing Co Ltd, India.
3. Michael EJ Lean. (2006). Food Science, Nutrition & Health.CRC Press
4. Srilakshmi, B. (2017). Nutrition Science.6th Edition. New Age International Publishers.
5. Sunetra Roday. (2018). Food Science and Nutrition. 3rd Edition. Oxford Publication.

REFERENCE BOOKS

1. Sumati R Mudambi (2001). Fundamentals of foods and nutritions, New age International publishers, New Delhi.
2. Mahtab s. Bamji, N. Pralhad Rao and Vinodini Reddy (2003). Text book of Human nutrition Second Edition, Oxford &IBH Publishing Co.Pvt, New Delhi.
3. Srilakshmi, B. (2003). Food Science. New Age International Publishers.
4. Michael EJ Lean. (2006). Food Science, Nutrition & Health.CRC Press.
5. Srilakshmi, B. (2017). Nutrition Science.6th Edition. New Age International Publishers.
6. Shubhangini A. Joshi. (2017). Nutrition and Dietetics. 4th Edition. Tata Mc Graw Hill Education Privated Limited.
7. Shubhangini A. Joshi. (2017). Nutrition and Dietetics. 4th Edition. Tata Mc Graw Hill Education Privated Limited.
8. Sunetra Roday. (2018). Food Science and Nutrition. 3rd Edition. Oxford Publication.

WEB RESOURCES

1. https://pmc.ncbi.nlm.nih.gov/articles/PMC11988532/
2. https://www.egyankosh.ac.in/bitstream/123456789/118031/1/Unit-13.pdf
3. https://pmc.ncbi.nlm.nih.gov/articles/PMC6366266/
4. https://academic.oup.com/fqs/article/1/3/171/4060885
5. https://www.sciencedirect.com/topics/food-science/food-preservation

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	H	M	H	M
CO2	H	S	H	S	M
CO3	S	H	M	H	H
CO4	H	H	S	M	S
CO5	H	H	S	M	M

S - Strong **H** - High **M** - Medium **L** – Low

Content prepared by (Based on Inputs) Dr. R. Thirugnanasampandan ignature of the Course in-charge	Signature of the HoD

PBO63

Programme Code: 05	M.Sc., BOTANY			
	Major Elective 4: MOLECULAR BIOLOGY			
Batch 2026-2027	Hours / Week 5	Total Hours 75	Credits 5	Skill Development

COURSE OBJECTIVES

- To understand the basic knowledge and organization of genome
- To learn the historical development of molecular biology
- To know and acquire fundamental knowledge on molecular mechanism of gene expression and protein synthesis

COURSE OUTCOMES

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

K1 ↕ K5	CO1	Gain fundamental knowledge on molecular biology
	CO2	Understand and acquire knowledge on nucleic acid and genome organization
	CO3	Gain impact knowledge on molecular mechanism of gene expression and various molecular process at RNA level
	CO4	Apply knowledge on machinery and molecular mechanism of protein synthesis
	CO5	Evaluate the acquired knowledge on molecular biological tools in to the future research

SYLLABUS

UNIT I **(15 HOURS)**

Historical developments of Molecular Biology: **Nucleic acid** – **Deoxyribonucleic acid (DNA)**: Physical and chemical structure of DNA, Types of DNA, Watson and Crick model of DNA, Viral DNA, Bacterial DNA, DNA as genetic material, DNA synthesis and replication, termination of replication, Enzymes of DNA replication, Methylation of DNA, DNA damage-types and repair Mechanisms, Recombination.

UNIT II **(15 HOURS)**

Brief Overview of Genome Organization: Gene structure and expression in Prokaryotic and Eukaryotic organization; Extra-chromosomal DNA: bacterial plasmids, mitochondria and chloroplast*.

UNIT III **(15 HOURS)**

Ribonucleic acid (RNA): Synthesis of RNA, Different types of RNA, DNA dependent RNA polymerase, Molecular events of transcription and RNA processing - Initiation of transcription, Post transcriptional changes in RNA, Transcription process in prokaryotes; Promoters; RNA polymerase; RNA processing; Splicing; Reverse transcriptase; RNA editing; Eukaryotic transcription; eukaryotic promoters and enhancers. Nuclear export of mRNA-mRNA stability and degradation.

UNIT IV **(15 HOURS)**

Translation: Machinery and mechanism (tRNA charging, initiation in prokaryotes and eukaryotes, elongation and termination); Regulation of gene expression: Regulation at the levels of chromatin organization, DNA amplification, initiation of transcription, attenuation, anti-sense RNA, alternate promoters, RNA processing, mRNA degradation and translation.

UNIT V **(15 HOURS)**

Genetic Code - Basic features of genetic code. Deciphering of genetic code. Wobble hypothesis. **Protein biosynthesis**: activation of amino acids, initiation, elongation and termination of translation in prokaryotes. Post translational modifications. Inhibitors of translation.

***Self study**

TEXTBOOKS

1. P.S. Verma, V.K. Agarwal (2010) Molecular Biology. S Chand publication, New Delhi.
2. P.S. Verma, V.K. Agarwal (2016) Cell Biology ((Cytology, Biomolecules and Molecular Biology). S Chand publication, New Delhi.
3. K.G. Ramawat, Goyal Shaily (2010) Molecular Biology and Biotechnology (For Undergraduate Courses). S Chand publication, New Delhi.
4. Walker J.M. and Rapley R. (2002). Molecular Biology and Biotechnology. Panima, New Delhi.
5. N. Vidyavathi, D.M. Chetan (2009) Molecular Biology. I K International Publishing House, Bengaluru, Karnataka
6. G. Jeyanthi (2019) Molecular Biology. MJP Publishers, Chennai, Tamil Nadu

REFERENCE BOOKS

1. The Biochemistry of the Nucleic Acids by R.L. Adams, J.T. Knowler, and D.P. Leader (Paperback May 31, 1992)
2. Lehninger (2008) Principles of Biochemistry by David L. Nelson and Michael M. Cox (Hardcover - Feb 1, 2008)
3. Watson, J. D., Baker, T.A., Bell, S.P., Gann, A., Levine, M. and Losick, R. (2014). Molecular biology of the gene. 7th edition. Pearson.
4. Freifelder, D. (2001). Essentials of Molecular Biology. Narosa Publishing House, New Delhi.
5. Brown, T. A. (2006). Essential Molecular Biology: Practical approach Vol I & II. Oxford.
6. Malacinski, G. M. (2002). Essentials of Molecular Biology. Fourth Edition. Jones & Bartlett Publishers.
7. Walker J.M. and Rapley R. (2002). Molecular Biology and Biotechnology. Panima, New Delhi.
8. Molecular Biology of the Gene (6th Edition) by James D. Watson, Tania A. Baker, Stephen P. Bell, and Alexander Gann (Hardcover - Dec 15, 2007)

WEB RESOURCES

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4. https://bio.libretexts.org/Bookshelves/Genetics/Online_Open_Genetics_(Nickle_and_Barrette-Ng)/01%3A_Overview_DNA_and_Genes/1.02%3A_DNA_is_the_Genetic_Material
5. https://www.news-medical.net/life-sciences/Mechanism-of-DNA-Synthesis.aspx
6. https://www.genome.gov/genetics-glossary/DNA-Replication
7. https://pmc.ncbi.nlm.nih.gov/articles/PMC6386472/
8. https://microbenotes.com/dna-replication-steps/
9. https://www.nature.com/articles/npp2012112
10. https://pubmed.ncbi.nlm.nih.gov/22781841/
11. https://biomodal.com/blog/the-fascinating-world-of-dna-methylation/
12. https://microbenotes.com/dna-damage-and-repair/
13. https://pmc.ncbi.nlm.nih.gov/articles/PMC10801582/
14. https://geneglobe.qiagen.com/us/knowledge/pathways/cellular-activity-metabolism-and-homeostasis-pathways/dna-damage-repair
15. https://www.sciencedirect.com/topics/neuroscience/dna-recombination
16. https://bio.libretexts.org/Bookshelves/Biochemistry/Fundamentals_of_Biochemistry_(Jakubowski_and_Flatt)/03%3A_Unit_III-_Information_Pathway/24%3A_DNA_Metabolism/24.03%3A_DNA_Recombination
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21. https://geneticeducation.co.in/organelle-dna-mitochondrial-and-chloroplast-dna/
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25. https://academic.oup.com/plcell/article/35/10/3641/7224772
26. https://bio.libretexts.org/Bookshelves/Introductory_and_General_Biology/Biology_(Kimball)/06%3A_Gene_Expression/6.05%3A_RNA_Editing
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MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	S	M	S	S
CO2	S	S	H	M	H
CO3	S	H	H	H	M
CO4	S	H	M	H	S
CO5	S	H	M	H	H

S - Strong **H** - High **M** - Medium **L** – Low

Content prepared by (Based on Inputs) **Dr. G. Dhandapani** Signature of the Course in-charge	 Signature of the HoD

PBO67

Programme Code: 05	M.Sc., BOTANY			
	Major Elective 5: HORTICULTURE			
Batch 2026-2027	Hours / Week 5	Total Hours 75	Credits 5	Skill Development

COURSE OBJECTIVES

- To learn about the propagation methods of horticultural crops.
- To study about gardening, landscaping and their maintenance.
- To acquire knowledge about commercial floriculture and cut flower arrangements.

COURSE OUTCOMES

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

K1 ↕ K5	CO1	Gain knowledge on solutions for a wide spectrum of plant health issues.
	CO2	Understand the components and adornments of gardening.
	CO3	Apply inherent knowledge on various plant propagation techniques.
	CO4	Explore knowledge on cultivation practices of fruits and vegetables.
	CO5	Demonstrate the aesthetic value of gardening.

SYLLABUS

UNIT I **(15 HOURS)**

Scope and importance - divisions of horticulture - classification of horticultural crops - climate, soil and nutritional needs - Irrigation. Organic horticulture - definition, synonyms, principles, methods, merits and demerits.

UNIT II **(15 HOURS)**

Gardening and landscaping - importance and scope of gardening - Gardens in India* - types - layout of a garden - Garden components and adornments - Special types of garden - principles and design - Water garden, bog garden, terrace garden, rockery garden, vertical garden, clock garden, colour wheels and temple garden. Terrarium and Bonsai techniques.

UNIT III **(15 HOURS)**

Asexual propagation - Advantages and disadvantages - Cuttings:- types, factors influencing rooting of cuttings - use of growth regulators in relation to horticulture - layering - types - Grafting and Budding - methods - factors for successful graft union - Stock scion relationship - Factors influencing the healing of graft union.

UNIT IV **(15 HOURS)**

Pomology - Establishment of orchard***** - cultivation of Banana, Citrus - Fruit carving - Olericulture - cultural aspects of vegetables - types of vegetable growing - Kitchen garden, Market garden, vegetable garden - Preservation of fruits and vegetables - ornamental floriculture - Cultivation of Jasmine and Rose - Extraction of jasmine concrete.

UNIT V **(15 HOURS)**

Bio-aesthetic planning, eco-tourism, theme parks, indoor gardening, therapeutic gardening, non-plant components, water scaping, xeriscaping and hardscaping.

***Self study**

TEXTBOOKS

1. Kumar, N. (1999). An introduction to horticulture. Rajalakshmi Publication, Nagarcoil.
2. Chaha, K.L. (2001). Handbook of horticulture. ICAR, New Delhi.
3. Prasad, S., U.Kumar. (2013). A handbook of Floriculture. Agrobios, Jodhpur.
4. Peter KV. Basics of Horticulture, 2nd Revised edition, New Delhi Publishing Agency.
5. Manibhushan Rao. Text Book of Horticulture, Lakshmi Publications & Pvt. Ltd.,

REFERENCE BOOKS

1. Bose, T.K., J. Kabir, P. Das and P.P. Joy. (2001). Tropical Horticulture. Naya Prakash Publications, Calcutta.
2. George Acquaach. (2003). Horticulture - Principles and practices.
3. Edwin Biles. (2003). The complete book of gardening. Biotech book, New Delhi.
4. Singh, S.P. (1999). Advances in Horticulture and Forestry - Scientific Publishers, Jodhpur.
5. Sharma, V.K. (2004). Advances in Horticulture: Strategies, Production, Plant Protection and Value Addition - Deep and Deep Publications, New Delhi.
6. Bhattacharjee, S.K. (2006). Advances in Ornamental Horticulture -Pointer Publications, Jaipur.
7. Desh Beer Singh and Poonam Wazir. (2002). Bonsai-An Art. Scientific Publishers, Jodhpur.

WEB RESOURCES

1. https://www.kngac.ac.in/elearning-portal/ec/admin/contents/2_18KP3B10_2020101608323615.pdf.
2. https://agrimoon.com/wp-content/uploads/Principles-of-Landscape-Gardening.pdf
3. https://www.egyankosh.ac.in/bitstream/123456789/73068/1/Unit-2.pdf
4. https://siesascs.edu.in/docs/notes/Horticulture%20and%20branches_29420.pdf
5. https://agriculture.institute/floriculture-and-landscaping/jasmine-cultivation-species-propagation-oil/.
6. https://agritech.tnau.ac.in/horticulture/horti_flower%20crops_commercial%20rose.html.
7. https://www.slideshare.net/slideshow/presentation1-62510718/62510718.

PBO69

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	S	H	M	S
CO2	S	H	M	H	H
CO3	H	S	H	M	H
CO4	S	M	S	H	S
CO5	H	S	H	M	H

S - Strong **H** - High **M** - Medium **L** – Low

Content Prepared by (Based on Inputs) Dr. H. Abdul Kaffoor Signature of the Course in-charge	Signature of the HoD

PBO70

Programme Code: 05	M.Sc., BOTANY			
	Major Elective 6: ALGAL TECHNOLOGY			
Batch 2026-2027	Hours / Week 5	Total Hours 75	Credits 5	Skill Development

COURSE OBJECTIVES

- To study the laboratory culture protocol for algae
- To know the morphological characters and nutrient requirement of algae
- To learn seaweed farming and harvesting methods

COURSE OUTCOMES

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

K1 ↕ K5	CO1	Provide knowledge on commercial importance of algae
	CO2	Prepare and optimize the medium for culturing algae
	CO3	Work on seaweeds and utilize the benefits
	CO4	Learn various culture techniques for mass cultivation of seaweeds
	CO5	Start a small scale unit for marketing of cultivated algae

SYLLABUS

UNIT I **(15 HOURS)**

Brief description and taxonomic identification of micro and macroalgae of fresh water and marine habitats. General principles of culturing algae in laboratory and growth measurement. Isolation and culture of algae of different forms (single cell, colonial, filamentous and thallus forms). Chemical composition of culture media for fresh water and marine algae.

UNIT II **(15 HOURS)**

Photobioreactor technology for microalgae cultivation and their components – light system, optical transmission system, air handling and gas exchange systems, mixing system, nutrient system, instrumentation system and electrical system. Cultivation of micro algae: algae for biodiesel, process, strains and sources of contamination. Bio-pond – production in open ponds, Harvesting and Oil Extraction: principles and methods.

UNIT III **(15 HOURS)**

Seaweeds: Morphology and classification, light, carbon metabolism, translocation, polysaccharides of seaweeds, chemical constituents of seaweeds, morphogenesis and growth regulators, sexuality and sex attraction, nutrients, individual populations and communities, morphology and environment.

UNIT IV **(15 HOURS)**

Seaweeds farming: Objectives, site selection, installation of test plants, Kinds of test planting, introduction of test plants. Preparation of the farm site and other culture activities –construction of farm – Line method, Rope and Raft methods, Net method, Floating bamboo method, Mangrove stakes and nets method. Management – Seed selection and preparation, tying of seedlings, Planting, Harvesting, Pre-harvest

activities, harvesting procedures, drying, maintenance of the farm and Marketing of seaweeds.

UNIT V **(15 HOURS)**

Generalized uses of seaweeds, Human food, Seaweed Baths, Cosmetics, Seaweed as agricultural fertilizers*, Liquid seaweed extracts, Seaweed industrial gums: Alginates, Agars, Carrageenan, other polysaccharides and their medicinal Uses.

***Self study**

TEXTBOOKS

1. Stein, H. (1973) Handbook of Phycological methods. Culture methods and growth measurements, Cambridge University Press.
2. Christopher S. Lobban and Michael James Wynne (1981) The Biology of seaweeds, University of California Press.
3. Hilson, C.J. (1990). Seaweeds: A Color-Coded, Illustrated Guide to Common Marine Plants of the East Coast of the United States. Penn State University Press.
4. Bhavanath Jha, C. R. K. Reddy, Mukund C. Thakur and M. Umamaheswara Rao. (2009). Seaweeds of India. Springer Publications

REFERENCE BOOKS

1. Valentine Chapman.(1980). Seaweeds and their uses. 3rd Edition, Springer Publications
2. Gavino C. Trono, Jr. (1988). Manual on seaweed culture, FAO Manual
3. Klaus Lüning (1990). Seaweeds: their environment, biogeography and ecophysiology, Wiley-IEEE.
4. Clinton J. Dawes (1998). Marine Botany, 2nd ed, John Wiley and Sons, Inc.
5. Jha**,** B., Reddy**,** C.R.K., Thakur**,** M.C., Rao **(**2009). Seaweeds of India: The Diversity and Distribution of Seaweeds of Gujarat Coast Series: Developments in Applied Phycology. Vol. 3. Springer Publications.
6. David Sieg (2012). Making algae biodiesel at Home. Information Specialists, Corporation.
7. Ole G. Mouritsen (2013). Seaweeds: Edible, Available and Sustainable. University of Chicago Press.
8. Leonel Pereira. (2016). Edible Seaweeds of the World. CRC Press

WEB RESOURCES

1. https://ina.tmsoc.org/CODENET/culturenotes.htm
2. https://pmc.ncbi.nlm.nih.gov/articles/PMC6999644/
3. A review on microalgae cultivation and harvesting, and their biomass extraction processing using ionic liquids - PMC
4. https://eprints.cmfri.org.in/10671/1/12.%20Gulshad.pdf
5. http://techsciresearch.com/report/india-seaweed-market/14366.html
6. https://www.seaweed.ie/uses_general/

PBO72

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	S	M	S	S
CO2	S	S	H	M	H
CO3	S	H	H	H	M
CO4	S	H	M	H	S
CO5	S	H	M	H	H

S - Strong **H** - High **M** - Medium **L** – Low

Content Prepared by (Based on Inputs) Dr. V. Aravindhan Signature of the Course in-charge	Signature of the HoD

PBO73

Programme Code: 05	M.Sc., BOTANY			
	Major Elective 7: BIOINOCULANTS AND SOLID WASTE MANAGEMENT			
Batch 2026-2027	**Hours / Week 5**	**Total Hours 75**	**Credits 5**	**Skill Development**

COURSE OBJECTIVES

- To study the basic knowledge on biofertilizers
- To understand the impact of solid waste on environment, human and plant health
- To acquire knowledge about reuse, recycle and recovery of solid waste by biological processing methods

COURSE OUTCOMES

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

K1 ↕ K5	CO1	Apply knowledge on implementations of biofertilizers in agriculture
	CO2	Know about microbial based fertilizers
	CO3	Acquire knowledge on solid waste management.
	CO4	Understand the method in maintenance of sanitary landfills
	CO5	Provide awareness on the various policies of solid waste management

SYLLABUS

UNIT I **(15 HOURS)**

General account about the microbes used as bioinoculants, Rhizobium – isolation, identification, mass cultivation, carrier based inoculants, symbiosis and *Azospirillum* – isolation, mass cultivation, carrier based inoculants, *Azotobacter* – classification, characteristics, crop response to *Azotobacter* inoculum, maintenance and mass cultivation.

UNIT II **(15 HOURS)**

Cyanobacteria (blue green algae), *Anabaena Azolla* association, nitrogen fixation, factors affecting growth, Mycorrhizal association types AM – isolation and inoculum production of AM- influence on growth and yield of crop plants. Organic farming – Green manuring and organic fertilizers, Biocomposting – methods, types and method of vermin composting and its field application.

UNIT III **(15 HOURS)**

Effect of solid waste disposal on environment: Sources and generation of municipal solid waste; hazardous waste and biomedical waste. Impact of solid waste on environment, human and plant health; water quality and aquatic life; mining waste and land degradation; effect of land fill leachate on soil characteristics and ground water pollution.

UNIT IV **(15 HOURS)**

Solid waste Management: Different techniques used in collection, storage, transportation and disposal of solid waste* (municipal, hazardous and biomedical waste); landfill (traditional and sanitary landfill design); thermal treatment (pyrolysis and incineration) of waste material; drawbacks in waste management techniques; Concept of Integrated waste management

UNIT V **(15 HOURS)**

Policies for solid waste management**:** 4R - reduce, reuse, recycle and recover; composting, anaerobic digestion, aerobic treatment; reductive dehalogenation; mechanical biological treatment; green techniques for waste treatment. Municipal Solid Wastes (Management and Handling) Rules 2000; Hazardous Wastes Management and Handling Rules 1989; Biomedical Waste (Management and Handling) Rules 1998; Plastic Waste (Management and Handling) Rules, 2011; Biomedical Waste Management Rules, 2016.

***Self study**

TEXTBOOKS

1. Gaston, KJ. & Spicer, J.I. 1998. *Biodiversity: An Introduction.* Blackwell Science, London,
2. K.V. Krishnamurthy, (2004). An Advanced Text Book of Biodiversity - Principles and Practices. Oxford and IBH Publications Co. Pvt. Ltd. New Delhi
3. Gupta PK. 2004. Methods in Environmental analysis - water, soil and air. Agrobios
4. (India), Jodhpur
5. Judith, P. 1999. Handbook of Environmental Impact Assessment. Blackwell Science.
6. Marriott, B. 1997. Environmental Impact Assessment: A Practical Guide. McGraw-Hill

REFERENCE BOOKS

1. Sathe, T.V. 2004 Vermiculture and Organic Farming. Daya publishers.
2. Subha Rao, N.S. 2000, Soil Microbiology, Oxford & IBH Publishers, New Delhi.
3. Vayas,S.C, Vayas, S. and Modi, H.A. 1998 Bio-fertilizers and organic Farming Akta Prakashan, Nadiad.
4. Rittman, B.E. & McCarty, P.L. 2001. Environmental Biotechnology. Principles and
5. Applications. McGraw-Hill, New York.
6. Scagg, A.H. 2005. Environmental Biotechnology. Oxford University Press.
7. Dubey, R.C., 2005 A Text book of Biotechnology S.Chand & Co, New Delhi.
8. Kumaresan, V. 2005, Biotechnology, Saras Publications, New Delhi.
9. John Jothi Prakash, E. 2004. Outlines of Plant Biotechnology. Emkay Publication, New Delhi.

WEB RESOURCES

1. https://www.slideshare.net/slideshow/microbial-inoculantspptx/256236618
2. https://www.kngac.ac.in/elearning-portal/ec/admin/contents/2_18KP1BELB1_2020120403355711.pdf
3. https://uou.ac.in/sites/default/files/slm/BOT(N)-121.pdf
4. https://www.slideshare.net/slideshow/solid-waste-management-using-4-r-121723334/12172333
5. https://www.msuniv.ac.in/images/distance%20education/learning%20materials/ug%20pg%202023/pg%202021/Msc%20physics%202023/SPHS41%20-%20IV%20Sem%20-%20Solid%2

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	S	M	S	S
CO2	S	S	H	M	H
CO3	S	H	H	H	M
CO4	S	H	M	H	S
CO5	S	H	M	H	H

S - Strong **H** - High **M** - Medium **L** – Low

Content Prepared by (Based on Inputs) Dr. M. Parveen Signature of the Course in-charge	 Signature of the HoD

PBO76

Programme Code: 05	M.Sc., BOTANY			
	Major Elective 8: BIOTECHNOLOGY AND NANOBIOLOGY			
Batch 2026-2027	Hours / Week 5	Total Hours 75	Credits 5	Skill Development

COURSE OBJECTIVES

- To know the principles and applications of plant tissue culture
- To learn and familiarize plant genetic transformation and its applications
- To learn the basic knowledge of Nanobiology

COURSE OUTCOMES

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

K1 ↕ K5	CO1	Acquire knowledge on various developments and potential applications of biotechnology
	CO2	Understand the basic techniques of gene manipulation and their rapid applications in the field of plant tissue culture and genetic engineering
	CO3	Exploit nanotechnological tools to create new biomedical research tools, diagnostic tests and drug delivery systems
	CO4	Apply the concept of nanotechnology for achieving major task using nanoparticles
	CO5	Evaluate the applications of both biotechnology and nanobiology

SYLLABUS

UNIT-I **(12 HOURS)**

Introduction to Classical and Modern Biotechnology - Scope and Importance. **Genetic engineering**: Enzymes used in gene cloning – Restriction endonuclease, Ligase, Topo Isomerase, DNA polymerase, Alkaline phosphatase, Gyrase. Gene cloning - Isolation of genes, Sequencing of genes and Synthesis of genes.

UNIT-II **(12 HOURS)**

Molecular Probing: Radiolabelled probes and Non-radioactive probes, Southern, Northern, Western blotting and ELISA techniques. Monoclonal antibodies. **Biotechnology for Sustainable Industrial Processes**: Biotechnology in Paper Industry, Biohydro-metallurgy, Biomineralization and Bioinoculants.

UNIT-III **(12 HOURS)**

Nanobiology: Introduction, Definition, Historical aspects, Classification of nanomaterials - Metallic (e.g. gold, silver), Semiconductor (e.g., ZnO, CdS), and Polymeric (e.g., nanospheres, nanocapsules), Quantam dots, Magnetic, Polymeric nanoparticles and Liposomes. Types of Nanoparticles - Organic, Inorganic, and Carbon-based types. Carbon nanotubes and Bucky balls.

UNIT-IV **(12 HOURS)**

Methods and Synthesis of Nanoparticles – Physical, Chemical and Biological synthesis, Top down and Bottom up approach. **Characterization of Nanoparticles**: Principle, working mechanism and applications. Dynamic light scattering (DLS), TEM, SEM, AFM and X-ray diffraction (XRD).

UNIT-V **(12 HOURS)**

Applications of Nanotechnology in Plant Growth and Crop Protection: Nano-Farming, Nanofertilizers, Nanopesticides, Nanoparticles for improving soil quality, Plant Nanobionics, Nanosensors for smart agriculture, Genetically engineered plants using nanotechnology, Nanomaterials in seed germination, crop growth and quality enrichment. Application of nanotechnology in Nanofoods, Nanotherapeutics, Environmental applications and Fuel energy resources*. Nanotoxicology.

***Self study**

TEXT BOOKS

1. Dubey. R.C. (2014). A Text book of Biotechnology. S Chand & Company P. Ltd, New Delhi.
2. Kumaresan, V. (2015). Biotechnology. Saras Publication, Nagercoil, Tamil Nadu.
3. Gregory, L. Timp. (1998). Nanotechnology (1st Ed.). American Institute of Physics.
4. Bharat Bhusan. (2006). Hand Book of Nanotechnology. (1st Ed.), Springer.
5. Madhuri Sharon (2011). Bio-Nanotechnology: Concepts and Applications. CRC Press. Taylor & Francis Group
6. Subbaiah Balaji (2013). Nanobiotechnology. MjP Publishers, India.

REFERENCE BOOKS

1. Ignachimuthu, S. (1995). Basic Biotechnology. Tata Mc Graw-Hill Publishing Company Ltd., Madras.
2. Gupta, P.K. (1998). Elements of Biotechnology. Rastogi Publications.
3. Meyyan, R.P. and V. Kumaresan. (2004). Genetics and Biotechnology. Saras Publication, Nagercoil.
4. S. B. Primrose and R.M. Twyman (2006). Principles of Gene Manipulation and Genomics. Blackwell Publishing, New Jersey, USA
5. Nirmala, B., Chandra Karthik, and Rajalakshmi, G. 2019. Plant Biotechnology. MJP Publishers.
6. Chen, J. T. (Ed.). (2024). Advanced Nanotechnology in Plants: Methods and Applications. CRC Press.

WEB RESOURCES

1. Siddiqui, M. H., Al-Whaibi, M. H., & Mohammad, F. (2015). Nanotechnology and plant sciences. Springer International Publishing, Cham., 303p. doi, 10, 978-3 (https://link.springer.com/book/10.1007/978-3-319-14502-0)
2. Jameel M. Al-Khayri, T.R. Anju, Shri Mohan Jain. (2025). Plant Nanotechnology Fundamentals and Methodologies. Springer Cham (https://link.springer.com/book/9783031818950#publish-with-us
3. Mahmood, I., Ansari, R. A., & Rizvi, R. (Eds.). (2024). Nanotechnology and Plant Disease Management. CRC Press (https://www.routledge.com/Nanotechnology-and-Plant-DiseaseManagement/Mahmood-Ansari-Rizvi/p/book/9781032188829?srsltid=AfmBOooqVI19li7r9C-4PZAslOh8Kxc_x2csvoojffuBm6UhlXu7C49c).
4. Neme, K., Nafady, A., Uddin, S. and Tola, Y.B., 2021. Application of nanotechnology in agriculture, postharvest loss reduction and food processing: food security implication and challenges. Heliyon, 7(12).
5. Gupta, A., Rayeen, F., Mishra, R., Tripathi, M., & Pathak, N. (2023). Nanotechnology applications in sustainable agriculture: An emerging eco-friendly approach. Plant Nano Biology, 4, 100033.

6. Liu, C., Zhou, H., & Zhou, J. (2021). The Applications of Nanotechnology in Crop Production. Molecules, 26(23), 7070. https://doi.org/10.3390/molecules26237070.
7. Shang Y, Hasan MK, Ahammed GJ, Li M, Yin H, Zhou J. Applications of Nanotechnology in Plant Growth and Crop Protection: A Review. Molecules. 2019 Jul 13;24(14):2558. doi: 10.3390/molecules24142558. PMID: 31337070; PMCID: PMC6680665.
8. https://vajiramandravi.com/upsc-exam/nanotechnology-in-agriculture/
9. Online Resources – Latest Research & Review articles and Chapters on Nanotechnology.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	H	S	M	H
CO2	H	M	H	H	H
CO3	S	M	H	S	S
CO4	S	S	S	H	M
CO5	S	S	S	H	H

S - Strong **H** - High **M** - Medium **L** – Low

Content Prepared by (Based on Inputs) Dr. K. Thenmozhi Signature of the Course in-charge	Signature of the HoD

PBO79

Programme Code: 05	M.Sc., BOTANY			
Major Elective 9: INDUSTRIAL BOTANY				
Batch	**Hours / Week**	**Total Hours**	**Credits**	**Entrepreneurship**
2026-2027	**5**	**75**	**5**	

COURSE OBJECTIVES

- To study the importance of plant based industries
- To learn the various types of plant industries and its products
- To inculcate entrepreneurial and employment opportunities in plant industries to students

COURSE OUTCOMES

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

K1 ↑	CO1	Acquire knowledge about plant industries
	CO2	Utilize leaf and timber products for day today life
	CO3	Explore and exploit edible part of plants for human welfare
	CO4	Implement the cultivation and marketing practices of cut flowers
K5 ↓	CO5	Know about herbal products and funding opportunities available to start an industry

SYLLABUS

UNIT I **(15 HOURS)**

Introduction to Industrial Botany: Introduction, scope, entrepreneurial opportunities in plants, brief account of plant based industries and institutions in India. Introduction about product preparation, standardization, quarantine and commercialization. Rules and regulations to start plant based industry. *Employment opportunities in plant industries.

UNIT II **(15 HOURS)**

Leaf and Timber Industry: Utility products of leaf (Areca and Banana), Essential oil industries (Mint, Camphor, Neem, Eucalyptus, Citronella, Geranium, Davanum and Lemon grass), Leaves used as spices (Fenugreek, Rosemary, Indian bay leaf, Basil and Curry leaf). Timber yielding trees of India and their products (Shisham, Sal, Teak, Deodar and Babool), Bamboo and Katha industry.

UNIT III **(15 HOURS)**

Flower, Seed and Fruit Industry: Perfume based products of Rose, Jasmine and Tuberose. Jams, jellies, juices, sauce and pickles. Edible oil industries (Coconut, Ground nut and Sesame). Starch, glucose and dextrose industries. Sugar and jaggery industries, Jute and Agarbatti stick making industry.

UNIT IV **(15 HOURS)**

Floriculture Industry: Production and packaging of cut flowers, Flower arrangements, Methods to prolong vase life, Cultivation and marketing of important cut flowers (Orchids, Anthurium Chrysanthemum, Jasmine, Rose, Gladiolus, Gerbera and Carnation).

UNIT V **(15 HOURS)**

Herbal Drugs Industry: Good manufacturing practice of Indian systems of herbal medicine and its objectives. Evaluation of drugs- WHO and ICH guidelines for the assessment of herbal drugs and stability testing of herbal drugs. *****Regulatory Issues-Regulations in India (ASU DTAB, ASU DCC), Regulation of manufacture of ASU drugs - Schedule Z of Drugs and Cosmetics Act for ASU drugs. Project proposal preparation for establishment of an industry, Grant and funding opportunities to start an industry.

***Self study**

TEXT BOOKS

1. Khare, C.P. 2004. Indian herbal remedies: rational Western therapy, ayurvedic, and other traditional usage, Botany. Springer science and business media, Germany.
2. Agrawal and Paridhavi. 2012. Herbal drug technology. 2nd Edition, University Press, India.
3. Hema Sane, Savita Rahangdale, Sanjaykumar Rahangdale. 2013.A text book of industrial botany. 2nd Edition. Vision Publications, Pune.
4. Pooja.2014. Applied Botany. Discovery Publishing House Pvt Ltd., India.
5. Khan, M.S.A., Ahmad, I., Chattopadhyay, D. 2018. New Look to Phytomedicine: Advancements in Herbal Products as Novel Drug Leads. Academic Press.

REFERENCE BOOKS

1. Simpson, B.B. and Ogorzaly, M.C. 1986. Economic Botany, Tata Macgray Hill Publishers
2. Kocchar, S.L. 2016. Economic Botany, Cambridge University Press, UK.
3. Khan Mahfooz Raza, Joseph, R.D., Smita Krishnarao. 2018. Industrial Botany, Success Publications.
4. Ravi Nath. 2024. Industrial Process Plants: Global Optimization of Utility Systems. De Gruyter.
5. Amit Kumar, Anubha Sharma, Upendra Kumar Balyan, Tejbir Singh Dhak. 2025. Economic Botany and Plant Genetic Resources. 1st Edition. Sharma Publisheres and Distributors.

WEB RESOURCES

1. https://www.bioconferences.org/articles/bioconf/pdf/2024/47/bioconf_pibidr2024_00001.pdf.
2. https://link.springer.com/journal/12231
3. https://visionpune.com/product/industrial-botany-i/?srsltid=AfmBOor%20kuX_Q764v25c9M2tOt8be7e_jKwuBeRV2UNc94Lb1HCHjS87
4. https://www.scribd.com/document/558756361/Unit-v-Economic-Botany-Notes
5. https://www.ncbi.nlm.nih.gov/books/NBK92773/

PBO81

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	S	H	S	H
CO2	S	M	S	M	M
CO3	H	S	M	S	H
CO4	S	S	H	S	H
CO5	S	M	M	H	H

S - Strong **H** - High **M** - Medium **L** – Low

Content Prepared by (Based on Inputs) Dr. R. Thirugnanasampandan Signature of the Course in-charge	Signature of the HOD

NON-MAJOR ELECTIVE PAPERS

PBO83

Programme Code: 05	M.Sc., BOTANY			
	NON-MAJOR ELECTIVE 1: HERBAL MEDICINE			
Batch **2026-2027**	**Hours / Week** **4**	**Total Hours** **60**	**Credits** **4**	**Skill Development**

COURSE OBJECTIVES

- To impart inherent knowledge on traditional system of herbal medicine
- To understand the history, scope and therapeutic aspects of medicinal plants
- To apply the gained knowledge and advice the community on issues concerning the cultivation, harvesting and processing of medicinal plants and their products.
- To classify crude drugs based on their morphological, taxonomical, chemical or pharmacological characters

COURSE OUTCOMES

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

K1 ↕ K5	CO1	Recollect indigenous knowledge on Indian systems of traditional medicine
	CO2	Provide therapeutic and pharmaceutical aspects of traditionally used medicinal plants
	CO3	Apply various methods of plant analysis for the exploitation of phytochemical constituents from plant sources
	CO4	Analyze cultivation and marketing strategies of medicinal plants
	CO5	Assess the potential applications of natural plant based drugs in pharmaceutical, nutraceutical and cosmeceutical industries

SYLLABUS

UNIT I **(12 HOURS)**

Medicinal Plants: History of medicinal plants – some important terms used in herbal medicine, Medico-ethnobotanical sources in India – Vrikshayurveda - Indian medicinal system - AYUSH (Ayurveda, Unani, Siddha and Homeopathy) and modern medicines (Chinese and Tibetan Medicines) - principles and diagnostic methods – Folk and Tribal Medical Practices - Ayurvedic medicinal benefits of Tulasi, Arjuna and Sandalwood.

UNIT II **(12 HOURS)**

Cultivation of Medicinal Plants: Medicinal plants in trade-cultivation practices and therapeutic and pharmaceutical uses of the following drugs; *Piper nigrum*, *Piper betle Azadirachta indica*, *Curcuma longa* and *Aloe vera*. Factors influencing the cultivation of medicinal plants. Herbal remedies for heart, respiratory, skin, cancer, immune and liver diseases - Nutraceuticals and cosmeceuticals.

UNIT III **(12 HOURS)**

Pharmacognosy: History, definition, scope and future. Source and classification of Natural drugs. Analytical Phamacognosy – methods of drug evaluation, biological testing of herbal drugs. Adulteration of drugs of natural origin. Plant drug quality control – significance, status and challenges. Potential plant derived drugs in market - Taxol, Camptothecin, Vincristine - source, morphology and properties

UNIT IV **(12 HOURS)**

Major plant primary and Secondary metabolites: Nature, classification, distribution, biosynthesis and functions of Carbohydrates, Lipids, Phenols, Flavonoids, Volatile oils, Terpenoids, Resins, Alkaloids and Steroids. Factors influencing production of secondary metabolites*.

UNIT V **(12 HOURS)**

Herbal Wealth: Intellectual Property Rights (IPR): Choice of IPR, Patents, Trade secrets, Trade mark, copyrights, GATT (General Agreement on Trariff and Trade) and its relevance to international trade, TRIPS (Trade Related Intellectual Property Rights) and PGR (Plant Genetic Resource). WTO- Herbal industry – Prospects and constraints, export and import status in Indian scenario.

***Self study**

TEXTBOOKS

1. Trease G.E. and W. C Evans (1983) Pharmocognosy, ELBS, Britain.
2. Biren Shah and Avinash Seth (2013).Textbook of Pharmacognosy and Phytochemistry. Elsevier India.
3. Suresh Narayana P, Varalakshmi D and Pullaiah T (2016). A Textbook of Pharmacognosy, CBS Publishers & Distributors Pvt Ltd, India.
4. Biren Shah and AK Seth. (2016). Textbook of Pharmacognosy and Phytochemistry, CBS Publishers & Distributors.
5. Purohit and Vyas. (2005). Medicinal plant cultivation- A scientific approach, Agrobios, Jodhpur.
6. John Jothi Prakash, E. (2004). Medicinal Botany and Pharmacognosy. JPR Publication, Vallioor

REFERENCE BOOKS

1. Hocking, G.M. (1955). A dictionary of terms used in Pharmacognosy, Spring Field.
2. Kokate C.K., A.P. Purohit, Gokhale S.B. (2008). Pharmacognosy, Nirali.
3. Handa, S S and V.K. Kapoor. (2014). Pharmacognosy, Vallabh Prakashan
4. Evans, WC (2019), Trease and Evans of Pharmacognosy
5. Kuntal Das, (2019). Pharmacognosy and Phytochemistry – I, Nirali Prakashan
6. Neeraj Kumar Sharma, Mona Kejariwal and Md. Rageeb Md. Usman. 2021. PV Publication, Jalandhar

WEB RESOURCES

1. https://www.slideshare.net/slideshow/indian-system-of-medicine-ayurveda-siddha-unani-and-homeopathy-system/278548858
2. https://www.rcfceast.org/wp-content/uploads/2019/02/Medicinal_Plants_in_India_An_Assessment_of_their_Demand_and_Supply.pdf
3. https://www.intechopen.com/chapters/1209007
4. https://www.davidpublisher.com/Public/uploads/Contribute/550924ffb662e.pdf
5. https://www.wto.org/english/tratop_e/trips_e/intel2_e.htm

PBO85

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	S	S	S	S
CO2	H	S	S	H	S
CO3	S	S	S	S	S
CO4	H	H	H	S	H
CO5	H	H	M	H	M

S - Strong **H** - High **M** - Medium **L** – Low

Content Prepared by (Based on Inputs) Dr. R. Rekka Signature of the Course in-charge	 Signature of the HoD

PBO86

Programme Code: 05	M.Sc., BOTANY			
	Non - Major Elective 2: APPLIED MICROBIOLOGY			
Batch 2026-2027	Hours / Week 4	Total Hours 60	Credits 4	Skill Development

COURSE OBJECTIVES

- To provide basic knowledge on the various applications of microorganisms
- To introduce the techniques involved in microbiology
- To assess the role of microorganisms in human welfare

COURSE OUTCOMES

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

K1 ↕ K5	CO1	Acquire knowledge on the fundamental aspects of microbiology.
	CO2	Understand the use of microbes in industries for the welfare of mankind.
	CO3	Apply knowledge on preservation of food and vegetables using suitable techniques and their commercial applications
	CO4	Grasp the knowledge on distribution of microbes in the environment and prevent their harmful effects.
	CO5	Predict the pathogenesis and control of disease causing microbes.

SYLLABUS

UNIT I **(12 HOURS)**

Fundamentals of Microbiology: Scope of microbiology - Culture of bacteria: Pure culture techniques - Culture media and preparation: solid and liquid - Preservation of cultures - Sterilization: principles, methods of sterilization-physical method and chemical method.

UNIT II **(12 HOURS)**

Industrial Microbiology: Fermentation - aerobic and anaerobic fermentation - production of microbial products - alcohol - lactic acid- penicillin - L-lysine- L-protease and riboflavin.

UNIT III **(12 HOURS)**

Food Microbiology: Microbial flora of fresh food – Botulism – Mycotoxins – food preservation methods – microbiology of milk and milk products (yoghurt and cheese) – fermented fruits and vegetables – single cell protein (*Spirulina* and *Chlorella*).

UNIT IV **(12 HOURS)**

Environmental Microbiology: Microbes in water, air and soil environment - interactions between microbes and plants: rhizosphere, phyllosphere, mycorrhizae– biodegradation of pesticides and pollutants in soil- role of microorganisms in sewage treatment*.

UNIT V **(12 HOURS)**

Medical Microbiology: Distribution and significance of normal human microbial flora. Infections- source of infections - Epidemiology of infectious diseases - microbial pathogens: Bacterial –*Salmonella typhii*, *Mycobacterium tuberculosis*; Viral - Dengue, SARS Virus-COVID-19; Fungal-*Candida*, *Aspergillus*

***Self study**

TEXTBOOKS

1. Michael J. Pelczar, E.C.S. Chan and Noel R. Krieg (2008), 'Microbiology' 5th edition, Tata McGraw-Hill Publishing Company Ltd, New Delhi.
2. Dubey, R.C. and D.K. Maheshwari (2005), A Text Book of Microbiology' S. Chand and Company Limited, New Delhi.
3. Prescott, L.M., Harley, J.P. and Klien, D.A. 1996. Microbiology (3rd ed.), Brown W.C. Publishers, Boston, USA.

REFERENCE BOOKS

1. Sullia, S.B. and Shantharam, S. 1998. General Microbiology, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Nduka Okafor, Benedict C. Okeke. 2017. Modern Industrial Microbiology and Biotechnology, CRC Press, New Delhi.
3. Apurba S. Sastry and Sandhya Bhat, 2019. Essentials of Medical Microbiology. Jaypee Brothers Medical Publishers (P) Ltd. New Delhi.
4. Sanjai Saxena. 2015. Applied Microbiology, Springer, New Delhi.

WEB RESOURCES

1. https://agrimoon.com/wp-content/uploads/Fundamentals-of-Microbiology.pdf
2. https://www.basu.org.in/wp-content/uploads/2020/03/Fundamentals-of-Microbiology-1.pdf
3. https://microbenotes.com/sterilization-physical-and-chemical-methods/
4. https://microbenotes.com/fermentation/
5. https://bcrti.co.in/digitallibrary/includeFolder/noticeFolder/21081007475737.pdf
6. https://www.vivekanandcollege.ac.in/uploads/dptmicrobiology/ebooks/food-microbiology-by-wc-frazier-.pdf
7. https://repository.poltekkes-kaltim.ac.id/1145/1/food-microbiology-3rd-ed.pdf
8. https://microbenotes.com/category/environmental-microbiology/
9. https://www.oficyna.pwr.edu.pl/wp-content/media/Ko%C5%82wzan-B.-Adamiak-W.-Grabas-K.-Pawe%C5%82czyk-A.-Introduction-to-environmental-microbiology.pdf
10. https://nursingcollege.mespune.in/wp-content/uploads/2023/04/The-Short-Textbook-of-Medical-Microbiology-Including-Parasitology-PDFDrive.com-.pdf

PBO88

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	S	M	S	S
CO2	S	S	H	M	H
CO3	S	H	H	H	M
CO4	S	H	M	H	S
CO5	S	H	M	H	H

S - Strong **H** - High **M** - Medium **L** – Low

Content Prepared by (Based on Inputs) Dr. K. Sowndhararajan Signature of the Course in-charge	Signature of the HoD

PBO89

Programme Code: 05	M.Sc., BOTANY			
	Non-Major Elective 3: LIMNOLOGY			
Batch 2026-2027	Hours / Week 4	Total Hours 60	Credits 4	Skill Development

COURSE OBJECTIVES

- To study morphological and anatomical characters of aquatic flora.
- To understand the significance of the diffused light for the planktons.
- To find the gross and net productivity in fresh water life forms.

COURSE OUTCOMES

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

K1 ↕ K5	CO1	Acquire knowledge on structural and functional aspects of freshwater ecosystem
	CO2	Understand the factors responsible for lotic and lentic ecosystems
	CO3	Implement knowledge on methods of conservation of fresh water bodies
	CO4	Apply inherent knowledge on various kinds of planktonic communities and their adaptations
	CO5	Compare various aspects of biomass efficiency and their productivity

SYLLABUS

UNIT I **(12 HOURS)**

Definition, facts of limnology - scope and importance of limnology, structure of freshwater aquatic system - lentic, lakes, - their distribution, origin and forms, morphology, physical, chemical and biological structure, watershed. Ponds - swamps and estuaries. Lotic - stream, springs and rivers - discharge, temperature, nutrient, biotic categories and drift.

UNIT II **(12 HOURS)**

Physical factors influencing lotic and lentic type of vegetation - light, heat, water movements. Chemical factors - O_2 and CO_2, Nitrogen, Phosphorus, other nutrients, alkalinity and pH.

UNIT III **(12 HOURS)**

Water pollution and eutrophication* - effluent water, - nature, treatment, and uses. Freshwater formation in India. Conservation and management of freshwater bodies.

UNIT IV **(12 HOURS)**

Planktonic communities - phyto and zoo planktons. Littoral communities - algae and zoo planktons, large plants, benthos formation organisms - knowledge of adaptations of the above mentioned formations.

UNIT V **(12 HOURS)**

Freshwater ecosystem - energy and production, community concept, diversity, community succession, food chains and bio-geochemical aspects of ecosystems, energy flow in ecosystem and community metabolism. Productivity - primary, biomass and efficiency of primary production, secondary production. Biomass and efficiency- gross and net productivity.

***Self study**

TEXT BOOKS

1. The text book of limnology. Cole. The C.V. Morby Company
2. Gerald A. Cole (1994). Textbook of Limnology. G.A. Publisher Waveland Press
3. Gerald A. Cole and Paul E. Weihe. Textbook of limnology. G.A. Publisher Waveland Press
4. Gerald A. Cole (2015). Text book of Limnology. CBS publisher
5. Simon Oakenfold. Textbook of Aquatic Ecology. Syrawood Publishing House
6. Rajiv Tyagi. Textbook of Hydrobiology. Discovery Publishing Pvt. Ltd.,

REFERENCE BOOKS

1. Ruttner Franz. (1954). Fundamentals of Limnology. University of Toronto Press.
2. Ruttner Franz. (1963). Fundamentals of Limnology. University of Toronto Press.
3. Charles R. Goldmen, Alexander, Jorne. (1994). Limnology. International students
4. Edition.
5. Wezel. Sauders. Limnology College Publishing Co
6. Jayashree Datta Munshi and Jyotiswarup Datta Munshi. (2015). Fundamentals of Limnology
7. Shaarad Srivastava. Understanding Limnology. Discovery Publishing Pvt. Ltd
8. Robert G. Wetzel and Gene E. Likens. (2000). Limnological Analysis.
9. Barnes R.S.K and K.H. Mann. Fundamentals of Aquatic Ecology. Blackwell Science Ltd

WEB RESOURCES

1. https://dpbck.ac.in/wp-content/uploads/2022/03/Aquatic-Biomes-Notes.pdf
2. https://www.slideshare.net/slideshow/fundamentals-of-ecology-and-its-importance/270954993
3. https://www.scribd.com/document/976570914/Introduction
4. file:///C:/Users/User/Downloads/Unit-9.pdf

PBO91

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	H	S	M	S
CO2	H	M	H	S	H
CO3	H	H	M	H	H
CO4	S	H	S	M	M
CO5	S	S	H	M	M

S - Strong **H** - High **M** - Medium **L** – Low

Content Prepared by (Based on Inputs) Dr. P. Sumathi Signature of the Course in-charge	Signature of the HoD

PBO92

Programme Code: 05	M.Sc., BOTANY			
	Non-Major Elective 4: ADVANCEMENTS IN INDUSTRY 4.0			
Batch 2026-2027	Hours / Week 4	Total Hours 60	Credits 4	Skill Development

COURSE OBJECTIVES

- Understand the biological systems and processes with the aid of communication and information technology tools.
- Familiarize with Machine Learning, Robotic Process Automation and Virtual Reality.
- Explore avenues for digitization and integration of information technology with plant biology.
- To prepare students for the 4th industrial revolution and to make them a part of industrial value chain.

COURSE OUTCOMES

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

K1 ↑	CO1	Exhibit skills in Machine Learning, Robotic Process Automation and Virtual Reality in solving biological problems.
↕	CO2	Demonstrate the use of Cloud Computing in different fields of plant biology
↕	CO3	Analyze critically various biological processes using technology based tools and resources
↕	CO4	Apply more efficiently the virtual reality and augmented reality into real life
↓ K5	CO5	Formulate methods to collect, analyze and store biological data (data bases).

SYLLABUS

UNIT I **(12 Hours)**

Machine Learning - Introduction – Definition – Types of Machine Learning – Supervised, Unsupervised, Reinforcement Learning – Algorithms for Machine Learning – Problems solved by Machine Learning - Tools for Machine Learning - Applications areas of Machine Learning

UNIT II **(12Hours)**

Robotic Process Automation (RPA): Introduction to RPA – Need for automation – Programming constructs in RPA – Robots and Softbots – RPA architecture and process methodologies - Industries best suited for RPA - Risks & Challenges with RPA

UNIT III **(12 Hours)**

Cloud Computing: Need – Definition – Types of Cloud - Types of Services – SaaS, PaaS, Iaas

UNIT IV **(12 Hours)**

Cyber Security : Cyber Crime and Information Security – Classification of Cyber Crimes - Types of Cyber Attacks - Cyber crime and Indian IT Act 2000 – Security Methods

UNIT V **(12 Hours)**

Virtual Reality: Definition – Types of Head Mounted Displays – Tools for Virtual Reality – Applications of VR in Education, Industries - Difference between VR and AR. Augmented Reality Augmented Reality: Definition - Tools for Augmented Reality – Hololens - Advantages and Challenges of AR - Applications of AR in Education, Industries - Mixed Reality

***Self- study questions for examination may be taken from the self-study portions also.**

TEXT BOOK

1. P. Kaliraj, T. Devi, Industry 4.0 and Education: Transformative Technology and Applications, 2022, CRC Press, Taylor & Francis Group
2. P. Kaliraj, T. Devi, Artificial Intelligence Theory, models and Applications, 2022, ISBN 9781032008097, CRC Press, Taylor & Francis Group
3. P. Kaliraj, T. Devi, Innovating with Augmented Reality: Applications in Education and Industry, 2022, ISBN 9781032008127, CRC Press, Taylor & Francis Group Curriculum 4.0 for incorporating Industry 4.0 tools in Higher Education 19
4. P. Kaliraj, T. Devi, Securing IoT in Industry 4.0 Applications with Blockchain, 2022, ISBN 9781032008103, CRC Press, Taylor & Francis Group

REFERENCE BOOKS

1. Bahga, A., Medisetti, V. 2014. Internet of Things: A Hands-On Approach. Universities Press, Hyderabad, India.
2. Bhuvaneswari, V., Devi, T. 2018. Big Data Analytics: Scitech Publisher, Chennai, India.
3. Soraya, S. 2018. Data Analytics and Big Data. John Wiley & Sons, Inc., Hoboken, USA.
4. Venkat, A. 2016. Big Data Analytics. Packt, Mumbai, India

WEB RESOURCES

1. https://www.geeksforgeeks.org/machine-learning/types-of-machine-learning/
2. https://www.scribd.com/document/863384464/RPA-Unit-1
3. https://www.rcet.org.in/uploads/academics/regulation2021/rohini_67300404426.pdf
4. https://mrcet.com/pdf/Lab%20Manuals/IT/CYBER%20SECURITY%20(R18A0521).pdf
5. https://www.coursera.org/articles/augmented-reality-vs-virtual-reality
6. Uipath Inc., https://www.uipath.com/rpa/robotic-process-automation
7. Uipath Inc., https://www.uipath.com/rpa/academy

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	H	S	M	S
CO2	H	M	H	S	H
CO3	H	H	M	H	H
CO4	S	H	S	M	M
CO5	S	S	H	M	M

S–Strong **H** –High **M**– Medium **L**–Low

Content Prepared by (Based on Inputs) Dr. K. Karthika Signature of the Course in-charge	Signature of the HoD

PBO94

26PGI4N2

Programme Code: 05		M.Sc., BOTANY			
		Non-Major Elective 5: FUNDAMENTALS OF INFORMATION SECURITY			
Batch 2026-2027	**Semester IV**	**Hours / Week 4**	**Total Hours 60**	**Credits 4**	**Skill Development**

COURSE OBJECTIVES

- To introduce the fundamentals of Information Security systems.
- To appraise on the concepts of Cryptography and security systems.
- To explore the nuances of vulnerable systems and their preventive methods.
- To sensitize the students on the current Cyber laws.

COURSE OUTCOMES

After Completion of the Course the student will be able to

K1	CO1	Comprehend the issues pertaining to Security at workplace.
↕	CO2	Establish methods of protecting data and data sets from attacks.
	CO3	Introduce a roboust data complaince model.
	CO4	Adopt novel methods of data/information protection through policies.
K5	CO5	Implement and appraise the existing Cyber Laws to appropriate Stakeholders.

SYLLABUS

UNIT I **(12 Hours)**

Information Security basics: Definition of Information Security - History of Information Security - Characteristics of Information Security - Components of Information Security -Types of Security -Security System Development Life Cycle (SDLC) - Threats, Vulnerabilities, and Risks - Types of Cyber Attacks. Information Security for technical administrators: Types of Servers (Web, Database, Application) - Server Hardening Techniques- Server Security – Network security- Social Media Security -Secure Software Development Practices- Security Testing and Evaluation

UNIT II **(12Hours)**

Cryptography: Basic concepts - plain text - Cipher text -Types of Cryptography - Substitution and Transposition Techniques - Classical Ciphers- Encryption Principles – CRYPT Analysis - Cryptographic Algorithms - Cryptographic Tools – Authentication -Biometrics* -passwords - Access Control Devices - Physical Security - Security and Personnel- Cryptanalysis. Language-based Security: Analysis of code for security errors, Safe language and sandboxing techniques- Language-Based Access Control - Modern Cryptography Trends- Secure Communication- Privacy & Data Protection.

UNIT III **(12 Hours)**

Firewalls, Viruses, Worms Digital Rights Management: Viruses and Worms- Worms - Digital Rights Management – Firewalls - Application and Circuit Proxies - Stateful Inspection - Design Principles of Firewalls - Malware Concepts- Ransomware Attacks- Intrusion Detection and Prevention Systems (IDS/IPS)- Virtual Private Networks (VPNs)- Security Policies and Standards. Logical Design: Access Control Devices- Physical Security- Security and Personnel - NIST Models-VISA

International Security Model- Design of Security Architecture-Planning for Continuity- Identity and Access Management (IAM) - Risk Management in Security Design- Security Monitoring and Logging- Compliance and Governance

UNIT IV **(12 Hours)**

Hacking: Introduction – Hacker Hierarchy – Password cracking – Phishing - Network Hacking - Wireless Hacking - Windows Hacking - Web Hacking*- Ethical Hacking - Foot printing and Reconnaissance - Vulnerability Assessment- Exploitation Techniques - Malware Analysis- Social Engineering. Security Investigation: Need for Security- Business Needs-Threats- Attacks- IP Addressing and Routing – Social Media - Digital Forensics- Log Analysis and Monitoring- Vulnerability Assessment and Penetration Testing- Cyber Laws and Ethics- Email and Communication Security- Mobile and Endpoint Security.

UNIT V **(12 Hours)**

Cyber Laws: What is Cyber Law? - Need for Cyber laws - Common Cyber Crimes and Applicable Legal Provisions: A Snapshot - Cyber Law (IT Law) in India – The Information Technology Act of India 2000 - Cyber Law and Punishments in India - Cyber Crime Prevention guide to users – Regulatory Authorities- Data Protection and Privacy Laws- Intellectual Property Rights (IPR) in Cyberspace- Electronic Contracts (E-Contracts)- International Cyber Laws- E-Commerce and Legal Issues- Emerging Trends in Cyber Law.

*** Self-study and questions for examinations may be taken from the self-study portions also.**

WORK BOOK:

Fundamentals of Information Security – prepared by Kongunadu Arts and Science College, Coimbatore -29.

REFERENCE BOOKS:

1 Charles P Pfleeger and Shai Lawrence Pfleeger, **"Security in Computing",** Fourth & Third Edition, Prentice Hall, 2007 & 2011.
2 Ross J. Anderson and Ross Anderson, "Security Engineering: A guide to building Dependable Distributed System", Wiley,2009.
3 Thomas R. Peltier, Justin Peltier and John Bleckley, "Information Security Fundamentals",2nd Edition, Prentice Hall 1996.
4 Gettier, Urs E. Information Security: Strategies for Understanding and Reducing Risks John Wiley & Sons, 2011.
5 "Principles of information security". Michael Whiteman and Herbert J. Mattord,2012.
6 Information security -Marie wright and John kakalik,2007.
7 Information security Fundamentals- Thomas R. Peltier, Justin Peltier and John Blackley-2005.
8 Information Security theory and practical PHI publication, Dhiren R. Patel-2008.
9 Debby Russell and Sr.G.T. Gangemi," computer Security Basics,2nd edition, O'Reilly Media,2006.

PBO96

Question Paper Pattern

Duration: 3 hrs. **Max: 75 marks**

Section - A (10×1=10)

Choose the correct answer

Section - B (5×5=25)

Short answer questions, either or type, one question from each unit.

Section - C (5× 8=40)

Essay answer questions, either or type, one question from each unit.

CIA EXAMINATION MARK BREAKUP

S. NO	DISTRIBUTION COMPONENT	MARKS
1.	CIA I – 75 Marks Converted to 30	**30**
2.	CIA II – 75 Marks Converted to 30	**30**
3.	Seminar / Objective Capacity Testing	**10**
4.	Seminar /Objective Capacity Testing	**10**
5.	Attendance	**05**
6.	Any Case Study related to Information Security (as a Group)	**15**
	Total	**100**

EXTRA DEPARTMENTAL COURSE (EDC)

PBO98

26PBO3X1

Programme Code: 05		**For PG STUDENTS**			
Extra Departmental Course (EDC) - APPLIED HORTICULTURE					
Batch	**Semester**	**Hours / Week**	**Total Hours**	**Credits**	**Entrepreneurship**
2026-2027	**III**	**2**	**30**	**2**	

COURSE OBJECTIVES

- To learn about the propagation methods of horticultural crops.
- To study about gardening, landscaping and their maintenance.
- To acquire knowledge on commercial floriculture and cut flower arrangements.

COURSE OUTCOMES

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

K1	CO1	Demonstrate solutions for a wide spectrum of plant health issues
↑	CO2	Understand the components and adornments of gardening
↕	CO3	Develop employability skills in the field of gardening and landscaping
↓	CO4	Analyze inherent knowledge on various nursery practices and their management systems
K5	CO5	Evaluate the concepts and principles of floriculture

SYLLABUS

UNIT I **(6 HOURS)**

Landscaping: Importance and scope of Landscape Architecture. Functional uses of plants for landscape and pollution control. Landscaping for specific areas (home garden, public parks, educational institutes).

UNIT II **(6 HOURS)**

Principles of Garden Designs: Styles of gardens - English, Italian, French, Persian, Mughal, Japanese gardens and its layout. Some Famous gardens of India.

UNIT III **(6 HOURS)**

Gardening: Definition, objectives and scope - different types of gardening - Special types of gardens (rock, water, terrace, vertical and terrarium).

UNIT IV **(6 HOURS)**

Nursery Management and Routine Garden Operations: Definition of a nursery. Different types of nursery beds – (flat beds, raised beds and sunken beds), their merits and demerits. Different nursery techniques and their management. Propagation Methods: Advantages and disadvantages*.

26PBO3X1

UNIT V **(6 HOURS)**

Cut flowers - Identification and selection of flowers and plant parts, value addition in cut flowers, flower arrangement, styles, Ikebana, morebana, free style, bouquets, flower baskets, garlands. Selection of containers and accessories for floral products and decorations. Dry flowers - Designing and arrangement

***Self study**

TEXTBOOKS

1. Kumar, N. (1999). An introduction to horticulture. Rajalakshmi Publication, Nagarcoil.
2. Chaha, K.L. (2001). Handbook of horticulture. ICAR, New Delhi.
3. Prasad, S., U.Kumar. (2013). A handbook of Floriculture. Agrobios, Jodhpur.
4. Bhattacharjee, S.K. (2006). Advances in Ornamental Horticulture -Pointer Publications, Jaipur.
5. Desh Beer Singh and Poonam Wazir. (2002). Bonsai-An Art. Scientific Publishers, Jodhpur

REFERENCE BOOKS

1. Bose, T.K., J. Kabir, P. Das and P.P. Joy. (2001). Tropical Horticulture. Naya Prakash Publications, Calcutta.
2. George Acquaach. (2003). Horticulture - Principles and practices.
3. Edwin Biles. (2003). The complete book of gardening. Biotech book, New Delhi.
4. Singh, S.P. (1999). Advances in Horticulture and Forestry - Scientific Publishers, Jodhpur.
5. Sharma, V.K. (2004). Advances in Horticulture: Strategies, Production, Plant Protection and Value Addition - Deep and Deep Publications, New Delhi.

WEB RESOURCES

1. https://sist.sathyabama.ac.in/sist_coursematerial/uploads/SAR1401.pdf
2. https://www.scribd.com/document/526226896/L-1-Scope-and-Importance-of-Landscaping-edited-converted
3. https://ymw.edu.in/wp-content/uploads/2020/04/Types-of-Gardens-Compatibility-Mode-pdf.pdf
4. http://eagri.org/eagri50/HORT281/lec34.html
5. https://ncert.nic.in/vocational/pdf/kegr102.pdf
6. https://agritech.tnau.ac.in/horticulture/horti_Landscaping_nursery%20management.html
7. https://agritech.tnau.ac.in/horticulture/horti_Landscaping_freshflower.html
8. https://www.britannica.com/art/floral-decoration/Forms-of-floral-decoration

PBO100

26PBO3X1

Question Paper Pattern

Duration: 3 hrs. **Max: 75 marks**

Section - A (10×1=10)

Choose the correct answer

Section - B (5×5=25)

Short answer questions, either or type, one question from each unit.

Section - C (5×8=40)

Essay answer questions, either or type, one question from each unit.

CIA EXAMINATION MARK BREAKUP

(For Theory Only)

S. NO	DISTRIBUTION COMPONENT	MARKS
1.	CIA I – 75 Marks Converted to 40	**40**
2.	CIA II – 75 Marks Converted to 40	**40**
3.	Seminar / Objective Capacity Testing	**05**
4.	Seminar /Objective Capacity Testing	**05**
5.	Attendance	**05**
6.	Others (Group Discussion, Flipped Class room, etc.,)	**05**
	Total	**100**

Content Prepared by (Based on Inputs) Dr. H. Abdul Kaffoor Signature of the Course in-charge	 Signature of the HoD

JOB ORIENTED COURSE PAPERS

PBO102

26PBO0J1

Programme Code: 05	**M.Sc., BOTANY**		
JOC 1: Floriculture and Landscaping			
Batch 2026-2027	**Hours / Week 4**	**Credits 2**	**Entrepreneurship**

COURSE OBJECTIVES

- To know the latest development in the field of floriculture.
- To develop skills on arena of floriculture and landscaping.
- To create knowledge on self employment through entrepreneur skills

COURSE OUTCOMES

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

K1 ↕ K5	CO1	Acquire knowledge on cultivation of economic flowers.
	CO2	Understand the techniques involved in flower arrangement and decoration.
	CO3	Apply knowledge on green house cultivation practices.
	CO4	Implement acquired knowledge on commercial applications of plants in landscape gardening.
	CO5	Demonstrate strategic plans for designing various types of gardens

SYLLABUS

UNIT I **(12 Hours)**

Floriculture - Global floriculture - Floriculture in India - Economic flowers - Rose, Jasmine, Crossandra, Chrysanthemum - Cultivation and uses.

UNIT II **(12 Hours)**

Cut flowers - Significance of cut flower industry in India* - Export - Flower arrangement and decoration - dehydrated flowers, foliage and floral craft.

UNIT III **(12 Hours)**

Green house cultivation of cut flowers -Green house technology - advantages - Green house cultivation of Orchids - Anthurium - Gerbera - Dahlia - Tuberosa - Gladioli.

UNIT IV **(12 Hours)**

Landscape gardening - important principles in layout a garden - Aboriculture - Shrubs and climbers - annual, biennial herbaceous perennials - Ornamental palms - Succulents and Cacti, Miniature Garden, and Computer aided designing (CAD) for outdoor and indoor scaping.

UNIT V **(12 Hours)**

Water garden, Rock garden, Roof garden, Vertical garden, Hydrophonics, Lawn, Bonsai - Horticultural shows.

***Self study**

26PBO0J1

TEXT BOOKS

1. Kumar, N. (1999). An introduction to horticulture. Rajalakshmi Publication, Nagarcoil.
2. T.K. Bose, R.G. Maity, R.S. Dhua and P.Das, (1999). Floriculture and Landscaping, Naya Prokash, Calcutta.
3. S. Prasad and U.Kumar. (2013). A handbook of Floriculture Agrobios (India).
4. Pooja. (2012). Handbook of Floriculture. Discovery Publishing Pvt. Ltd.
5. Alka Singh (2015). A Colour Handbook: Landscape Gardening. New India Publishing Agency

REFERENCE BOOKS

1. Doesh Beer Singh and Poonam Wazir, (2002). Bonsai - An art. Scientific Publishers, Jodhpur.
2. Roy Edwin Biles, (2003). The complete Book of Gardening. Biotech Books, Delhi
3. Bhattacharjee, S.K. (2006). Advances in Ornamental Horticulture. Pointer Publication, Jaipur.
4. P. Ranchana, M Kannan, S Vinodh. (2017). An Illustrated Dictionary of Floriculture and Landscaping. New India Publishing Agency.
5. Sachin Tyagi and Sanjay Sahay. (2019). Protected Cultivation of Flowers. New India Publishing Agency.
6. Anil K Singh, (2020). Text book of floriculture and landscaping. New India Publishing Agency.

WEB RESOURCES

1. https://www.slideshare.net/slideshow/introduction-to-floriculture-251884230/251884230
2. https://ncert.nic.in/vocational/pdf/kefc101.pdf
3. https://www.slideshare.net/slideshow/floral-craft-utilisation-of-flower/183283918
4. https://agritech.tnau.ac.in/horticulture/horti_Greenhouse%20cultivation.html

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	H	H	M	H
CO2	S	M	H	H	M
CO3	H	S	M	H	H
CO4	S	H	M	S	M
CO5	S	S	H	H	M

S - Strong **H** - High **M** - Medium **L** - Low

Content Prepared by (Based on Inputs) Dr. P. Sumathi Signature of the Course in-charge	 Signature of the HoD

PBO104

26PBO0J2

Programme Code: 05	**M.Sc., BOTANY**		
JOC 2: Food Processing and Preservation			
Batch	**Hours / Week**	**Credits**	**Entrepreneurship**
2026-2027	**4**	**2**	

COURSE OBJECTIVES

- To know the recent technologies developed in the field of food science
- To develop skills in the aspects of Food processing and preservation
- To get employment opportunities in food processing industries

COURSE OUTCOMES

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

K1 ↕ K5	CO1	Recognize about preliminary preparation of food through various processes
	CO2	Understand the nutritive values and significance of cereals
	CO3	Apply knowledge on pulses and nuts and their nutritive perspectives
	CO4	Implement food preservation techniques applicable for day to day life
	CO5	Evaluate strategies for the preservation of food products and their quality enhancement

SYLLABUS

UNIT I **(12 Hours)**

Food groups - Basic groups**:** basic Four, Five and Seven, food in relation to health. Preliminary preparation of food - cleaning, peeling, stinging, cutting and grafting, soaking, marinating, sprouting, fermenting, grinding, drying and filtering - their advantages and disadvantages.

UNIT II **(12 Hours)**

Cereals and cereal products, structure composition and nutritive value of cereals - wheat and wheat products, rice and its products; fermented and unfermented products.

UNIT III **(12 Hours)**

Pulses composition and nutritive value, toxic constituents, trypsin inhibitor, hemagglutinins, cyanogenic glucoside, saponins and tannins. Nutritive values of nuts and oil seeds, toxins - aflatoxins and gossypol. Fruits and Vegetables - classification, composition and nutritive values.

UNIT IV **(12 Hours)**

Milk and milk products, nutritive value of milk, processing - clarification, pasteurization and homogenization. Milk products - fermented milk products - butter, cheese and curd. Preparation of cheese. Non-fermented products - skimmed milk, dry milk, ice cream. Flesh foods - meat, fish and poultry - composition and nutritive values.

26PBO0J2

UNIT V **(12 Hours)**

Food preservation by high and low temperatures (outline). Preservation by high osmotic pressure, high concentration of sugar, jam and jelly preparation, high concentration of salts. Principles and preparation of pickles - preservation by dehydration*. Principles and methods of drying - freeze drying, sun drying, mechanical driers - spray drying and foam mat drying and by smoking.

***Self study**

TEXT BOOKS

1. Srilakshmi. B. (2003). Food Science, New Age International Publishers, New Delhi.
2. Frazier W.C. and Westhoff. D.C. (1978). Food Microbiology, Tata McGraw-Hill, Chennai.

REFERENCE BOOKS

1. Subbulakshmi, G. (2006). Food processing and preservation, New Age International Pvt Ltd Publishers.
2. Adams M.R. and Moss M.O. (2008). Food Microbiology, The Royal Society of Chemistry, Cambridge.
3. Swaminathan M.S. (1985). Essentials of food and nutrition, Bappco Publisher, Bangalore.

WEB RESOURCES

1. https://www.slideshare.net/slideshow/preliminary-preparationpptx/255921234
2. https://www.scribd.com/document/843306859/Cereals-and-Cereal-Products
3. https://www.slideshare.net/slideshow/vegetables-and-fruits-clssification-structure-composition-and-nutritive-value-pptx/286070396
4. http://www.eolss.net/sample-chapters/c10/e5-08-04-04.pdf

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	H	M	H	S
CO2	H	H	S	H	H
CO3	S	M	H	M	H
CO4	S	M	S	H	M
CO5	H	H	M	S	M

S - Strong **H** - High **M** - Medium **L** - Low

Content Prepared by (Based on Inputs) Dr. P. Sumathi Signature of the Course in-charge	Signature of the HoD