ST. MARY'S COLLEGE (AUTONOMOUS)
Re-accredited with A+ Grade by NAAC

Thoothukudi – 628001, Tamil Nadu

(Affiliated to Manonmaniam Sundaranar University)

Syllabus

B.Sc. Botany

School of Biological Sciences Outcome Based Curriculum

(w.e.f. 2024)

Programme Outcome

PO No.	After completion of the Undergraduate programme the students of St. Mary's College will be able to
PO 1	acquire an in-depth domain knowledge and a comprehensive knowledge of various disciplines to become skilled professionals
PO 2	enrich their communicative skills, and enhance their creative, numerical, analytical and problem-solving skills
PO 3	gain potential skills to excel in digital literacy, team management, scientific reasoning, research and self-directed life-long learning to emerge as entrepreneurs
PO 4	be aware of the environment with a social responsibility for the well-being of humanity and the planet at large
PO 5	be an empowered, economically independent woman with a global perspective to emerge holistically in the egalitarian society

Programme Specific Outcome:

PSO No.	Students of B.Sc. Botany will be able to	PO Matched
PSO-1	acquire a comprehensive understanding of diverse plant life by delving into their economic importance, life cycles, classification, morphology, anatomy, physiological functions, embryological processes, genetics and ecological contributions.	**PO1**
PSO-2	demonstrate essential skills in the identification of plants, cultivation practices, application of basic microbial techniques, proficiency with diverse instruments, understanding environmental laws and adeptness in clear and effective scientific communication	**PO2**
PSO-3	perform experiments in both field and laboratory contexts, utilizing analytical skills, interpretive abilities and effective writing to analyze and communicate research outcomes.	**PO3**
PSO-4	comprehend the interconnections between various branches of botany and other scientific disciplines. practice and demonstrate the techniques that ensure skill development and job option.	**PO3, PO4**
PSO-5	cultivate an awareness of the natural world and adopt a sense of social responsibility, applying acquired knowledge to contribute actively to environmental conservation as responsible citizens.	**PO5**

ST. MARY'S COLLEGE (AUTONOMOUS), THOOTHUKUDI
DEPARTMENT OF BOTANY
UG COURSE STRUCTURE (2024 - 2027)
SEMESTER – I

Part	Course	Course Code	Course Title	Contact Hours / Week	Credits	Max Marks		
						CIA	ESE	Total
I	Tamil / French	24ULTA11 24ULFA11	இக்கால இலக்கியம் : மரபுக்கவிதை, புதுக்கவிதை, இலக்கணம், இலக்கிய வரலாறு, சிறுகதை Fundamental French Course	6	3	40	60	100
II	General English	24UGEN11	English Poetry, Prose, Extensive Reading and Communicative English - I	6	3	40	60	100
III	Core **I**	24UBOC11	Algae, Bryophytes, Fungi and Lichens	6	5	40	60	100
	Core Practical **I**	24UBOCR1	Algae, Bryophytes, Fungi and Lichens Practical	2	2	40	60	100
	Generic Elective **I** (Allied)	24UZOE11	Diversity of Invertebrates and Chordates	4	4	40	60	100
	Elective Practical **I**	24UZOER1	Diversity of Invertebrates and Chordates	2	1	40	60	100
IV	Skill Enhancement Course **I** (Discipline Specific Course)	24UBOSE1	Herbal Drugs	2	2	20	30	50
	Ability Enhancement Course **I**	24UAVE11	Value Education	2	2	20	30	50
			Total	**30**	**22**			

SEMESTER – II

Part	Course	Course Code	Course Title	Contact Hours / Week	Credits	Max Marks		
						CIA	ESE	Total
I	Tamil / French	24ULTA21 24ULFA21	சமய இலக்கியங்கள்: செய்யுள், இலக்கணம், இலக்கிய வரலாறு, உரைநடை, வாழ்க்கை வரலாறு Proficient French Course	6	3	40	60	100
II	General English	24UGEN21	English Poetry, Prose, Extensive Reading and Communicative English – II	6	3	40	60	100
III	Core **II**	24UBOC21	Pteridophytes, Gymnosperms and Paleobotany	6	5	40	60	100
	Core Practical **II**	24UBOCR2	Pteridophytes, Gymnosperms and Paleobotany Practical	2	2	40	60	100
	Generic Elective **II** (Allied)	24UZOE21	Physiology, Developmental Zoology, Immunology and Genetics	4	4	40	60	100
	Elective Practical **II**	24UZOER2	Physiology, Developmental Zoology, Immunology and Genetics	2	1	40	60	100
IV	Skill Enhancement Course **II** (Discipline Specific Course)	24UBOSE2	Mushroom Cultivation	2	2	20	30	50
	Ability Enhancement Course **II**	24UAEV21	EVS	2	2	20	30	50
			Total	**30**	**22**			

SEMESTER III

Part	Compon-ents	Course Code	Course Title	Hrs/ Week	Credits	Max. Marks		
						CIA	ESE	Total
I	Tamil / French	24ULTA31 24ULFA31	காப்பிய இலக்கியங்கள் : பெருங்காப்பியம், சமயக் காப்பியம், இலக்கணம், இலக்கிய வரலாறு, புதினம் French Literature and Grammar I	6	3	40	60	100
II	General English	24UGEN31	English Poetry, Prose, Extensive Reading and Communicative English – III	6	3	40	60	100
III	Core **III**	24UBOC31	Taxonomy of Angiosperms	5	5	40	60	100
	Core Practical **III**	24UBOCR3	Taxonomy of Angiosperms Practical	2	2	40	60	100
	Generic Elective **III**	24UCHE32	Chemistry for Biological Sciences I	4	3	40	60	100
	Elective Practical **III**	24UCHER1	Chemistry Practical I	2	1	40	60	100
	Skill Enhancement Course **III** (Discipline Specific Course)	24UBOSE3	Plant Propagation Techniques	2	2	20	30	50
	NME **I**	24UBON31	Herbal Health Care Products	2	2	20	30	50
IV	Skill Enhancement Course **III** (Discipline Specific Course)	24UBOSE3	Plant Propagation Techniques	2	2	20	30	50
	Ability Enhancement Course **III**	24UAYM31	Yoga & Meditation	1	1	--	50	50
	Self-Study/ MOOC / Internship (Compulsory)	24UBOSS1	Food Processing Technology		+2			
Total				**30**	**22+2**			

SEMESTER IV

Part	Components	Course Code	Course Title	Hrs/ Week	Credits	Max. Marks		
						CIA	ESE	Total
I	Tamil / French	24ULTA41 24ULFA41	சங்க இலக்கியங்கள் : எட்டுத்தொகை, பத்துப்பாட்டு, இலக்கணம்,இலக்கிய வரலாறு, நாடகம் French Literature and Grammar II	6	3	40	60	100
II	General English	24UGEN41	English Poetry, Prose, Extensive Reading and Communicative English - IV	6	3	40	60	100
III	Core **IV**	24UBOC41	Biochemistry	5	5	40	60	100
	Core Practical **IV**	24UBOCR4	Biochemistry Practical	2	2	40	60	100
	Generic Elective **IV**	24UCHE42	Chemistry for Biological Sciences II	4	3	40	60	100
	Elective Practical **IV**	24UCHER2	Chemistry Practical II	2	1	40	60	100
	NME **II**	24UBON41	Horticulture	2	2	20	30	50
IV	Skill Enhancement Course **IV** (Discipline Specific Course)	24UBOSE4	Biofertilizer and Biocontrol Agents	2	2	20	30	50
	Ability Enhancement Course **IV** (Entrepreneurial Based)	24UBOA41	Value added Products from Plants	1	1	--	50	50
V	NCC / NSS / Sports				1			
	CDP/Extension Activity				+1			
Total				**30**	**23+1**			

SEMESTER V

Part	Components	Course Code	Course Title	Hrs/ Week	Credits	Max. Marks		
						CIA	ESE	Total
III	Core **V**	24UBOC51	Marine Biology	4	4	40	60	100
	Core **VI**	24UBOC52	Anatomy and Embryology	4	4	40	60	100
	Core **VII**	24UBOC53	Cell Biology and Genetics	4	4	40	60	100
	Core **VIII**	24UBOC54	Microbiology and Plant Pathology	4	4	40	60	100
	Core Practical **V**	24UBOCR5	Marine Biology, Anatomy and Embryology Practical	4	2	40	60	100
	Core Practical **VI**	24UBOCR6	Cell Biology, Genetics, Microbiology and Plant Pathology Practical	4	2	40	60	100
	Discipline Specific Elective *I* (Provide two choices with full Syllabus)	24UBOE51 24UBOE52	Molecular Biology Ethnobotany	4	4	40	60	100
IV	Skill Enhancement Course **V**	24UBOSE5	Biological Techniques	2	1	20	30	50
	Self-Study / Online Course / Internship (Optional)	24UBOSS2	Botany for Competitive Exam		+2		50	50
				30	**25+2**			

SEMESTER VI

Part	Components	Course Code	Course Title	Hrs/ Week	Credits	Max. Marks		
						CIA	ESE	Total
III	Core **IX**	24UBOC61	Plant Physiology	5	5	40	60	100
	Core **X**	24UBOC62	Ecology and Phytogeography	5	5	40	60	100
	Core **XI**	24UBOC63	Biotechnology	5	5	40	60	100
	Core Practical **VII**	24UBOCR7	Plant Physiology Practical	2	1	40	60	100
	Core Practical **VIII**	24UBOCR8	Ecology and Phytogeography and Biotechnology Practical	4	2	40	60	100
	Core **XII**	24UBOP61	Project	5	4	40	60	100
	Discipline Specific Elective **II** (Provide two choices with full Syllabus)	24UBOE61 24UBOE62	Basics of Bioinformatics Entrepreneurial Botany	4	4	40	60	100
				30	**26**			

SEMESTER I			
CORE I - ALGAE, BRYOPHYTES, FUNGI AND LICHENS			
Course Code: 24UBOC11	**Hrs / Week: 6**	**Hrs / Sem: 90**	**Credits: 5**

COURSE OBJECTIVE

To understand the major groups of lower plants and their characteristics and to study the effective utilization of algae, fungi, lichens and bryophytes for the environment and human well being

COURSE OUTCOMES

CO	On completion of this course, students will	PO
CO1	relate to the structural organization, reproduction and significance of algae, bryophytes, fungi and lichens	**K1**
CO2	demonstrate the knowledge in understanding the various life cycle patterns, fundamental concepts in thallophytes	**K2**
CO3	explain the importance of existence of algae, bryophytes, fungi and lichens on the ecosystem.	**K3**
CO4	compare and contrast the thallus organization and modes of reproduction among thallophytes.	**K4**
CO5	recommend the knowledge acquired for self-employability	**K5**

SEMESTER I			
CORE I - ALGAE, BRYOPHYTES, FUNGI AND LICHENS			
Course Code: 24UBOC11	**Hrs / Week: 6**	**Hrs / Sem: 90**	**Credits: 5**

UNIT I **Algae**: Introduction, brief history of Algae, classification of algae based on Fritsch (1945), Habitat. General characteristics of algae, range of thallus organization, Methods of reproduction: vegetative, asexual and sexual, life cycle patterns, alternation of generation in algae. Algal cytology – cell wall, cytoplasm (algal pigments, reserve food materials), flagella and nucleus. Economic importance of algae.

UNIT II **Type Study:** Systematic position, structure, reproduction and life cycle of *Oscillatoria, Volvox, Caulerpa, Vaucheria, Sargassum* and *Gracilaria*.

UNIT III **Bryophytes:** General characteristics of Bryophytes, affinities between algae and bryophytes. Classification of Bryophytes by Rothmaler (1951). **Type Study:** Systematic position, structure, reproduction and life cycle of *Riccia*, *Marchantia* and *Polytrichum.* Economic importance of Bryophytes.

UNIT IV **Fungi:** General Characteristics and mode of nutrition in fungi, Classification of fungi based on Alexopoulus and Mims (1979). **Type Study:** systematic position, structure, reproduction and life cycle of *Albugo, Aspergillus, Peziza,* and *Polyporous*. Heterothallism and para sexuality in fungi. Economic importance of fungi

UNITV V **Lichens:** Classification of lichen based on habit, habitat, anatomy, nature of partners. Vegetative propagules: isidia, soredia, cyphellae, cephalodia. **Type Study:** systematic position, structure and reproduction of *Parmelia* and *Usnea*. Economic and ecological significance of lichens.

Text Books

1. Pandey, S. N., & Trivedi, P. S. (2006). *A Text Book of Botany* Vol. I and II. New Delhi: Vikas Publishing House Pvt. Ltd.
2. Sharma, O. P. (2006). *Text Book of Algae.* NewDelhi: Tata Mc.Graw-Hall Publications.
3. Johri, R. M., Lata, S., & Tyagi, K. (2011). *A Text Book of Fungi*, Dominant Publishers and Distributors Pvt. Ltd., New Delhi
4. Singh,V., Pandey, P. C., & Jain, D. K. (2002). *A Text Book of Botany*. Meerut: Rastogi Publication.

Books for Reference

1. Fritsch, F. E. (1972). *The Structure and Reproduction of Algae*. London: Vol.I all II. Cambridge Univeristy Press.
2. Kamat, N. D. (1982). *Topics in Algae*. Aurangabad:SaiKraipaPrakasham.
3. Parihar, N. S. (1967). *Bryophyta*. Allahabad: Central Book Depot Publications in Botany.
4. Lee, R. E. (2009). *Phycology*: Cambridge University Press.
5. Vashishta, B. R, Sinha, A.K., & Singh, V. P. (2007). *Algae*. New Delhi: S. Chand and Co. Ltd.
6. Vashishta, B. R., Sinha, A. K., & Singh, V. P. (2006). *Bryophyta*: NewDelhi: S. Chand and Co. Ltd.
7. Ahmadjian, V., & Hale, M. E. (1973). *The lichens.* London:AcademicPress.
8. Alexpoulous, C. J., Mims, C. W., & Blackwell, M. (1988). *Introductory Mycology.* NewDelhi: Wiley Eastern Limited.
9. Dubey, H. C. (2005). *An introduction of fungi.* NewDelhi:Vikas Publishing House.

MAPPING WITH PROGRAMME OUTCOMES:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3	3	3	3	3	3
CO2	3	2	2	2	2	3	2	2	2	3
CO3	3	3	3	3	3	3	3	3	3	2
CO4	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3
Avg	3	2.8	2.8	2.8	2.8	3	2.8	2.8	2.8	2.8

S-Strong (3) **M-Medium (2)** **L-Low (1)**

SEMESTER I			
CORE PRACTICAL I - ALGAE, BRYOPHYTES, FUNGI AND LICHENS PRACTICAL			
Course Code: 24UBOCR1	**Hrs / Week: 2**	**Hrs / Semester: 30**	**Credits: 2**

COURSE OBJECTIVE

To develop skills to identify algae, bryophytes and lichens based on habitat, thallus structure and the internal organization.

COURSE OUTCOME

CO	On completion of this course, the students will be able to	PO
CO1	recall and identify algae, bryophytes, fungi and lichens by using key identification characters.	**K1**
CO2	illustrate the internal structure of algae, bryophytes, fungi and lichens prescribed in the syllabus.	**K2**
CO3	demonstrate the practical skills in micro preparation of algae, bryophytes, fungi and lichens	**K3**
CO4	examine the major morphological and anatomical difference between the thallophytes	**K4**
CO5	evaluate the relationship between the morphological and anatomical features of the thallophytes.	**K5**

SEMESTER I			
CORE PRACTICAL I - ALGAE, BRYOPHYTES, FUNGI AND LICHENS PRACTICAL			
Course Code: 24UBOCR1	**Hrs/Week: 2**	**Hrs/Semester: 30**	**Credits: 2**

- Micropreparation and evaluation of

  Algae: *Oscillatoria, Volvox*, Diatoms, *Vaucheria, Caulerpa, Sargassum, Stocheospermum, Acanthophora, Gracilaria*

  Bryophytes: *Riccia, Marchantia* and *Polytrichum*

  Fungi: *Albugo, Aspergillus, Peziza* and *Polyporous*.

  Lichens: *Parmelia*

- Identification of microscopic algae from the algal mixture
- Identification of microscopic fungi from the mixed culture
- Field visit: No. of days: 2 (Collection of seaweeds and bryophytes)

  Submission: Record note book

Reference

1. Chmielewski, J.G., & Krayesky, D. (2013). *General Botany Laboratory Manual*. Author House, Bloomington, USA.
2. Gangulee, H.C., & Kar. A. K. (2013). College Botany. Vth Edition. S. Chand.
3. Kumar, H. D. (1999). *Introductory Phycology*. Affiliated East-West Press, Delhi.
4. Sharma, O. P. (2017). *Bryophyta*, MacMillan India Ltd, New Delhi.
5. Webster, J., & Weber, R. (2007). *Introduction to Fungi*, 3rd Ed. Cambridge University Press, Cambridge.

MAPPING WITH PROGRAMME OUTCOMES:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	2	2	3	3	3	3	3
CO2	3	2	2	3	3	3	2	2	2	3
CO3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	2
Avg	3	2.8	2.8	2.8	2.8	3	2.8	2.8	2.8	2.8

S-Strong (3) **M-Medium (2)** **L-Low (1)**

SEMESTER I			
SKILL ENHANCEMENT COURSE I - HERBAL DRUGS			
Course Code: 24UBOSE1	**Hrs / Week: 2**	**Hrs / Semester: 30**	**Credits: 2**

COURSE OBJECTIVE

To understand the nuances of medicinal plants and their phytoconstituents of commercial value and to develop the skill to prepare value added products using herbs.

COURSE OUTCOMES

CO	On completion of this course, the students will be able to:	PO
CO1	remember the foundational concepts of the historical use of plants in herbal medicine.	**K1**
CO2	understand the pharmacological properties of herbal medicines.	**K2**
CO3	apply techniques for determining the appropriate use of herbal medicines for various health conditions	**K3**
CO4	assess the efficacy of different herbal remedies.	**K4**
CO5	evaluate the potential benefits and limitations of herbal medicines in the modern therapeutic context.	**K5, K6**

SEMESTER I			
SKILL ENHANCEMENT COURSE I - HERBAL DRUGS			
Course Code: 24UBOSE1	**Hrs / Week:2**	**Hrs / Semester:30**	**Credits:2**

UNIT I History, definition and scope of pharmacognosy. Indian system of medicines: Siddha, Ayurveda and Unani. Crude drugs: Definition and classification of crude drugs (morphological, taxonomic, therapeutic and chemical).

UNIT II Botanical name, family, useful part and medicinal uses of Root drugs: *Rauwolfia serpentina, Asparagus racemosus, Vetiveria zizananoides*. Rhizomes: *Zingiber officinale, Curcuma longa, Acorus calamus*. Woods: *Santalum album, Azadirachta indica, Pterocarpus santalinus.* Bark: *Terminalia arjuna, Saraca asoca, Cinnamomum zeylanicum.*

UNIT III Botanical name, family, useful part and medicinal uses of leaves: *Aloe vera, Justicia adhatoda, Ocimum tenuiflorum*. Flowers: *Syzygium aromaticum, Crocus sativus, Hibiscus rosa-sinenesis.* Fruits: *Coriandrum sativum, Phyllanthus emblica, Piper nigrum*. Seed: *Elettaria cardamomum, Trigonella foenum-graecum, Terminalia chebula.* Entire plant: *Phyllanthus amarus, Bacopa monnieri, Catharanthus roseus.*

UNIT IV Poisonous plants: Types of plant poison, action of poisons, treatment for poisons, some poisonous plants and their toxicity and action. Adulteration of crude drugs and its detection, methods of adulteration. Medicinal plants of export values. Medicinal uses of non-flowering plants.

UNIT V Preparation of herbal products: bath powder, toothpowder, shampoo, rose water, tea, cough syrup. Herbal remedies for common diseases: cold, fever, constipation.

Textbook

1. Roseline, A. (2011). *Pharmacognosy*. Chennai: MJP Publishers.

Books for Reference

1. Agarwal, O. P. (1985). *Chemistry of Organic – Natural Products* (Vol. II). New Delhi, India: S Chand & Company.

2. Chopra, R. N., Badhuvar, R. L., & Gosh, G. (1965). *Poisonous Plants in India*.
3. Chopra, R. N., Chopra, I. C., Handa, K. L., & Kapur, L. D. (1994). *Indigenous Drugs of India*.
4. Chopra, R. N., Nagar, S. L., & Chopra, I. C. (1956). *Glossary of Indian Medicinal Plants*.
5. Gokhale, S. B., Kokate, C. K., & Purohit, A. P. (2004). *A Textbook of Pharmacognosy*. Pune, India: Nirali Prakashan.
6. Jains, S. K. (1996). *Medicinal Plants*. New Delhi, India: Deep Publications.
7. John Jothi Prakasj, E. (2001). *Medicinal and Aromatic Plants*. Vallioor, India: JPR Publication.
8. Kumar, N. C. (2004). *An Introduction to Medical Botany and Pharmacognosy*. New Delhi, India: Emkay Publication.
9. Miller, L., & Miller, B. (2017). *Ayurveda & Aromatherapy: The Earth Essential Guide to Ancient Wisdom and Modern Healing* (4th ed.). Motilal Banarsidass.
10. Nair, N. C., & Henrry, A. N. (1983). *Flora of Tamil Nadu, India*. Botanical Survey of India.
11. Patri, F., & Silano, V. (2002). *Plants in Cosmetics: Plants and Plant Preparations Used as Ingredients for Cosmetic Products* (Vol. 1). ISBN 978-92-871-8474-0.
12. Somasundaram, S. (1997). *Medicinal Botany (MaruthuvarThavaraviyal)* [Tamil Medium Book].
13. Srivastava, A. K. (2006). *Medicinal Plants*. Dehradun, India: International Book Distributors.
14. Wallis, T. E. (1967). *Textbooks of Pharmacognosy*. London, UK: J. & A. Churchill Ltd.

MAPPING WITH PROGRAMME OUTCOMES:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3	3	3	3	3	2
CO2	3	3	3	3	3	3	3	3	3	3
CO3	3	2	3	2	3	3	2	3	2	3
CO4	3	3	2	3	3	3	3	3	3	3
CO5	2	3	3	3	3	3	3	3	3	3
Avg	2.8	2.8	2.8	2.8	3	3	2.8	3	2.8	2.8

S-Strong (3) **M-Medium (2)** **L-Low(1)**

SEMESTER II			
CORE II - PTERIDOPHYTES, GYMNOSPERMS AND PALEOBOTANY			
Course Code: 24UBOC21	**Hrs / Week: 6**	**Hrs / Semester: 90**	**Credits: 5**

COURSE OBJECTIVES

1. To identify and classify various species of pteridophytes and gymnosperms, comprehending their morphological, anatomical, and reproductive diversity
2. To investigate the paleoecology of ancient plant communities through the study of paleobotany, emphasizing their role in past ecosystems.

COURSE OUTCOMES

CO. No.	Upon completion of this course, students will be able to	PO
CO1	recall the classification, structure and economic importance of pteridophytes and gymnosperms	K1
CO2	discuss the life cycle pattern of pteridophytes and gymnosperms and their importance in paleobotany	K2
CO3	compile the methods of fossilization of pteridophytes and gymnosperms	K3
CO4	analyze the affinities of gymnosperms with pteridophytes and gymnosperms along with their fossils	K4
CO5	evaluate the interdependence of plants' life cycle	K5

SEMESTER II			
CORE II - PTERIDOPHYTES, GYMNOSPERMS AND PALEOBOTANY			
Course Code: 24UBOC21	**Hrs / Week: 6**	**Hrs / Semester: 90**	**Credits: 5**

UNIT I **Pteridophytes:** General characteristics, origin and evolution. **Classification of pteridophytes:** Pteridophyte Phylogeny Group (PPG) by Erics (2016) (up to order level). Stelar Evolution, Heterospory and seed habit, Life cycle pattern in homosporous and heterosporous pteridophytes, abnormalities in life cycle (apogamy and apospory), Economic importance.

UNIT II Systematic position, structure (external and internal), reproduction, types of gametophytes and life cycle of *Lycopodium*, *Selaginella* and *Equisetum* (Developmental details not required).

UNIT III Systematic position, structure (external and internal), reproduction, types of gametophytes and life cycle of *Gleichenia*, *Marsilea* and *Salvinia* (Developmental details not required).

UNIT IV Gymnosperms: General characteristics, classification of gymnosperms by Sporne (1965) (up to family level), Affinities of gymnosperms with angiosperms and pteridophytes. Systematic position, structure (external and internal), reproduction and life cycle of *Cycas*, *Pinus* and *Gnetum.* (Developmental details not required)

UNIT V Paleobotany: Geological time scale, fossilization and fossil types. General characters of fossil pteridophytes: *Rhynia* and *Calamites*. Fossil gymnosperms: *Lyginopteris* and *Williamsonia.*

Textbooks

1. Vashishta, P. C., Sinha, A. K., & Anil Kumar. (2007). *Botany for Degree Students – Pteridophyte*. New Delhi: S. Chand & Co.
2. Vashishta, P. C., Sinha, A. K., & Anil Kumar. (2007). *Botany for Degree Students - Gymnosperms*. New Delhi: S. Chand & Co.

Books for Reference

1. Pandey, S. N., Trivedi, P. S., & Misra, S. P. (2006). *A Textbook of Botany Vol. II*. New Delhi: Vikas Publishing House Pvt. Ltd.
2. Parihar, N. S. (1967). *An Introduction to Embryophyta, Pteridophyta*. Allahabad: Central Book Depot Publications in Botany.
3. Rashid, A. (1985). *An Introduction to Pteridophyta.* New Delhi: Vani Educational Books, Vikas Publishing House Pvt. Ltd.
4. Shukla, A. C., & Misra, S. P. (1982). Essentials of Paleobotany. New Delhi: Vikas Publishing House Pvt. Ltd.

MAPPING WITH PROGRAMME OUTCOMES:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	2	3	3	3	3	3
CO2	3	3	2	2	3	2	2	3	3	3
CO3	3	3	3	3	3	3	3	2	3	3
CO4	2	3	3	3	3	3	3	3	2	2
CO5	2	2	3	3	3	3	3	3	3	3
Avg	2.6	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8

S - Strong (3) **M - Medium (2)** **L - Low (1)**

SEMESTER II			
CORE PRACTICAL II - PTERIDOPHYTES, GYMNOSPERMS AND PALEOBOTANY PRACTICAL			
Course Code: 24UBOCR2	**Hrs / Week: 2**	**Hrs / Semester: 30**	**Credits: 2**

COURSE OBJECTIVE

To develop practical skills in the identification, classification, and hands-on study of pteridophytes, gymnosperms, and paleobotanical specimens

COURSE OUTCOMES

CO. No.	Upon completion of this course, students will be able to	PO
CO1	recall the morphology and identification of pteridophytes and gymnosperms	K1
CO2	discuss the internal structure and identification of different stellar structure in pteridophytes	K2
CO3	compile the internal structure variations in gymnosperms	K3
CO4	analyse the variation in the spore producing organs in pteridophytes and gymnosperms	K4
CO5	evaluate the fossil specimens	K5

SEMESTER II			
CORE PRACTICAL II - PTERIDOPHYTES, GYMNOSPERMS AND PALEOBOTANY PRACTICAL			
Course Code: 24UBOCR2	**Hrs / Week: 2**	**Hrs / Semester: 30**	**Credits: 2**

Pteridophytes:

1. *Lycopodium* - Habit, T.S. of stem
   Permanent slide: L.S. of cone
2. *Selaginella* - Habit, T. S. of rhizophore, stem
   Permanent slide: L.S. of cone
3. *Equisetum* - Habit, T. S. of node, internode
   Permanent slide: L.S. of cone
4. *Gleichenia* - Habit, T. S. of rhizome, petiole and pinnule
5. *Marsilea* - T. S. of rhizome, petiole
   Permanent slide: V. S. of sporocarp
6. *Salvinia* - Habit, T. S. of stolon
   Permanent slide: L.S. of sporocarp

Gymnosperms:

1. *Cycas* - Habit, T.S. of coralloid root, rachis and leaflet
   Permanent slide: L.S. of microsporophyll, Male cone and female cone (entire)
2. *Pinus* - Habit, T. S. of young stem, needle
   Permanent slide:
3. *Gnetum* - Habit, T.S. of stem and leaf
   Permanent slide: L.S. of male cone and female cone, Wood showing anomalous secondary thickening and seed (entire)

Paleobotany:

1. Pteridophytes - Permanent slides of *Rhynia* and *Calamites*
2. Gymnosperms - Permanent slides of *Lyginopteris* and *Williamsonia.*
   - Submission of record

References

1. Bendre, A. M., & Kumar, A. (2009). *A Text Book of Practical Botany Volume 1*. Meerut: Rastogi Publications.
2. Srivastava, H. N. (1987). *Practical Botany Volume 1*. Jalandhar: Pradeep Publications.

MAPPING WITH PROGRAMME OUTCOMES:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	2	3	3	3	3	3
CO2	3	3	3	2	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	2	2	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	2	2	2
Avg	3	3	2.8	2.6	2.8	3	3	2.8	2.8	2.8

S - Strong (3) **M - Medium (2)** **L - Low (1)**

SEMESTER II			
SKILL ENHANCEMENT COURSE II - MUSHROOM CULTIVATION			
Course Code: 24UBOSE2	**Hrs / Week: 2**	**Hrs / Semester: 30**	**Credits: 2**

COURSE OBJECTIVE

To understand and appreciate the role of mushrooms in nutrition, medicine, health and its cultivation

COURSE OUTCOMES

CO. No.	Upon completion of this course, students will be able to	Programme outcomes
CO1	recall the life cycle of edible mushrooms	**K1**
CO2	explain about different steps involved in the cultivation of mushroom	**K2**
CO3	apply various techniques studied in the storage of mushroom.	**K3**
CO4	examine the diseases and pest factors and economic value associated with mushroom cultivation	**K4**
CO5	estimate and construct mushroom cultivation chamber and cultivation of edible mushrooms	**K5 & K6**

SEMESTER II			
SKILL ENHANCEMENT COURSE II - MUSHROOM CULTIVATION			
Course Code: 24UBOSE2	**Hrs / Week: 2**	**Hrs / Semester: 30**	**Credits: 2**

UNIT I **Introduction:** History of mushroom cultivation, present status of mushroom industry in India. Morphology, nutritive value and uses of mushroom. Identification of edible and poisonous mushroom. Life cycle of *Pleurotus spp.*

UNIT II **Cultivation of mushroom:** Mushroom farm location and layout, factors affecting mushroom cultivation. **Steps in mushroom cultivation**: Selection and sterilization of substrate, spawning (types, production, preparation of mother spawn, storage and transit), incubation.

UNIT III Common problems during processing of mushroom cultivation, harvesting and post harvesting. **Preservation of mushroom:** Short term storage, long term storage (canning and drying), marketing.

UNIT IV **Diseases management of mushroom: Fungal diseases:** Dry bubble or brown spot disease, wet bubble, green mould, Mildew of cobweb disease. **Bacterial diseases:** Bacterial pit, bacterial blotch or brown blotch. **Insect Pests:** Sciarid flies, Phorids, mites, nematodes.

UNIT V **Hands on training and Field work:** Cultivation of White button mushroom, oyster mushroom and paddy straw mushroom. **Mushroom recipes:** Creamy mushroom soup, mushroom souffle, mushroom pulao, stuffed mushroom, mushroom samosa and mushroom pickles. **S**ymptoms and treatment of mushroom allergy.

Textbooks

1. Pandey, R. K., & Ghosh, S. K. (1999). *A handbook on mushroom cultivation*. Delhi: Emkay Publications.
2. Pathak, V. N., Nagendra Yadav, & Maneesha Gaur. (2000). *Mushroom Production and Processing technology*. Jodhpur: Agrobios.
3. Bahl, N. (1988). *Handbook on Mushroom*. New Delhi: Oxford and IBH Publishing Co. Pvt. Ltd.

Books for Reference

1. *Handbook of Mushroom Cultivation.* (1999). TNAU publication.
2. Marimuthu, T., Krishnamoorthy, A.S., Sivaprakasam, K. and Jayarajan. R. (1991). *Oyster Mushrooms*, Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore.
3. Swaminathan, M. (1990). *Food and Nutrition*. Bappco, The Bangalore Printing and Publishing Co. Ltd., No. 88, Mysore Road, Bangalore - 560018.
4. Nita Bahl. (2002). *Handbook on Mushroom 4th edition*. Vijayprimlani for oxford & IBH publishing co., Pvt., Ltd., New Delhi.

MAPPING WITH PROGRAMME OUTCOMES:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	2	3	3	3	3	3
CO2	3	3	2	2	3	2	2	3	3	3
CO3	3	3	3	3	3	3	3	2	3	3
CO4	2	3	3	3	3	3	3	3	2	2
CO5	3	2	3	3	3	3	3	3	3	3
Avg	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8

S-Strong (3) **M-Medium (2)** **L-Low (1)**