POOMPUHAR COLLEGE (AUTONOMOUS)

Of the Tamilnadu HR & CE Admn., Dept.

(Accredited B^+ By NAAC)

MELAIYUR - 609 107

***

Plant Biology & Plant Biotechnology

DEPARTMENT OF BOTANY

(Plant Biology & Plant Biotechnology)

2023 – 2024

DEPARTMENT OF BOTANY

POOMPUHAR COLLEGE (AUTONOMOUS) MELAIYUR

COURSE STRUCTURE

FOR UG COURSE - 2023 – 2024

Plant Biology and Plant Biotechnology

Semester	Subject	Hours	Credit	Exam	Marks		Total
					Intn.	Extn.	
I	**Tamil I**	5	3	3	25	75	100
	English I	5	3	3	25	75	100
	First Allied I (Zoology)	5	3	3	25	75	100
	First Allied Prac.- II	3	-	-	-	-	-
	Core course 1	5	5	3	25	75	100
	Core course- II	3	-	-	-	-	-
	Value education	2	1	3	25	75	100
	Gender studies	2	1	3	25	75	100
		30	16				
II	**Tamil- II**	5	3	3	25	75	100
	English - II	5	3	3	25	75	100
	First Allied- Practical II	3	3	3	40	60	100
	First Allied -III	5	4	3	25	75	100
	Core course -II Practical -1	3	3	3	40	60	100
	SBE- I	2	2	3	25	75	100
	Environmental studies	2	1	3	25	75	100
	Core course-3	5	5	3	25	75	100
		30	24				

POOMPUHAR COLLEGE (AUTONOMOUS), MELAIYUR

COURSE STRUCTURE FOR ALL UG DEGREE COURSES

(Applicable to the candidates admitted from the academic year 2022 – 2023 onwards)

PART	NAME OF THE PAPERS	NUMBER OF PAPERS	CREDITS
I	TAMIL	04	12
II	ENGLISH	04	12
III	CORE (INCLUDING OPTIONAL)	21	78
	FIRST ALLIED	03	10
	SECOND ALLIED	03	10
IV	NON-MAJOR ELECTIVE	02	04
	SKILL BASED ELECTIVE	03	06
	VALUE EDUCATION	01	02
	ENVIRONMENTAL STUDIES	01	02
	SOFT SKILLS DEVELOPMENT	01	02
	GENDER STUDIES	01	01
V	EXTENSION ACTIVITIES	--	01
	TOTAL	**44**	**140**

Head of the Department **Principal**

OUTCOME BASED EDUCATION

Under Graduate – Science

Programme Outcomes:

PO1: Disciplinary Knowledge: Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate programme of study.

PO2: Critical Thinking: Capability to apply analytic thought to a body of knowledge; analyse and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development.

PO3: Problem Solving: Capacity to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one's earning to real life situations.

PO4: Analytical & Scientific Reasoning: Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyze and synthesize data from a variety of sources; draw valid conclusions and support them with evidence and examples and addressing opposing viewpoints. Ability to analyse, interpret and draw conclusions from quantitative / qualitative data; and critically evaluate ideas, evidence, and experiences from an open minded and reasoned perspective.

PO5: Self-directed & Lifelong Learning: Ability to work independently, identify and manage a project. Ability to acquire knowledge and skills, including "learning how to learn", through self-placed and self-directed learning aimed at personal development, meeting economic, social and cultural objectives.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

The specific objectives of B.Sc., Botany Programme are to

PSO – 1 : Importance of Plants to other life forms

Enrich the knowledge on diversity, life patterns of plants and their importance to other life forms.

PSO – 2 : Career Development

Utilize the theoretic and practical knowledge of Botany in achieving a successful career.

PSO – 3 : Entrepreneurship

Impart the knowledge obtained from the programme to develop their entrepreneurship skills in self supported or funded business /giving consultancy

PSO – 4 : Communication

Communicate appropriately and effectively in botanical science and also interact productively with people from diverse background

PSO – 5 : Research and Higher Studies

Impart the basic laboratory experiments and hands on training perceived will pave way to advanced research and higher studies

DEGREE OF BACHELOR OF SCIENCE IN BOTANY

1. Eligibility for Admission

A candidate who has passed Higher Secondary Examination in Academic or vocational stream with Botany under higher secondary board of examination, Tamil Nadu or an examination accepted as Equivalent there to by the syndicate subject to such conditions as may be prescribed there to are permitted to appear and qualify for the B.Sc degree examination of this university after a course of study of three academic years.

2. **Duration of the Course**

The course for the degree of Bachelor of Science shall consist of three academic years divided into six semesters.

3. Medium of Instruction: English

4. Pass Mark Particulars

THEORY

Particular	Maximum marks	Passing minimum (CIA) 40% Marks
University Semester Examination (ESE)	75	30
Continuous Internal Assessment (CIA)	25	10

Classification of Internal Assessment Structure

Particulars	Marks
Average of Best two from III Internal Examinations	**15**
Average of 2 Assignments & 1 Seminar Marks	**5**
Attendance	**5**
Total	**25**

PRACTICAL

Particular	Maximum marks	Passing minimum (CIA) 40% Marks
University Semester Examination (ESE)	75	30
Continuous Internal Assessment (CIA)	25	10

First Year **B.Sc., Plant biology & Plant biotechnology** **Semester - I**

SEMESTER - I **PART – III**	**Core paper I : Plant Diversity I** **ALGAE**	**CREDITS: 5** **HOURS: 75**

COURSE OBJECTIVES

1. To provide a comprehensive knowledge on the biology of algae.
2. To provide a basis for better understanding of the evolution higher of plants.
3. To understand reproductive biology, ecology of plants by studying the simpler systems in algae.
4. To understand the role of algae in ecosystems as primary producers of nutrition.
5. To understand importance of algae to animals and humans.

UNIT – I :

Classification (Fritsch-1935-1945), criteria for classification, algal distribution

UNIT - II

Thallus organization (unicellular-*Chlorella*, Diatoms, colonial-*Volvox*, filamentous-*Anabaena*, *Oedogonium*, siphonous-*Caulerpa*, parenchymatous- *Sargassum*, *Gracilaria*).

UNIT – III

Reproduction-Vegetative, asexual, sexual reproduction and life histories (haplontic-, *Oedogonium* and *Chara*, diplontic-Diatoms and *Sargassum*, diplohaplontic-*Ulva* and diplobiontic-*Gracilaria*) (Examples may be changed according to the availability of the specimens)..

UNIT – IV :

Algal cultivation methods, Algal production systems; indoor cultivation methods and large-scale cultivation of algae, harvesting of algae, post-harvest technology

UNIT - V

Algae as food and feed: Agar-agar, Alginic acid and Carrageenan; Diatomite.
Resource potential of algae: Application of algae as fuel, agriculture and pharmaceutical. Phycoremediation. Role of algae in CO_2 sequestration, Algae as indicator of water pollution, algal bioinoculants, Bioluminescence.

Text Books

1. Edwardlee, R. 2018. Phycology, 5th Ed., Cambridge University Press, London.
2. Kumar, H.D. 1999. Introductory Phycology. Affiliated East-West Press, Delhi
3. Singh, Pandey and Jain. 2020. A text book of Botany, 5th Edition, Rastogi Publication, Meerut.
4. Vashishta, P.C. 2014. S.Chand & Company Ltd, New Delhi.
5. Ian Morris. 1977. An introduction to the algae. Hutchinson & Co (Publishers) Ltd. London

Reference Books

1. Aziz, F and Rasheed, R. 2019. A Course Book of Algae. Publisher: University of Sulaimani.ISBN: 978-9922-20-391-1.

2. Mihir Kumar, D. 2010. Algal Biotechnology. Daya Publishing House, New Delhi

3. Chapman V.J. and Chapman D.J, 2013. The Algae. Alpha Numera..

4. Fritsch, F.E. 1945. Structure and reproduction of Algae. Cambridge University press.
5. Round, FE. 1984.The Ecology of Algae. Cambridge University Press.
6. Lee, R.D. 2008.Phycology 4th Edition, Cambridge University Press, New York.

Web resources

https://www.crcpress.com/Therapeutic-and-Nutritional-Uses-of-Algae/Pereira/p/book/9781498755382
https://www.crcpress.com/Algae-Anatomy-Biochemistry-and-Biotechnology-Second-Edition/Barsanti-Gualtieri/p/book/9781439867327
https://www.crcpress.com/Marine-Algae-Biodiversity-Taxonomy-Environmental-Assessment-and-Biotechnology/Pereira-Neto/p/book/9781466581678
https://www.ikbooks.com/books/book/life-sciences/botany/a-textbook-algae/9788188237449/

COURSE OUTCOMES

On successful completion of this course, the student will be able to

1. Relate to the structural organization, reproduction and significance of algae.
2. Demonstrate knowledge in understanding the various life cycle patterns and the fundamental concepts in algal growth
3 Explain the benefits of various algal technologies on the ecosystem
4. Compare and contrast the thallus organization and modes of reproduction in algae.
5. Determine the emerging areas of Algal Biotechnology for identifying commercial potentials of algal products and their uses.

OUTCOME MAPPING

	PO1	PO2	PO3	PO4	PO5
CO1	2	3	3	2	2
CO2	3	2	2	3	3
CO3	1	3	3	2	2
CO4	2	2	2	3	2
CO5	3	2	3	2	3

First Year B.Sc., Plant biology & Plant biotechnology Semester - I

SEMESTER – I PART – III	**Core paper II – Practical - I**	**CREDITS: 5 HOURS: 60**

Course Objectives

To develop skills to identify algae based on habitat, thallus structure and the internal organization.
To identify microalgae in a mixture.
To develop skills to prepare the microslides of algae,
To study the economic importance of few species.
To understand importance of algae, to animals and humans.

EXPERIMENTS TO BE CARRIED OUT

ALGAE

Micro-preparation of the types prescribed in the syllabus.
2. Identifying the micro slides relevant to the syllabus.
3. Identifying types of algal mixture.
4. Economic importance of Algae as: (i) Food (ii) Feed (iii) Bio fertilizers (iv) Seaweed liquid fertilizer (v) Hydrogen production by algae (vi) SCP (vii) Agar Agar (viii) Alginate (ix) Diatomaceous earth.
5. Field visit to study fresh water/marine water algal habitats.
6. Visit to nearby industry actively engaged in algal technology.

Botanical excursion for collection of algae

Bonafide record of practical work done should be submitted for the practical examination

Course outcomes:

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

1. Recall and identify algae, fungi using key identification characters.
2. Demonstrate practical skills in preparation of fresh mount and identification of algal forms from algal mixture.
3. Describe the internal structure of algae, prescribed in the syllabus.
4. Decipher the algal diversity in fresh/marine water, algae, fungi, bacteria, virus lichens, bryophytes and pteridophytes, and their economic importance

Recommended texts

1. Kumar, H.D. 1999. Introductory Phycology. Affiliated East-West Press, Delhi.
2. Bendre, M. Ashok and Ashok Kumar, A. 2020. Text Book of Practical Botany-1 (10^{th} ed). Rastogi Publications, Meerut.
3. Round, FE. 1984.The Ecology of Algae. Cambridge University Press.
4. Aziz, F and Rasheed, R. 2019. A Course Book of Algae. Publisher: University of Sulaimani.ISBN: 978-9922-20-391-1.
5. Singh, Pandey and Jain. 2020. A text book of Botany, 5th Edition, Rastogi Publication, Meerut..

Reference books

1. Nancy Serediak and M. Huynh. 2011. Algae identification lab Guide.
2. Manual to algae identification field guide, Ottawa Agriculture and Agri food Canada publisher.

3. Chapman, V.J and Chapaman, D.J. 1960.The Algae, ELBS & MacMillan, London.
4. Lee, R.D. 2008.Phycology 4th Edition, Cambridge University Press, New York.
5. Dehradun. Edwardlee, R. 2018. Phycology, 5th Ed., Cambridge University Press, London.

Web Resources

1. https://www.amazon.in/Practical-Manual-Algae-Sundara-Rajan/dp/8126106492
2. https://books.google.co.in/books/about/Practical_Manual_of_Algae.html?id=8d5DAAAACAAJ&redir_esc=
3. https://freebookcentre.net/biology-books-download/Concepts-of-Botany-Algae-(PDF-21P).html

OUTCOME MAPPING

	PO1	PO2	PO3	PO4	PO5
CO1	2	3	1	3	2
CO2	2	3	2	2	3
CO3	2	1	3	2	3
CO4	1	3	3	2	2
CO5	2	2	3	1	3

First Year **B.Sc., Plant biology & Plant biotechnology** **Semester - I**

MAJOR BOTANY PRACTICAL I

Time: 3 Hours Max. Marks: 75

PRACTICAL QUESTION PAPER

1. Make suitable micro preparations of the given specimens A and B.
Submit the slides for valuation. Identify the specimens, draw diagrams and give reasons.
(Identification – 2, diagram – 3, Reasons – 4, Slide -4) (13 X 2) (26)

2. Identify the any TWO / THREE species from the given algal mixture C.
(Identification – 2, diagram – 4, Reasons – 3) (9)

3. Identify the given specimens D and E and write their economic importance.
(Identification -1, economic importance-4) (2 X 5) (10)

4. Spotters – F, G, H, and I
(Identification – 1, diagram – 2, Reasons –2) (4 X 5) (20)

Total = 65
Record = 10

Grand Total = 75

KEY & SCHEME OF VALUATION

1. A and B – Algae: *Caulerpa, Sargassum, Ulva*

(Any two – based on the availability of the specimens)
(Identification – 2, diagram – 3, Reasons – 4, Slide -4) (13 X 2) (26)

2. Algal mixture - C : *Chlorella, Volvox, Anabaena, Oedogonium*
(Any two/three species– based on the availability of the specimens)
(Identification – 2, diagram – 4, Reasons – 3) (9)

3. Economic importance – D and E
Algae: SCP, food, feed, biofertilizers, seaweed liquid fertilizer, agar
(Identification -1, economic importance-4) (2 X 5) (10)

4. Spotters - F, G, H, and I (any four of the following)
(Algae–Unicellular, Filamentous, colonial, parenchymatous, siphonous -permanent slides, book diagrams or wet preserved jar specimens)
(Identification – 1, diagram – 2, Reasons – 2) (5 X 4) (20)

Total = 65
Record = 10

Grand Total = 75

First Year **B.Sc., Plant biology & Plant biotechnology** **Semester - II**

SEMESTER - II PART – III	**PLANT DIVERSITY – II: FUNGI, BACTERIA, VIRUSES, PLANT PATHOLOGY AND LICHENS**	**CREDITS: 5 HOURS: 75**

COURSE OBJECTIVES

1. To describe the common characteristics of fungi as being heterotrophic, unicellular/multicellular.
2. To understand the biology of fungi and to discuss the importance of fungi in various ecological roles.
3. To understand lichen structure, function, identification, and ecology; Comprehend the events of symbiosis and lichenization and to demonstrate the use of lichens as bio indicator species.
4. To identify the main groups of plant pathogens, their symptoms.
5. To understand the various types of plant diseases.

UNIT – I

FUNGI

Classification of fungi - (Alexopoulos and Mims, 1979), criteria for classification, Characteristic features, thallus organization, mode of nutrition, structure, reproduction and life-history of classes, each with one suitable example: Zygomycotina (*Pilobolus*, *Mucor, Rhizopus*), Ascomycotina (*Aspergillus*, *Saccharomyces Peziza*), Basidiomycotina (*Agaricus*, *Pleurotus*, *Puccinia*) and Deuteromycotina (*Cercospora, Alternaria*). (Examples may be changed according to the availability of the specimens). Importance of mycorrhizal association.

UNIT - II

ECONOMIC IMPORTANCE OF FUNGI

Cultivation of mushroom – *Pleurotus* (food). Fungi in agriculture application (biofertilizers): Mycotoxins (biopesticides), Production of industrially important products from fungi- alcohol (ethanol), organic acids (citric acid), enzymes (protease). Vitamins (Vitamin B-complex and Vitamin B-12), applications of fungi in pharmaceutical products (Penicillin). Importance of VAM fungi. Harmful effects of Fungi. Agriculture (Biofertilizers); Mycotoxins

UNIT – III

BACTERIA, VIRUS

Classification (Bergey's, 1994), structure and reproduction of bacteria, Mycoplasma, Virology -Viruses general characters, structure and reproduction.

UNIT – IV

PLANT PATHOLOGY

General symptoms of plant diseases; Geographical distribution of diseases; Etiology; Host-Pathogen relationships; Disease cycle and environmental relation; prevention and control of the following plant diseases. General characters of Bacteria and Viruses.

Bacterial diseases – Citrus canker and Bacterial wilt of Banana

Viral diseases – Tobacco Mosaic and Vein clearing of Papaya

Fungal diseases **– Blast disease in rice and Tikka disease**

UNIT - V

LICHENS

Classification (Hale, 1969). Habitat, nature of association, Structure, Nature of Mycobionts and Phycobionts, Study of growth forms of lichens (crustose, foliose and fruticose), types, distribution, thallus organization, reproduction and ecological significance of lichens with special reference to *Usnea*.

Economic importance of Lichens: food, fodder and nutrition, flavor, tanning and dyeing, cosmetics and perfumes, Brewing and distillation, minerals, Natural products, medicine (Ayurvedic, Siddha), pharmaceutical products, biodegradation agent, air pollution and biomonitoring, soil formation, nitrogen fixation, Harmful aspects, poison from lichens,.

Text Books

1. Pandey, B.P. 1997. College Botany. Vol. I Fungi & Pathology.
2. Mehrotra, R.S and Aneja, K.R. 2003. An introduction to mycology. New age International (P) Ltd, Publishers, New Delhi.
3. Poonam Singh and Ashok Pandey. 2009. Biotechnology for agro-Industrial residues utilization. Springer.
4. Satyanarayana T and Johri B.N. 2005. Microbial diversity, Current Perspectives and Potential Applications, IK International.
5. Nair, L.N. 2007. Topics in Mycology and Pathology, New Central Book agency, Kolkata.
6. Sharma, P.D. 2011. Plant Pathology, Rastogi Publication, Meerut, India.

Reference Books

1. 1. Alexopoulos, C.J., Mims, C.W., Blackwell, M. 1996. Introductory Mycology. 4th edition. John Wiley & Sons (Asia) Singapore.
2. Webster, J and Weber, R. 2007. Introduction to Fungi. 3rd edition. Cambridge University Press, Cambridge.
3. Sharma, O.P. 2011. Fungi and allied microbes The McGraw –Hill companies, New Delhi.
4. Burnett, J.H. 1971.The fundamentals of Mycology. ELBS Publication, London.
5. Bessey, E.A. 1979. Morphology and Taxonomy of fungi, Vikas publishing House Pvt. Ltd, New Delhi.
6. Dharani Dhar Awasthi. 2000. A Handbook of Lichens Vedams eBooks (P) Ltd. New Delhi.
7. Pelzer, M.J., Chan, E.C.S and Krieg, N.R. 1983. Microbiology , Tata MaGraw Hill Publishing House, New Delhi.
8. Pandey, P.B. 2014. College Botany- 1: Including Algae, Fungi, Lichens, Bacteria, Viruses, Plant Pathology, Industrial Microbiology and Bryophyta. Chand Publishing, New Delhi.
9. Mishra, A. and Agarwal, R.P. 1978. Lichens – A Preliminary Text. Oxford and IBH.

Web resources

1. https://www.amazon.in/Fungi-Sarah-C-Watkinson-ebook/dp/B0199YFDFE
2. http://www.freebookcentre.net/biology-books-download/A-text-book-of-mycology-and-plant-pathology.html
3. http://www.freebookcentre.net/Biology/Mycology-Books.html
4. https://www.kobo.com/us/en/ebook/introduction-to-fungi
5. **http://www.freebookcentre.net/biology-books-download/Introductory-Mycology.html**

COURSE OUTCOMES

On successful completion of this course, the student will be able to

1. Recognize the general characteristics of microbes, fungi and lichens and disease symptoms.

2. Develop an understanding of microbes, fungi and lichens and appreciate their adaptive strategies based on structural organization
3. Identify the common plant diseases, according to geographical locations and device control measures
4. Analyze the emerging trends in fungal biotechnology with special reference to agricultural and pharmaceutical applications.
5. Determine the economic importance of microbes, fungi and lichens.

OUTCOME MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**
CO1	2	3	3	2	2
CO2	3	2	2	3	3
CO3	1	3	3	2	2
CO4	2	2	2	3	2
CO5	3	2	3	2	3

First Year	B.Sc., Plant biology & Plant biotechnology	Semester - II

SEMESTER – II PART – III	**Core paper IV – Practical II**	**CREDITS: 5 HOURS: 60**

Course Objectives

1. To enable students to identify microscopic and macroscopic fungi..
2. To prepare microslides of fungi and lichens..
3. To know the presence of pathogen inside the plant tissues through microscopic sections
4. To identify the bacteria and viruses based on the morphology, and microslides
5. To know the economic importance of the microbes studied..

EXPERIMENTS TO BE CARRIED OUT

EXPERIMENTS

1. Microscopic observation of vegetative and reproductive structures of types prescribed in the syllabus through temporary preparations and permanent slides.
2. Identifying the micro slides relevant to the syllabus.
3. Herbarium specimens of bacterial diseases/photograph.
4. Protocol for mushroom cultivation.
5. Inoculation techniques for fungal culture (Demonstration only).
6. Study of economically important products obtained from fungi: Fungal biofertilizers, biopesticides, biofungicide (*Trichoderma*), edible mushroom/Yeast, organic acids (citric acid) enzymes (protease), antibiotics and vitamins.
7. Mycorrhiza: ecto-mycorrhiza and endo-mycorrhiza (Photographs)
8. Visit to fungal biotechnology laboratories.
9. Ultra structure of bacteria.
10. Structure of bacteriophage.
11. Micro-preparation of *Usnea* to study vegetative and reproductive structures.
12. Identifying the micro slides relevant to the syllabus.
13. Study of thallus and reproductive structures (apothecium) through permanent slides.
14. Economic importance of Lichens - Dye and perfume

Bonafide record of practical work done should be submitted for the practical examination

Course outcomes:

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

1. Identify microbes, fungi and lichens using key identifying characters.
2. Develop practical skills for culturing and cultivation of fungi.
3. Identify and select suitable control measures for the common plant diseases
4. Analyze the characteristics of microbes, fungi and plant pathogens.
5. Analyze the characteristics of microbes, fungi and plant pathogens

Recommended texts

1. Sharma O.P and S, Dixit. 2002. Gymnosperms. Pragati Prakashan.
2. Gangulee, H.C and A.K. Kar. 2013. College Botany. Vth Edition. S. Chand.
3. Sharma, O.P. 2012. Textbook of Pteridophyta, TATA MacMillan India Ltd., New Delhi.
4. Chamberlain, C.J. 1934. Gymnosperms: Structure and Evolution. Chicago Reprinted 1950). New York.

Bhatnagar, S.P and Moitra, A. 1996. Gymnosperms. New Age International Publishers, New Delhi, India

Reference books

1. Smith, G.M. 1955. Cryptogamic Botany Vol.II. Tata McGraw Hill. New Delhi.
2. James.W. Byng. 2015. The Gymnosperms practical hand book. A practical guide to extant families and genera of the world. Published by plant Gateway, Tol Bot Street, Herford, SG137BX, United Kingdom.
3. Sharma, O.P. 2012. Textbook of Pteridophyta, TATA MacMillan India Ltd., New Delhi.
4. Chamberlain, C.J. 1934. Gymnosperms: Structure and Evolution. Chicago Reprinted 1950). New York.
6. Kirkaldy, J.E. 1963. The study of Fossils. Hutchinson Educational, London.

Web Resources

1. https://www.google.co.in/books/edition/Gymnosperms/3YrT5E3Erm8C?hl=en&gbpv=1&dq=gymnosperms&printsec=frontcover
2. https://www.amazon.in/Paleobotany-Biology-Evolution-Fossil-Plants/dp/0123739721
1. https://books.google.co.in/books/about/Paleobotany.html?id=HzYUAQAAIAAJ
2. https://trove.nla.gov.au/work/11471742?q&versionId=46695996

OUTCOME MAPPING

	PO1	PO2	PO3	PO4	PO5
CO1	2	3	1	3	2
CO2	2	3	2	2	3
CO3	2	1	3	2	3
CO4	1	3	3	2	2
CO5	2	2	3	1	3

First Year **B.Sc., Plant biology & Plant biotechnology** **Semester - II**

MAJOR BOTANY PRACTICAL - II

Time: 3 Hours Max. Marks: 75

PRACTICAL QUESTION PAPER

1. Make suitable micro preparations of the given specimens A and B.
Submit the slides for valuation. Identify the specimens, draw diagrams and give reasons.
(Identification –1, diagram – 2, Reasons – 3, Slide -3) (9 X 2) (18)

2. Identify the Plant Pathology specimen C. . Name the disease (1) and causal organism (2), Write the symptoms (3) and control measures(3)
(Identification – 1, diagram – 2, Reasons – 2) (09)

3. Identify the given specimens D and E and write their economic importance.
(Identification -1, economic importance-4) (2 X 5) (10)

4. Spotters – F, G, H, I, J , K and L
(Identification – 1, diagram – 1, Reasons – 2) (7 X 4) (28)

Total = 65
Record = 10

Grand Total = 75

MAJOR BOTANY PRACTICAL - II
KEY & SCHEME OF VALUATION

1. Fungi – A and B
Peziza, Agaricus, Pleurotus, Puccinia, Cercospora
Any two based on availability
(Identification –1, diagram – 2, Reasons – 3, Slide -3) (9 X 2) (18)

2. Plant pathology - C - Citrus canker, Bacterial wilt, Tobacco mosaic, vein clearing, Blast disease and Tikka disease (Any one)
Name the disease (1) and causal organism (2), Write the symptoms (3) and control measures (3) (09)

3. Economic importance – D and E :
Fungi: Bio pesticide, Trichoderma, mushroom, yeast, vitamin and antibiotic sources
Lichens: Dye, Perfume
(Identification -1, economic importance-4) (2 X 5) (10)

4. Spotters - F, G, H, I, J, K and L (any Seven of the following)
(Fungi, Bacteria, Virus, Mycoplasma, Lichens, Plant pathology specimens – permanent slides, book diagrams or wet preserved jar specimens)
(Identification – 1, diagram – 1 Reasons – 2) (7 X 4) (28)

Total = 65
Record = 10

Grand Total = 75

First Year **B.Sc., Zoology** **Semester - I**

SEMESTER	COURSE TITLE: Allied Botany – I	H/W	C
I		3	2

Course Objective

1	To study morphological and anatomical adaptations of plants of various habitats.
2	To demonstrate techniques of plant tissue culture.
3	To familiarize with the structure of DNA, RNA.
4	To carryout experiments related with plant physiology.
5	To perform biochemistry experiments.

Unit – 1: Algae:

General characters of algae - Structure, reproduction and life cycle of the following genera - *Anabaena* and *Sargassum* and economic importance of algae.

Unit – 2: Fungi, Bacteria and Virus:

General characters of fungi, structure, reproduction and life cycle of the following genera –*Penicillium and Agaricus* and economic importance of fungi.

Bacteria - general characters, structure and reproduction of *Escherichia coli* and economic importance of bacteria. Virus - general characters, structure of TMV, structure of bacteriophage.

Unit – 3: Bryophytes, Pteridophytes and Gymnosperms:

General characters of Bryophytes, Structure and life cycle of *Funaria*.
General characters of Pteridophytes, Structure and life cycle of *Lycopodium*.

General characters of Gymnosperms, Structure and life cycle of *Cycas*.

Unit – 4: Cell Biology:

Prokaryotic and Eukaryotic cell-structure/organization.Cell organelles - ultra structure and function of chloroplast, mitochondria and nucleus. Cell division - mitosis and meiosis.

Unit – 5: Genetics and Plant Biotechnology:

Mendelism - Law of dominance, Law of segregation, Incomplete dominance. Law of independent assortment. Monohybrid and dihybrid cross - Test cross - Back cross. Plant tissue culture - *In vitro* culture methods. Plant tissue culture and its application in biotechnology.

Expected Course Outcomes (CO)

At the end of the course, the student will be able to

1	Increase the awareness and appreciation of human friendly algae and their economic importance.
2	Develop an understanding of microbes and fungi and appreciate their adaptive strategies.
3	Develop critical understanding on morphology, anatomy and reproduction of Bryophytes, Pteridophytes and Gymnosperms.
4	Compare the structure and function of cells and explain the development of cells.
5	Understand the core concepts and fundamentals of plant biotechnology and genetic engineering.

Recommended Texts

1. Singh,V., Pande ,P. Cand Jain ,D.K. 2021. A Text Book of Botany. Rastogi Publications,Meerut.
2. Bhatnagar, S.P and Alok Moitra. 2020. Gymnosperms, New Age International (P) Ltd., Publishers, Bengaluru.
3. Sharma,O.P. 2017. Bryophyta, MacMillanIndiaLtd.Delhi.
4. Lee, R.E. 2008. Phycology, IV Edition, Cambridge University Press, New Delhi.
5. Rao, K., Krishnamurthy, K.V and Rao, G.S. 1979. Ancillary Botany,S. Viswanathan Pvt. Ltd., Madras.

Reference books:

1. Parihar, N.S. 2012. An introduction to Bryophyta –Pteridophytes- Surjeet Publications, Delhi.
2. Alexopoulos, C.J. 2013. Introduction to Mycology. Willey Eastern Pvt. Ltd.
3. Vashishta, P.C. 2014. Botany for Degree Students Gymnosperms. Chand & Company Ltd, Delhi.
4. Coulter, M. Jhon, 2014. Morphology of Gymnosperms. Surjeet Publications, Delhi.
5. Vashishta, P.C. 2014. Botany for Degree Students Algae. 2014. Chand & Company Ltd, Delhi.
6. Parihar, N.S. 2013. An introduction to Bbryophyta –Bryophytes -, Surjeet Publications, Delhi.
7. Pandey B.P. 1986, Text Book of Botany (College Botany) Vol I &II, S.Chand and Co. New Delhi.

Web Resources

1. https://www.kobo.com/us/en/ebook/the-algae-world
2. http://www.freebookcentre.net/biology-books-download/Fungi-(PDF-15P).html
3. http://scitec.uwichill.edu.bb/bcs/bl14apl/bryo1.htm
4. https://www.toppr.com/guides/biology/plant-kingdom/pteridophytes/
5. https://arboretum.harvard.edu/wp-content/uploads/2013-70-4-beyond-pine-cones-an-introduction-to-gymnosperms.pdf**Mapping with Programme Outcomes:**

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S	S	S	S
CO3	M	S	S	S	S	L	S	S	S	S
CO4	S	S	M	S	S	S	M	S	M	S
CO5	S	M	M	M	M	M	M	L	M	L

S – Strong; M – Medium; L-Low

First Year **B.Sc., Zoology** **Semester - I**

SEMESTER	COURSE TITLE: Allied Botany Practical – I	H/W	C
I		2	1

Course Objectives

1. To enhance information on the identification of each taxonomical group by developing the skill-based detection of the morphology and microstructure of microorganisms, algae, and fungi
2. To comprehend the fundamental concepts and methods used to identify Bryophytes, Pteridophytes and Gymnosperms through morphological changes and evolution, anatomy and reproduction.
3. To be familiar with the basic concepts and principles of cell biology.
4. Understanding of laws of inheritance, genetic basis of loci and alleles.
5. To learn about the principles and applications of Biotechnology

EXPERIMENTS

1. Make suitable micro preparation of the types prescribed in Algae, Fungi, Bryophytes, Pteridophytes and Gymnosperms.
2. Micro photographs of the cell organelles ultra-structure.
3. Simple genetic problems.
4. Spotters - Algae, Fungi, Bryophytes, Pteridophytes, Gymnosperms Cell biology and Biotechnology.

Bonafide record of practical work done should be submitted for the practical examination

Course outcomes:

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

1. To study the internal organization of algae .
2. To study the structure and organization of fungi, bacteria and viruses
3. Develop critical understanding on morphology, anatomy and reproduction of Bryophytes, Pteridophytes and Gymnosperms.
4. To study the cell structure and function.
5. Understand the fundamental concepts of genetics and Biotechnology

Recommended texts

1. Sharma,O.P.2017. Bryophyta, MacMillan India Ltd, New Delhi.
2. Sharma,O.P.2012. Pteridophyta, Tata McGraw-Hills Ltd, New Delhi.
3 Benjamin, 2012. Genetics- A conceptual Approach. W.H. Freeman and Company, New York, England.
4. Noggle G.R and G.J. Fritz. 2002. Introductory Plant Physiology. Prentice Hall of India, New Delhi.

Reference books

1. Strickberger, M.W. 2005. Genetics (III Ed). Prentice Hall, New Delhi, India.
2. Nancy Serediak and M. Huynh. 2011. Algae identification lab Guide. Accompanying manual to algae identification field guide, Ottawa Agriculture and Agri food Canada publisher.
3. Mohammed Gufran Khan, Shite Gatew and Bedilu Bekele. 2012. Practical manual for Bryophytes and Pteridophytes. Lambert Academic Publishing.
4. AlerGingauz.2001. Medicinal Chemistry. Oxford University Press & Wiley Publications.
5. Steward, F.C. 2012. Plant Physiology Academic Press, US

OUTCOME MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**
CO1	2	3	1	3	2
CO2	2	3	2	2	3
CO3	2	1	3	2	3
CO4	1	3	3	2	2
CO5	2	2	3	1	3

First Year **B.Sc., Zoology** **Semester - I**

BOTANY PRACTICAL I

Time: 3 Hours Max. Marks: 75

PRACTICAL QUESTION PAPER

1. Make suitable micro preparations of the given specimens A, B and C.
Submit the slides for valuation. Identify the specimens, draw diagrams and give reasons.
(Identification – 1, diagram – 2, Reasons – 2, Slide -2) (7 X 3) (21)

2. Make suitable micro preparations of the given specimens D.
Submit the slides for valuation. Identify the specimens, draw diagrams and give reasons.
(Identification – 1, diagram – 2, Reasons – 2, Slide -2) (08)

3. Identify the given electron micrograph –E, describe and draw diagrams
(Identification – 2, Diagram – 3, Description – 3) (08)

4. Spotters – F, G, H, I, J, K and L.
(Identification – 1, diagram – 1, Reasons – 2) (7 X 4) (28)

Total = 65
Record = 10

Grand Total = 75

First Year **B.Sc., Zoology** **Semester - I**

ALLIED BOTANY PRACTICAL - I

KEY & SCHEME OF VALUATION

1. A – Algae / Fungi: *Sargassum/Agaricus*
   B – Bryophytes: *Funaria*
   C – Pteridophytes: *Lycopodium*
(Identification – 1, diagram – 2, Reasons – 2, Slide -2) (7 X 3) (21)

2. Gymnopserms - D :*Cycas* – rachis and leaflet
(Identification – 1, diagram – 2, Reasons – 2, Slide -3) (08)

3. Cell biology - E – Electron Micrograph of organelles- Chloroplast, Mitochondria, Nucleus, Mitosis, and Giant Chromosomes
– (Identification – 2, Diagram – 3, description – 3) (08)

4. Spotters – F, G, H, I, J, L and M (any seven of the following)
(Algae, Fungi, Bacteria, Virus, Bryophytes, Pteridophytes and Gymnosperms –permanent slides, book diagrams or wet preserved jar specimens, mentioned in the syllabus)
Cytology – photographs of cell organelles
Genetics – simple genetics problems
Plant biotechnology – tissue culture techniques: explants, callus, hardening
(Identification – 1, diagram – 1, Reasons – 2) (7 X 4) (28)

Total = 65
Record = 10

Grand Total = 75

First Year **B.Sc., Zoology** **Semester - II**

SEMESTER	COURSE TITLE: Allied Botany- II	H/W	C
II		3	2

1	To be familiar with the basic concepts and principles of plant systematics.
2	Learn the importance of plant anatomy in plant production systems.
3	Understand the mechanism underling the shift from vegetative to reproductive phase.
4	To learn about the physiological processes that underlie plant metabolism.
5	To know the energy production and its utilization in plants.

Unit – 1: MORPHOLOGY OF FLOWERING PLANTS

Plant and its parts. Structure and function of root and stem. Leaf and its parts. Leaf types- simple and compound. Phyllotaxy and types. Inflorescence - Racemose, Cymose and Special types. Terminology with reference to flower description.

Unit – 2: TAXONOMY

Study of the range of characters and plants of economic importance in the following families: Rutaceae, Caesalpiniaceae, Asclepiadaceae, Euphorbiaceae and Cannaceae

Unit – 3: ANATOMY

Tissue and tissue systems: Simple and complex tissues. Anatomy of monocot and dicot roots - anatomy of monocot and dicot stems - anatomy of dicot and monocot leaves.

Unit – 4: EMBRYOLOGY

Structure of mature anther and ovule - Types of ovules, structure of embryo sac, pollination -double fertilization, structure of dicotyledonous and monocotyledonous seeds.

Unit – 5: PLANT PHYSIOLOGY

Absorption of water, photosynthesis - light reaction - Calvin cycle; respiration - Glycolysis - Krebs cycle - electron transport system. Growth hormones - Auxins and cytokinins and their applications.

Expected Course Outcomes (CO)

At the end of the course, the student will be able to

1	Understand the fundamental concepts of plant anatomy and embryology.
2	Analyze and recognize the different organs of plants and secondary growth.
3	Understand water relation of plants with respect to various physiological processes
4	Classify aerobic and anaerobic respiration.
5	Classify plant systematics and recognize the importance of herbarium and virtual herbarium.

Recommended Texts:

1. Sharma, O.P. 2017. Plant Taxonomy. (II Edition).The McGraw Hill Companies.
2. Bhojwani, S.S. Bhatnagar, S.P and Dantu, P.K. 2015. The Embryology of Angiosperms (6th revised and enlarged edition).Vikas Publishing House, New Delhi.
3. Maheshwari, P. 1963. Recent Advances in Embryology of Angiosperms. Intl. Soc. Plant Morphologists, New Delhi.
4. Salisbury, F. B.C.W. Ross.1991. Plant Physiology. Wassworth Pub. Co. Belmont.
5. Ting, I.P. 1982. Plant Physiology. Addison Wesley Pb. Philippines.

Reference books

1. Lawrence.G.H.M. 1985. An Introduction to Plant Taxonomy, Central Book Depot, Allahabad.
2. Bhojwani, S.S and Bhatnagar, S.P. 2000. The Embryology of Angiosperms (4th revised and enlarged edition). Vikas Publishing House, New Delhi.
3. Pandey, B.P. 2012. Plant Anatomy. S Chand Publishing.
4. Jain, VK. 2006. Fundamentals of Plant Physiology, S. Chand and Company Ltd.
5. Rajni Gupta. 2012. Plant Taxonomy: Past, Present and Future. Vedams (P) Ltd. New Delhi.
6. Jain, V.K. 2006. Fundamentals of Plant Physiology, S.Chand and Company Ltd., New Delhi.
7. Verma, S.K. 2006. A Textbook of Plant Physiology, S.K.Chand& Co., New Delhi.

Web Resources

1. https://books.google.co.in/books/about/Plant_Taxonomy.html?id=0bYs8F0Mb9gC&redir_esc=y
2. https://books.google.co.in/books/about/PLANT_TAXONOMY_2E.html?id=Roi0lwSXFnUC&redir_esc=y
3. https://archive.org/EXPERIMENTS/plantanatomy031773mbp

Mapping with Programme Outcomes:

Cos	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S	S	S	S
CO3	M	S	S	S	S	L	S	S	S	S
CO4	S	S	M	S	S	S	S	M	S	M
CO5	S	M	M	M	M	M	M	L	M	M

S – Strong; M – Medium; L – Low

First Year **NME– I** **Semester - I**

Course Code	Title of the Course	Category	L	T	P	O	Credits	Inst. Hours	Marks		
									CIA	External	Total
	BIOFERTILIZER and MUSHROOMCULTIVATION			-		-	2	2	25	75	100

	Learning Objectives
1	Learn the importance of Biofertilizer.
2	Develop an understanding of Symbiotic association – Mass cultivation
3	Enrich knowledge about culture technique
4	Enable to learn various salient features edible mushrooms
5.	Develop critical understanding on mushroom cultivation

UNIT –I

Biofertilizer – Definition, Kinds of microbes as biofertilizers, Rhizobium-legume Symbiotic assotiation – Mass cultivation and carrier materials.

UNIT –II

Cultural methods of *Azospirillum*, *Azatobacter*, *Azolla* and *Anabaena*, carrier materials.

UNIT –III

Mycorrhizae – VAM association, types, isolation and inoculum production.

UNIT – IV

Edible and Poisonous mushrooms, nutritive value of mushrooms, structure of edible mushrooms, *Pleurotus* and *Agaricus* (Fruiting body)

UNIT – V

Mushroom cultivation: Spawn, mother spawn production, spawn multiplication, Requirements of mushroom cultivation (Polythene bags, paddy straw substrates, spawn running room, cropping room) – Preparation of paddy straw ,cylindrical beds, spawn running, cropping and harvesting, Diseases and control measures.

Course Outcomes: Students will be able to:

CO No.	CO Statement	Knowledge level
CO 1	Recall various types and categories of mushroom	K3
CO 2	Explain about various types mushroom industry.	K3
CO 3	Apply techniques studied for cultivation of various types of mushroom.	K4
CO 4	Understanding of Symbiotic association – Mass cultivation applications.	K4
CO 5	Analyze and decipher the environmental factors and economic value associated with mushroom cultivation	K3

References:

1. Sharma, A.K., 2003. Biofertilizers for sustainable agriculture, Agrobios.

2. NIIR Board, 2004. The complete Technology book on Biofertilizer and Organic Farming, National Institute of Industrial Research.

OUTCOME MAPPING

	PO1	PO2	PO3	PO4	PO5
CO1	3	2	3	2	2
CO2	2	3	2	3	3
CO3	3	2	3	2	2
CO4	2	2	2	3	2
CO5	2	3	3	2	3

First Year **NME– II** **Semester- II**

Course Code	Title of the Course	Category	L	T	P	O	Credits	Inst. Hours	Marks		
									CIA	External	Total
	HORTICULTURE AND GARDEN DESIGNING		5	-		-	5	5	25	75	100

	Learning Objectives
1	Learn the importance of Horticulture
2	Develop an understanding of propagation technique
3	Develop practical skills of Layering, Grafting, Budding technique
4	Enable to learn various types of garden making.
5.	Develop critical understanding on Common diseases in Garden Plants and its control

UNIT -I

Horticulture: Importance and scope of Horticulture, Classification of Horticultural crops – fruits, vegetable crops, climate, soil, water, and nutrition needs of Horticultural crops.

UNIT – II

Plant propagation methods: Cutting, Layering, Grafting, Budding, Stock-Scion relationship, use of plant regulators in Horticulture.

UNIT – III

Garden designs: Types of gardens- formal, informal and kitchen garden, units of garden, hedge, border and Topiary Arches and Lawn maintenance.

UNIT – IV

Floriculture, cultivation of commercial flowers – Rose and Jasmines. Cultivation of important fruit tress – Mangoes and Banana.

UNIT – V

Green house, Indoor gardening – Bonsai – Flower arrangements – Nursery management and maintenance. Common diseases in Garden Plants and its control measures.

Course Outcomes: Students will be able to:

CO No.	CO Statement	Knowledge level
CO 1	Recognize the importance of Horticulture	K3
CO 2	Develop an understanding of propagation technique	K3
CO 3	learn various types of garden making	K4
CO 4	Develop critical understanding on Common diseases in Garden Plants and its control	K4
CO 5	Develop practical skills of Grafting, Budding technique	K3

References:

Bose, T.K. & Mukherjee, D. (1972). Gardening in India Oxford & IBH Publishing Co., Kolkatta, New Delhi – 385pp,

Sandhu, M.K. (1989). Plant propagation – Wiley Eastern Ltd., New Delhi, Bangalore, Pune-287pp,

Kumar, N. (1997). Introduction to Horticulture. Rajalakshmi Publications, Nagercoil, India.

Manigush S.K. (1999). Horticulture. Wiley Eastern Ltd., New Delhi, Bangalore, 321pp,

OUTCOME MAPPING

	PO1	PO2	PO3	PO4	PO5
CO1	2	3	3	2	2
CO2	3	2	2	3	3
CO3	3	3	3	2	2
CO4	2	2	2	3	2
CO5	3	2	3	2	3