G. VENKATASWAMY NAIDU COLLEGE (AUTONOMOUS),

(Re-Accredited with 'A' grade by NAAC| DBT Star College Scheme)

(Affiliated to M.S. University, Tirunelveli)

KOVILPATTI – 628 502.

Department of BOTANY

BACHELOR OF SCIENCE

BOARD OF STUDIES

for the candidates admitted from the Academic Year 2023-2024 and onwards

Under CBCS PATTERN

G. VENKATASWAMY NAIDU COLLEGE KOVILPATTI.
(Autonomous Institution)
(Re-Accredited by NAAC with 'A' Grade)

Department of Botany
(For those admitted from the academic year 2023-2024 and onwards)

Vision

Provision of knowledge to contribute towards the sustainable utilization of Plant Biosphere

Mission

- To foster an environment of excellence by providing a comprehensive set of courses in plant sciences that enhances the understanding, depth of knowledge and technical competency of the students.
- To provide the students competence for entry-level research and teaching positions in biological sciences.
- To inculcate the students with an environment that fosters the development of appropriate scientific vocabulary, reasoning skills, and effective oral and written communication abilities for students.
- To create a holistic understanding of the allied subjects through interdisciplinary

CURRICULUM

Programme Outcomes - (PO) (Aligned with Graduate Attributes)

At the completion of the Undergraduate Programme, the student will be able to accomplish the following outcomes:

GPO No.	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; analyze 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 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.
PO5	**Scientific Reasoning:** 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.
PO6	**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.
PO7	Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision, and using management skills to guide people to the right destination, in a smooth and efficient way.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

The objectives of this Programme is to equip/prepare the students

GPO No.	Programme Educational Objective
PEO1	Students will pursue the study of the biological concepts, ability to appreciate the diversity in biology and kindling interest towards the creative and innovative in Life Sciences.
PEO2	Students will understand and gain the knowledge of basic plant biology and to study its relevant applications.
PEO3	Students will be able to demonstrate proficiency in the experimental techniques and methods of analysis appropriate for their area of specialization within biology.

PROGRAMME SPECIFIC OUTCOMES (PSO)

At the completion of the Undergraduate Programme, the student will be able to accomplish the following outcomes:

PSO No.	Intended Programme Specific Outcomes
PSO1	Implement the concept of science and technology to foster the traditional and modern techniques for solving the complex problems in Plant Biology and understanding the scope and significance of Botany.
PSO2	Develop the scientific problem solving skills during experimentation, research projects, analysis, interpretation of data and to generate useful information to address various issues in Botany.
PSO3	Enhanced capacity to think critically; ability to design and execute experiments independently and/or team under multidisciplinary settings

Graduate attributes

1. Clear, comprehensive, Skill in practical work, experiments, use of biological tool and techniques and advanced mastery in the field of Botany.

2. Understand Proficiency in the use of recent advanced biological technologies, advanced areas of biological sciences with special reference to Botany and its applied branches.

3. Confidence to apply the acquired knowledge in practical life, ensure the implementation of a holistic pedagogical model in botany so as to make our country self-reliant.

4. To mould a responsible citizen who is aware of most basic domain-independent Knowledge, including critical thinking and communication.

5. To enable the graduate prepare for national level competitive Examinations, especially UGC-CSIR NET and UPSC Civil Services Examination

6. The students would learn the use of the new technologies used in learning biology, digital platforms for fast transfer of information. Students will acquire digital skills and integrate the fundamental concepts with modern tools.

7. The vast and deep knowledge of the subject, analytical and scientific reasoning, effective communication and problem solving task develop special qualities in a person to attract and influence the audience, which would be gained after the completion of this course. Students are expected to be familiar with decision making process and basic managerial skills to become a better leader.

G. VENKATASWAMY NAIDU COLLEGE (AUTONOMOUS), KOVILPATTI

Programme Structure for B.Sc., Botany

(For those admitted from the academic year 2023-24 and onwards)

Category	Course Type	Course Code	Course Title	Contact Hours	Exam Hours	Marks			Credit
						CIA	ESE	Total Marks	
Semester-1									
PART-I	Language	U23TA1L1	Tamil– I	6	3	25	75	100	3
PART-II	English	U23EN1L1	English - I	6	3	25	75	100	3
PART-III	Core-1	U23BO101	Plant Diversity I – Algae	5	3	25	75	100	5
	Core-2 (Core Lab 1)	U23BO1P1	Plant Diversity I Algae	3	3	40	60	100	3
	Elective Generic -1	U23ZO1A1	Zoology Paper – I	4	3	25	75	100	3
	Elective Generic – Lab	U23ZO1AP	Zoology - Practical	2	3	40	60	100	1
PART-IV	Skill Enhancement Courses SEC1(NME – I)	U23BO1S1A	Organic farming	2	-	50	-	50	2
		U23BO1S1B	Environmental Biotechnology						
		U23BO1S1C	Nursery and Landscaping						
	Foundation Course FC	U23BOFC1	Basics of Botany	2	-	50	-	50	2
TOTAL				**30**				**700**	**22**
Semester-II									
PART-I	Language	U23TA2L2	Tamil– II	6	3	25	75	100	3
PART-II	English	U23EN2L2	English - II	6	3	25	75	100	3
PART-III	Core-3	U23BO202	Plant Diversity II – Fungi, Bacteria, Viruses, Plant pathology and Lichens	5	3	25	75	100	5
	Core-4 (Core Lab 2)	U23BO2P2	Fungi, Bacteria, Viruses, pathology and Lichens – Practical II	3	3	40	60	100	3
	Elective Generic -2	U23ZO2A2	Zoology Paper – II	4	3	25	75	100	3
	Elective Generic – Lab	U21ZO2AP	Zoology Practical – II	2	3	40	60	100	1
	Comprehension - 1(SSC- Online Exam)	U23BO2C1	Comprehension in Botany – I	-	1	-	50	50	1
PART-IV	Skill Enhancement Courses SEC2(NME – II)	U23BO2S2A	Mushroom cultivation	2	-	50	-	50	2
		U23BO2S2B	Herbal Medicine						
		U23BO2S2C	Global climate change						
	Skill Enhancement Courses (DS) SEC3	U23BO2S3	Botanical garden and landscaping	2	2	-	50	50	2
TOTAL				**30**				**750**	**23**

Part-III B.Sc. Botany / Semester – I/

CORE-I: PLANT DIVERSITY I ALGAE (U23BO101)

Lecture Hours	**: 70**	**Tutorial Hours**	**: 5**
Practical Hours	**: -**	**No. of Credit**	**: 05**
Contact Hours per Semester: 75			
Contact hours per Week	**: 05**		
Internal Marks	**: 25**		
External Marks	**: 75**		
Total Marks	**: 100**		

Objectives of the course

The course aims at giving an overall view of the

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

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: Relate to the structural organization, reproduction and significance of algae.

CO2: Demonstrate knowledge in understanding the various life cycle patterns and the fundamental concepts in algal growth

CO3: Explain the benefits of various algal technologies on the ecosystem.

CO4 : Compare and contrast the thallus organization and modes of reproduction in algae.

CO5: Determine the emerging areas of Algal Biotechnology for identifying commercial potentials of algal products and their uses.

CO-PO and PSO Mapping (Course Articulation Matrix)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	1	2	2	1	3	2	2	2
CO 2	3	3	2	2	1	2	2	3	3	2
CO 3	1	3	3	3	2	2	2	2	3	2
CO 4	2	1	2	2	2	3	2	2	2	3
CO 5	2	3	3	3	3	3	3	3	3	3
Total Contribution of COs to POs	11	12	11	12	10	11	12	12	13	12
Weighted Percentage of COs contribution to POs	73.3	80	73.3	80	66.6	73.3	80	80	86.6	80

0-No Correlation; 1-Weak; 2-Moderate; 3-Strong

COURSE CONTENTS

UNIT I: Algal Classification (L-14+T-1 Hrs)

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

UNIT II: Thallus organization (L-14+T-1 Hrs)

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

UNIT III: Reproduction (L-14+T-1 Hrs)

Reproduction-Vegetative, asexual, sexual reproduction and life histories (haplontic-, Oedogonium and Chara, diplontic-Diatoms and Sargassum, diplohaplontic-Ulva and diplobiontic-Gracilaria)

UNIT IV: Algal cultivation methods (L-14+T-1 Hrs)

Algal cultivation methods, Algal production systems; indoor cultivation methods and large-scale cultivation of algae, harvesting of algae.

UNIT V : Beneficial role of Algae (L-14+T-1 Hrs)

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.

Extended ProfessionalComponent (is a part of internal component only,not to be included in the External Examination question paper):

Questions related to the above topics, from various competitive exams UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved (To be discussed during the Tutorial hour).

Skills acquired from this course:

Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill.

Recommended Texts:

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

References 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.
7. Bold, H.C and Wynne, M.J. 1978. Introduction to the Algae: Structure and Function. Prantice Hall of India New Delhi.

Web Resources:

1. https://www.crcpress.com/Therapeutic-and-Nutritional-Uses-ofPereira/p/book/9781498755382
2. https://www.crcpress.com/Therapeutic-and-Nutritional-Uses-of-Algae/Pereira/p/book/9781498755382
3. https://www.crcpress.com/Algae-Anatomy-Biochemistry-and-Biotechnology-Second-Edition/Barsanti-Gualtieri/p/book/9781439867327
4. https://www.crcpress.com/Marine-Algae-Biodiversity-Taxonomy-Environmental-Assessment-and-Biotechnology/Pereira-Neto/p/book/9781466581678
5. https://www.kopykitab.com/Botany-For-Degree-Students-ALGAE-by-B-R-Vashishta-Dr-A-K-Sinha-Dr-V-P-Singh
6. https://www.wileyindia.com/a-textbook-of-algae.html
7. https://www.kobo.com/in/en/ebook/algae-biotechnology

Part-III B.Sc. Botany / Semester – I/

CORE-II PLANT DIVERSITY I ALGAE - PRACTICAL-I (U23BO1P1)

Lecture Hours	**: -**	**Tutorial Hours**	**: -**
Practical Hours	**: 03**	**No. of Credit**	**: 03**
Contact Hours per Semester:	**45**		
Contact hours per Week	**: 03**		
Internal Marks	**: 40**		
External Marks	**: 60**		
Total Marks	**: 100**		

Objectives of the course

The course aims at giving an overall view of the

- 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

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: Recall and identify algae using key identification characters.

CO2: Demonstrate practical skills in preparation of fresh mount and identification of algal forms from algal mixture.

CO3: Describe the internal structure of algae prescribed in the syllabus

CO4: Decipher the algal diversity in fresh/marine water and their economic significance.

CO5: Evaluate the various techniques used to culture algae for commercial purposes

CO-PO and PSO Mapping (Course Articulation Matrix)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	2	3	2	2	3	2	2	3
CO 2	3	3	2	2	2	2	3	1	3	2
CO 3	3	1	1	1	2	3	2	2	3	2
CO 4	3	3	3	2	2	2	2	3	3	2
CO 5	2	3	2	2	3	2	2	2	3	2
Total Contribution of COs to POs	14	12	10	10	11	11	12	10	14	11
Weighted Percentage of COs contribution to POs	93.3	80	66.6	66.6	73.3	73.3	80	66.6	93.3	73.3

0-No Correlation; 1-Weak; 2-Moderate; 3-Strong

COURSE CONTENTS

EXPERIMENTS:

1. Micro-preparation of *Caulerpa* and *Sargassum*.
2. Identifying the micro slides Chlorella, Diatoms, Volvox, Anabaena, Oedogonium,
3. Nostoc, , Chara, Ulva. Vaucheria. Diatoms. Polysiphonia
4. Identifying types of algal mixture.
5. Economic importance of Algae as: (i) Food (ii) Feed (iii) Biofertilizers (iv) Seaweed liquid fertilizer (v) Hydrogen production by algae (vi) SCP (vii) Agar Agar (viii) Alginate (ix) Diatomaceous earth.
6. Field visit to study fresh water/marine water algal habitats.
7. Visit to nearby industry actively engaged in algal technology.

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. Accompanying
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=
3. 8d5DAAAACAAJ&redir_esc=
4. https://freebookcentre.net/biology-books-download/Concepts-of-Botany-Algae-(PDF-21P).html
5. https://www.ebooks.com/en-in/book/210152662/algae/sachin-kumar-mandotra/
6. https://books.google.co.in/books/about/Algae.html?id=s1P855ZWc0kC&redir_esc=y

NON-MAJOR ELECTIVE-I/1.ORGANIC FARMING (U23BO1S1A)

Lecture Hours	**: 25**	**Tutorial Hours**	**: 05**
Practical Hours	**: -**	**No. of Credit**	**: 02**
Contact Hours per Semester: 30			
Contact hours per Week	**: 02**		
Internal Marks	**: 50**		
External Marks	**: -**		
Total Marks	**: 50**		

Objectives of the course

The course aims at giving an overall view of the

- To enable students to gain knowledge on the scope of organic farming and its significance.
- To impart practical insights sustainable agriculture, green manuring, recycling and composting.
- To understand the physical and chemical properties of soil.
- To study sustainable agriculture.
- To know about the importance of biofertilizers.

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: Recognize the different forms of biofertilizers and their uses.

CO2: Explain and interpret the components, patterns, and processes of bacteria for growth in crop production.

CO3: Apply techniques for synthesizing green manure and develop strategies to increase crop yield.

CO4 : Analyze and decipher the significance of biofertilizers in soil fertility.

CO5: Develop new strategies to enhance growth and quality check of medicinal herbs considering the practical issues pertinent to India.

CO-PO and PSO Mapping (Course Articulation Matrix)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	1	3	2	2	3	1	2	2
CO 2	3	3	2	1	2	2	3	3	2	3
CO 3	2	2	3	3	1	3	2	2	2	3

CO 4	3	2	2	1	2	2	2	3	2	3
CO 5	3	3	2	3	2	2	2	2	3	2
Total Contribution of COs to POs	14	12	10	10	9	11	12	11	11	13
Weighted Percentage of COs contribution to POs	93.3	80	66.6	66.6	60	73.3	80	73.3	73.3	86.6

0-No Correlation; 1-Weak; 2-Moderate; 3-Strong

COURSE CONTENTS

UNIT I: Soil (L 5 + T-1 Hours)

Physical, chemical properties. Soil pollution – oil, chemicals –fertilizers, pesticide and herbicide, non-degradable solids, biomagnification, consequences of land pollution – damage to soil and crops.

UNIT II: Organic farming (L 5 + T-1 Hours)

Organic farming – definition, basic concept of organic farming, integrated plant nutrient supply management, integrated insect pest and disease management, integrated soil and water management. Sustainable agriculture practices-crop rotation, mixed cropping.

UNIT III: Management of organic wastes and green manures(L 5 + T-1 Hours)

Farm manures, Composts, Mulches and pest control, importance of organic manure, importance of green manure, crops of green manure, oil cake. Animal based organic manure–cow dung.

UNIT IV: Bio fertilizers (L 5 + T-1 Hours)

Classification, nitrogen fixers–*Rhizobium*, Cyanobacteria, *Azolla* and Vesicular Arbuscular Mycorrhiza.

UNIT V: Recycling of bio-degradable municipal, agricultural and Industrial wastes (L 5 + T-1 Hours)

Biocompost making methods. vermicompost-methods, production and utilization.

Recommended Texts:

1. NIIR Board. 2012. The complete Technology Book on Biofertilizer and organic farming. 2nd Edition. NIIR Project Consultancy Services.
2. Sathe, T.V. 2004. Vermiculture and Organic Farming. Daya publishers.
3. Subba Rao N.S. 2017. Biofertilizers in Agriculture and Forestry. Fourth Edition.Medtech.
4. Vayas,S.C, Vayas, S. and Modi, H.A. 1998. Bio-fertilizers and organic Farming Akta Prakashan, Nadiad.
5. Dongarjal, R.P and Zade, S.B. 2019. Insect Ecology and Integrated Pest Management Akinik Publications, New Delhi.

Reference Books:

1. 1. Vayas,S.C, Vayas, S and Modi, H.A. 1998. Bio-fertilizers and organic Farming Akta Prakashan, Nadiad.
2. Sathe, T.V.2004. Vermiculture and Organic Farming. Daya publishers.
3. 3 Subha Rao, N.S.2000. Soil Microbiology, Oxford & IBH Publishers, New Delhi.
4. Reddy, S.R. 2019. Fundamentals of Agronomy Kalyani Publications, Uttar Pradesh.
5. Tolanur, S. 2018. Fundamentals of Soil Science IIndEdition , CBS Publishers , New Delhi.

Web Resources:

1. https://www.amazon.com/Beginners-Practical-botanical-horticulture-landscape-ebook/dp/B00MOURUNY
2. https://www.e-booksdirectory.com/listing.php?category=323
3. http://www.freebookcentre.net/Biology/Agriculture-Books.html
4. https://casfs.ucsc.edu/about/publications/Teaching-Organic-Farming/PDF-downloads/TOFG-all.pdf
5. https://www.amazon.in/s?k=the+organic+farming+manual&hvadid=72636563575133&hvbmt=bb&hvdev=c&hvqmt=b&tag=msndeskstdin-21&ref=pd_sl_6sbf0qtxcy_b

NON-MAJOR ELECTIVE-I/2. ENVIRONMENTAL BIOTECHNOLOGY (U23BO1S1B)

Lecture Hours	**: 25**	**Tutorial Hours**	**: 05**
Practical Hours	**: -**	**No. of Credit**	**: 02**
Contact Hours per Semester:30			
Contact hours per Week	**: 02**		
Internal Marks	**: 50**		
External Marks	**:**		
Total Marks	**: 50**		

Objectives of the course

The course aims at giving an overall view of the

- To introduce the student to the various developed and applications of environmental biotechnology.
- To provide knowledge about the scope of bioremediation and bioleaching using GMOs.
- To study about pollution of water bodies.
- To know about bioremediation.
- To study about biomineralization.

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: Recognize the various causes of pollution and control measures.

CO2: Explain about the beneficially role of GMOs on environment

CO3: Reflect upon various sustainable environmental protection strategies.

CO4: Analyze the different methods of air, water, and soil quality monitor process.

CO5: Evaluate the implications of international legislations and policies for environmental protection.

CO-PO and PSO Mapping (Course Articulation Matrix)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	1	3	2	2	3	2	2	3
CO 2	3	3	2	2	2	2	3	1	3	2
CO 3	2	2	3	3	2	3	2	2	3	2
CO 4	3	3	3	3	2	2	2	3	3	2
CO 5	3	3	2	3	3	2	2	2	3	2
Total Contribution of COs to POs	14	14	11	14	11	11	12	10	14	11
Weighted Percentage of COs contribution to POs	93.3	93.3	73.3	93.3	73.3	73.3	80	66.6	93.3	73.3

0-No Correlation; 1-Weak; 2-Moderate; 3-Strong

COURSE CONTENTS

UNIT I : Introduction: (L 5 + T-1 Hours)

The environment-soil, water and air, Pollution and its causes (outline only)

UNIT II : Source and treatment of polluted waters and effluents:(L 5 + T-1 Hours)

Pollution of water bodies by heavy metals and pesticides – removal of heavy metals and pesticides by Biosorption. Removal of oil spills by using microbes. Biological treatment of sewage – characteristics of sewage and objectives in sewage treatment – Anaerobic digestion.

UNIT III : Soil and air pollution and their treatment: (L 5 + T-1 Hours)

Soil pollution by Xenobiotics. Degradation of Xenobiotics – pathways of phenol, penta chlorophenol and polychlorinated biphenyl degradation.

UNIT IV: Bioremediation: (L 5 + T-1 Hours)

Introduction to bioremediation, *ex situ* and *in situ* bioremediation.

UNIT V: Biometallurgy and related topics: (L 5 + T-1 Hours)

Biomineralization – bioleaching - Biofilms and biocorrosion.

Recommended Texts:

1. Alan Scragg. 1999. Environmental Biotechnology. Pearson Education Limited.
2. Dubey R.C. 2004. A text book of Biotechnology aspects of microbiology, British Sun Publication.
3. Joseph C. Deniel. 1996. Environmental aspects of microbiology, British Sun Publication.
4. Keeshav Thehan. 1997. Biotechnology, New age international)P) Limited, New Delhi.
5. Chandra, A.M and Ghosh, S.K. 2010. Remote sensing and Geographical Information System, Narosa Publishing House Pvt. Ltd. New Delhi.

Reference Books:

1. Sharma, P.D. 2005. Environmental Microbiology, Narosa Publishing House Pvt. Ltd., New Delhi.
2. Raina Maier M. Iran Pepper L., Charles P. Gerba, 2000, Environmental Microbiology Academic press, U.K.
3. Alexander N. Glazer and Hiroshi Nikaido. 1994. Microbial Biotechnology.
4. Special issue on Bioremediation and biodegradation. Indian Journal of Experimental Biology, September 2003. Vol. 41(9). National Institute of Science Communication and Information Resources, CSIR New Delhi.
5. Keddy, P.A. 2017. Plant Ecology: Origins, processes, consequences. 2nd ed. Cambridge University Press. ISBN. 978-1107114234.

Web Resources:

1. https://www.elsevier.com/books/environmental-biotechnology/vallero/978-0-12-407776-8
2. http://www.freebookcentre.net/biology-books-download/Environmental-Biotechnology.html
3. https://www.amazon.in/INTRODUCTION-ENVIRONMENTAL-BIOTECHNOLOGY-K-Chatterji-ebook/dp/B00K7YGIWI
4. https://books.google.co.in/books/about/Textbook_of_Environmental_Biotechnology.html?id=Q2ROFx0WtBQC&redir_esc=y
5. http://library.umac.mo/ebooks/b28045907.pdf

NON-MAJOR ELECTIVE-I/ 3.NURSERY AND LANDSCAPING (U23BO1S1C)

Lecture Hours	**: 25**	**Tutorial Hours**	**: 05**
Practical Hours	**: -**	**No. of Credit**	**: 02**
Contact Hours per Semester: 30			
Contact hours per Week	**: 02**		
Internal Marks	**: 50**		
External Marks	**:**		
Total Marks	**: 50**		

Objectives of the course

The course aims at giving an overall view of the

- To recognize the importance of growing plants and practice the knowledge gained by developing kitchen garden and ornamental garden.
- To be able to design gardens and become entrepreneur in Horticulture.
- To study the methods of propagation.
- To know about nursery structure.
- To learn about gardening.

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: Recognize the basic principles and components of gardening.

CO2: Explain about bio-aesthetic planning and conceptualize flower arrangement

CO3: Apply techniques for design various types of gardens according to the culture and art of bonsai.

CO4: Compare and contrast different garden styles and landscaping patterns.

CO5: Establish and maintain special types of gardens for outdoor and indoor landscaping.

CO-PO and PSO Mapping (Course Articulation Matrix)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	1	3	2	2	3	2	2	3
CO 2	3	3	2	2	2	2	3	1	3	2
CO 3	2	2	3	3	2	3	2	2	3	2
CO 4	3	3	3	3	2	2	2	3	3	2
CO 5	3	3	2	3	3	2	2	2	3	2
Total Contribution of COs to POs	14	14	11	14	11	11	12	10	14	11
Weighted Percentage of COs contribution to POs	93.3	93.3	73.3	93.3	73.3	73.3	80	66.6	93.3	73.3

0-No Correlation; 1-Weak; 2-Moderate; 3-Strong

COURSE CONTENTS

UNIT I: Introduction (L 5 + T-1 Hours)

Prospects and scope of nursery and landscaping.

UNIT II: Methods of Propagation (L 5 + T-1 Hours)

Cutting, layering, grafting, budding, Floriculture – Rose, Chrysanthemum, Jasmine – cultivation.

UNIT III: Types of Gardening (L 5 + T-1 Hours)

Formal garden, informal garden, vegetable garden, landscaped layout designing – formation and maintenance of lawn.

UNIT IV: Nursery structures (L 5 + T-1 Hours)

Green house – Shade house, Mist chamber – Topiary, Bonsai culture.

UNIT V: Manures, composting – vermicomposting. **(L 5 + T-1 Hours)**

Extended ProfessionalComponent (is a part of internal component only,Not to be included in the External Examination question paper) :

Questions related to the above topics, from various competitiveexaminations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved (To be discussed during the Tutorial hour).

Skills acquired from this course: Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill.

Recommended Texts:

1. Amarnath V. 2006. Nursery and Landscaping, M/s IBD Publishers, New Delhi.
2. Butts, E and Stensson, K. 2012. Sheridan Nurseries: One hundred years of People, Plans, and Plants. Dundurn Group Ltd.
3. Russell, T. 2012. Nature Guide: Trees: The world in your hands(Nature Guides). Mukherjee D. Gardening in India, Oxford IBH publishing co, New Delhi.
4. Kumar, N. 1997. Introduction to Horticulture, Rajalakshmi Publications, Nagercoil.
5. Butts, E. and Stensson, K. 2012.Sheridan Nurseries: One hundred years of People,Plans, and Plants. Dundurn Group Ltd.

Reference Books:

1. Edmond Musser and Andres, Fundamentals of Horticulture, McGraw Hill Book Co. New Delhi.
2. Agrawal, P.K. 1993. Hand Book of Seed Technology, Dept. of Agriculture and Cooperation, National Seed Corporation Ltd., New Delhi.
3. Janick Jules. 1979. Horticultural Science. (3rd Ed.), W.H. Freeman and Co.,San Francisco, USA.
4. Singh, J. 2018. Fundamentals of Horticulture. Kalyani Publishers.
5. Sharma V. K. 1999. Encyclopaedia of Practical Horticulture, Vol I –IV, Deep And Deep Publ. Pvt. Ltd.

Web Resources:

1. https://www.kopykitab.com/higher-education-ebooks/higher-education-ebooks/Agricultural-Industry-agriculture-eBooks/Nursery-And-Landscaping-by-V-Amarnath
2. https://www.amazon.in/Nursery-Landscaping-Veena-Amarnath/dp/8177542788
3. https://www.amazon.in/Gardening/b?ie=UTF8&node=1637077031
4. https://in.pinterest.com/pin/496733033900458021/?lp=true
5. https://www.gardenvisit.com/ebooks

FOUNDATION COURSE FOR BOTANY

BASICS OF BOTANY (U23BOFC1)

Lecture Hours	**: 25**	**Tutorial Hours**	**: 05**
Practical Hours	**: -**	**No. of Credit**	**: 02**
Contact Hours per Semester:30			
Contact hours per Week	**: 02**		
Internal Marks	**: 50**		
External Marks	**:**		
Total Marks	**: 50**		

Objectives of the course

- To learn about the classification, distinguishing traits, geographic distribution, and reproductive cycle of algae, fungi, lichens, and bryophytes.
- To understand the biodiversity by describing and explaining the morphology and reproductive processes of algae, fungi, bryophytes and microorganisms.
- To investigate the classification, distinctive traits, distribution and reproduction and life history of the various classes and major types of Pteridophytes and Gymnosperms.
- Enable to learn various cell structures and functions of prokaryotes and eukaryotes and understand the salient features and functions of cellular organelles.
- Understanding of laws of inheritance, genetic basis of loci and alleles.

Course Learning Outcomes

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

CO1. Increase the awareness and appreciation of human friendly algae and their economic importance.

CO 2.Develop an understanding of microbes and fungi and appreciate their adaptive strategies

CO 3.Develop critical understanding on morphology, anatomy and reproduction of Bryophytes, Pteridophytes and Gymnosperms.

CO4.Compare the structure and function of cells and explain the development of cells.

CO5.Understand the core concepts and fundamentals of plant biotechnology and genetic engineering.

CO-PO and PSO Mapping (Course Articulation Matrix)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	2	3	3	3	3
CO 2	3	3	3	3	3	2	3	3	3	3
CO 3	2	3	3	3	3	3	2	1	3	3
CO 4	3	3	2	3	3	2	2	3	3	2
CO 5	3	3	2	2	2	2	2	2	2	1
Total Contribution of COs to POs	14	15	13	14	14	11	12	12	14	12
Weighted Percentage of COs contribution to POs	93.3	100	86.6	93.3	93.3	73.3	80	80	93.3	80

0-No Correlation; 1-Weak; 2-Moderate; 3-Strong

COURSE CONTENTS

UNIT I:BIODIVERSITY (L 5 + T-1 Hours)

Systematics: Two Kingdom and Five Kingdom systems - Salient features of various Plant Groups : Algae, Fungi, Bryophytes, Pteridophytes and Gymnosperms- Viruses - Bacteria.

UNIT II: CELL BIOLOGY (L 5 + T-1 Hours)

Cell as the basic unit of life - Prokaryotic and Eukaryotic Cell (Plant Cell) - Light Microscope and Electron Microscope Ultra Structure of Prokaryotic and Eukaryotic Cells - Cell Wall - Cell Membrane, Nucleus and Mitochandria.

UNIT III: PLANT MORPHOLOGY (L 5 + T-1 Hours)

Structure and Modification of Root, Stem and Leaf - Structure and Types of Inflorescences - Structure and Types of Flowers, Fruits and Seeds.

UNIT IV: GENETICS (L 5 + T-1 Hours)

Concept of Heredity and Variation - Mendel's Laws of Inheritance.

UNIT V: PLANT PHYSIOLOGY (L 5 + T-1 Hours)

Cell as a Physiological Unit: Water relations -Absorption and movement: Diffusion, Osmosis, Plasmolysis, Imbibition -Permeability, Water Potential - Transpiration – Movement.

Extended Professional Component (is a part of internal component only, not to be included in the External Examination question paper)

Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)

Skills acquired from this course:

Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill

Recommended Texts

1. Singh, V., Pande, P.C and 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, MacMillan India Ltd. Delhi.
4. Lee, R.E. 2008. Phycology, IV Edition, Cambridge University Press, New Delhi.
5. Pandey B.P. 1986, Text Book of Botany (College Botany) Vol I and II,
6. S.Chand and Co. New Delhi.
7. 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 Embryophyta –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.

Web Resources

1. 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. 5.https://arboretum.harvard.edu/wp-content/uploads/2013-70-4-beyond-pine-cones-an-introduction-to-gymnosperms.pdf
6. https://www.us.elsevierhealth.com/medicine/cell-biology
7. https://www.kobo.com/us/en/ebook/plant-biotechnology-1

II SEMESTER

Category	Course Type	Course Code	Course Title	Contact Hours	Exam Hours	Marks			Credit
						CIA	ESE	Total Marks	
Semester-II									
PART-I	Language	U23TA2L2	Tamil– II	6	3	25	75	100	3
PART-II	English	U23EN2L2	English - II	6	3	25	75	100	3
PART-III	Core-3	U23BO202	Plant Diversity II – Fungi, Bacteria, Viruses, Plant pathology and Lichens	5	3	25	75	100	5
	Core-4 (Core Lab 2)	U23BO2P2	Fungi, Bacteria, Viruses, pathology and Lichens – Practical II	3	3	40	60	100	3
	Elective Generic -2	U23ZO2A2	Zoology Paper – II	4	3	25	75	100	3
	Elective Generic – Lab	U21ZO2AP	Zoology Practical – II	2	3	40	60	100	1
	Comprehension - 1(Self Study Course- Online Exam)	U23BO2C1	Comprehension in Botany – I	-	1	-	50	50	1
PART-IV	Skill Enhancement Courses SEC2(NME – II)	U23BO2S2A	Mushroom cultivation	2	-	50	-	50	2
		U23BO2S2B	Herbal Medicine						
		U23BO2S2C	Global climate change						
	Skill Enhancement Courses (DS) SEC3	U23BO2S3	Botanical garden and landscaping	2	2	-	50	50	2
TOTAL				**30**				**750**	**23**

Part-III B.Sc. Botany / Semester – II

CORE-III PLANT DIVERSITY II FUNGI, BACTERIA, VIRUSES, PLANT PATHOLOGY AND LICHENS (U23BO202)

Lecture Hours	**: 85**	**Tutorial Hours**	**: 05**
Practical Hours	**: -**	**No. of Credit**	**: 04**
Contact Hours per Semester:	**75**		
Contact hours per Week	**: 5**		
Internal Marks	**: 25**		
External Marks	**: 75**		
Total Marks	**: 100**		

Objectives of the course

The course aims at giving an overall view of the

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

Course Learning Outcomes (for Mapping with Pos and PSOs)

On completion of the course the students should be able to

CO1: Recognize the general characteristics of microbes, fungi and lichens and disease symptoms.

CO2: Develop an understanding of microbes, fungi and lichens and appreciate their adaptive strategies based on structural organization.

CO3: Identify the common plant diseases, according to geographical locations and device control measures.

CO4: Analyze the emerging trends in fungal biotechnology with special reference to agricultural and pharmaceutical applications.

CO5: Determine the economic importance of microbes, fungi and lichens.

CO-PO and PSO Mapping (Course Articulation Matrix)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	1	3	2	1	2	2	2	2
CO 2	3	3	2	2	3	3	2	1	2	1
CO 3	2	2	3	3	1	2	1	3	1	3
CO 4	3	3	3	3	3	2	3	3	3	3
CO 5	3	3	2	3	2	3	3	3	3	3
Total Contribution of COs to POs	14	14	11	14	12	11	11	12	11	12
Weighted Percentage of COs contribution to POs	93.3	93.3	73.3	93.3	80	73.3	73.3	80	73.3	80

0-No Correlation; 1-Weak; 2-Moderate; 3-Strong

COURSE CONTENTS

UNIT I: FUNGI (L-14+T-1 Hours)

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 (*Mucor*), Ascomycotina (*Saccharomyces*), Basidiomycotina (*Agaricus*) and Deuteromycotina (*Cercospora,)*.

UNIT II: ECONOMIC IMPORTANCE OF FUNGI: (L-14+T-1 Hours)

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.

UNIT III: BACTERIA, VIRUS: (L-14+T-1 Hours)

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

UNIT IV: PLANT PATHOLOGY: (L-14+T-1 Hours)

General symptoms of plant diseases; Geographical distribution of diseases; Etiology; Host-Pathogen relationships; Disease cycle and environmental relation; prevention, symptoms 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 of groundnut.

UNIT V : **LICHEN:** **(L-14+T-1 Hours)**

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.

Extended Professional Component (is a part of internal component only, not to be included in the External Examination question paper)

Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC–CSIR/GATE/TNPSC/others to be solved (To be discussed during the Tutorial hour).

Skills acquired from this course:

Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill.

Recommended Texts:

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.
7. Mahendra Rai. 2009. Advances in Fungal Biotechnology. I.K. International Publishing House, New Delhi.

References Books:

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.
10. Pandey, B.P. 2005. College Botany I: Including Algae, Fungi, Lichens, Bacteria, Viruses, Plant Pathology, Industrial Microbiology and Bryophyta. S Chand & Company.

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
6. http://www.freebookcentre.net/biology-books-download/Fungi-(PDF-15P).html

Part-III B.Sc. Botany / Semester – II

CORE-IV PLANT DIVERSITY II FUNGI, BACTERIA, VIRUSES, PATHOLOGY AND LICHENS - PRACTICAL-II (U23BO2P2)

Lecture Hours	**: -**	**Tutorial Hours**	**: -**
Practical Hours	**: 3**	**No. of Credit**	**: 03**
Contact Hours per Semester:	**45**		
Contact hours per Week	**: 3**		
Internal Marks	**: 40**		
External Marks	**: 60**		
Total Marks	**: 100**		

Objectives of the course

The course aims at giving an overall view of the

- To enable students to identify microscopic and macroscopic fungi.
- To prepare microslides of fungi and lichens.
- To know the presence of pathogen inside the plant tissues through microscopic sections.
- To identify the bryophytes based on the morphology, and microslides.
- To know the economic importance of the microbes studied.

Course Learning Outcomes (for Mapping with Pos and PSOs)

On completion of the course the students should be able to

CO1: Identify microbes, fungi and lichens using key identifying characters

CO2: Develop practical skills for culturing and cultivation of fungi.

CO3: Identify and select suitable control measures for the common plant diseases.

CO4: Analyze the characteristics of microbes, fungi and plant pathogens

CO5: Access the useful role of fungi in agriculture and pharmaceutical industry.

CO-PO and PSO Mapping (Course Articulation Matrix)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	1	3	2	1	2	2	2	1
CO 2	2	3	2	2	3	3	2	3	3	3
CO 3	2	2	3	3	1	2	1	3	1	2
CO 4	3	3	3	3	3	2	3	3	3	2
CO 5	3	3	2	3	2	3	3	3	2	3
Total Contribution of COs to POs	13	14	11	14	11	11	11	14	11	11
Weighted Percentage of COs contribution to POs	86.6	93.3	73.3	93.3	73.3	73.3	73.3	93.3	73.3	73.3

0-No Correlation; 1-Weak; 2-Moderate; 3-Strong

COURSE CONTENTS

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 (Fungi & Lichen).
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. Study of thallus and reproductive structures (apothecium) through permanent slides.
13. Economic importance of Lichens - Dye and perfume.

Recommended Texts:

1.Chmielewski, J.G and Krayesky, D. 2013. General Botany laboratory Manual. AuthorHouse, Bloomington, USA.

2. Das, S and Saha, R. 2020. Microbiology Practical Manual. CBS Publishers andDistributors (P) Ltd., New Delhi, India.

3. Webster, J and Weber, R. 2007. Introduction to Fungi, 3rd Ed. Cambridge UniversityPress, Cambridge.

4. Nair, L.N. 2007. Topics in Mycology and Pathology, New Central Book agency, Kolkata.

5. Nair, L.N. 2007. Topics in Mycology and Pathology, New Central Book agency, Kolkata.

References Books:

1. Alexopoulos, J and Mims, W. 1985. Introductory Mycology, Wiley Eastern Limited NewDelhi.
2. Bendre, M. Ashok and Ashok Kumar, A. 2020. Text Book of Practical Botany 1 (10th ed). Rastogi Publications, Meerut.
3. Singh, R and U.C. Singh 2020. Modern mushroom cultivation, 3d Edition Agrobios (India), Jodhpur.
4. Poonam Singh and Ashok Pandey. 2009. Biotechnology for agro-Industrial residues utilization. Springer.
5. Satyanarayana T and Johri B.N. 2005. Microbial diversity, Current Perspectives and Potential Applications, IK International.

Web Resources:

1. https://www.amazon.in/Practical-Manual-Fungi-Fungicides/dp/B0025AEFP4
2. https://books.google.co.in/books/about/Practical_Mycology.html?id=5ycJAQAAMAAJ&redir_esc=y
3. https://www.flipkart.com/colour-handbook-practical-plant-pathology/p/itmefsn6dyhfhs9b
4. https://books.google.co.in/books/about/Practical_Botany.html?id=T5narQEACAAJ&redir_esc=y
5. https://www.kobo.com/us/en/ebook/introduction-to-fungi.

NON-MAJOR ELECTIVE-II

1. MUSHROOM CULTIVATION (U23BO2S2A)

Lecture Hours	**: 25**	**Tutorial Hours**	**: 5**
Practical Hours	**: -**	**No. of Credit**	**: 2**
Contact Hours per Semester:	**30**		
Contact hours per Week	**: 2**		
Internal Marks	**: 50**		
External Marks	**: -**		
Total Marks	**: 50**		

Objectives of the course

The course aims at giving an overall view of the

- To learn and develop skills in mushroom cultivation.
- To understand and appreciate the role of mushrooms in Nutrition, Medicine and health.
- To cultivate mushroom cultivation in small scale industry.
- To learn about diseases and post-harvest technology.
- To study new methods and strategies to contribute to mushroom production.

Course Learning Outcomes (for Mapping with Pos and PSOs)

On completion of the course the students should be able to

CO1: Recall various types and categories of mushroom.

CO2: Explain about various types of food technologies associated with mushroom industry.

CO3: Apply techniques studied for cultivation of various types of mushroom.

CO4: Analyze and decipher the environmental factors and economic value associated with mushroom cultivation

CO5: Develop new methods and strategies to contribute to mushroom production.

CO-PO and PSO Mapping (Course Articulation Matrix)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	1	3	2	1	2	2	2	1
CO 2	2	3	2	2	3	3	2	3	3	3
CO 3	2	2	3	3	1	2	1	3	1	2
CO 4	3	3	3	3	3	2	3	3	3	2
CO 5	3	3	2	3	2	3	3	3	2	3
Total Contribution of COs to POs	13	14	11	14	11	11	11	14	11	11
Weighted Percentage of COs contribution to POs	86.6	93.3	73.3	93.3	73.3	73.3	73.3	93.3	73.3	73.3

0-No Correlation; 1-Weak; 2-Moderate; 3-Strong

COURSE CONTENTS

UNIT I : Introduction: (L 5 + T-1 Hours)

Morphology, Types of Mushroom, identification of edible and poisonous mushroom, Nutritive values, life cycle of common edible mushrooms.

UNIT II: Cultivation Method (L 5 + T-1 Hours)

Cultivation of *Pleurotus spp* and *Agaricus spp.*

UNIT III: Spawn (L 5 + T-1 Hours)

Spawn production, growth media, spawn running and harvesting of mushrooms and marketing.

UNIT IV: Cultivation (L 5 + T-1 Hours)

Mushroom cultivation, prospects and scope of Mushroom cultivation in small scale Industry.

UNIT V: Post harvest Techniques (L 5 + T-1 Hours)

Diseases and post-harvest technology, Insect pests, nematodes, mites, viruses, fungal competitors and other important diseases.

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination questionpaper)

Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC–CSIR/GATE/TNPSC/others to be solved (To be discussed during the Tutorial hour).

Skills acquired from this course:

Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill.

Recommended Texts:

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. Sing. 2005. Modern Mushroom Cultivation, International Book Distributors, Dehradun.
5. 5. Verma, 2013. Mushroom: edible and medicinal: cultivation conservation, strainimprovement with their marketing. Daya Publishing House

References Books:

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. Dr.C. Sebastian Rajesekaran Reader in Botany Bishop Heber College, Trichy – 17.
5. Suman. 2005. Mushroom Cultivation Processing and Uses, M/s. IBD Publishers and Distributors, New Delhi.

Web Resources:

1. https://www.amazon.in/Mushroom-Cultivation-India-B-C/dp/817035479X
2. http://nrcmushroom.org/book-cultivation-merged.pdf
3. http://agricoop.nic.in/sites/default/files/ICAR_8.pdf
4. http://www.agrimoon.com/mushroom-culture-horticulture-icar-pdf-book/
5. https://books.google.co.in/books/about/Mushroom_Cultivation_in_India.html?id=6AJx99OGTKEC&redir_esc=y

NON-MAJOR ELECTIVE-II

2. HERBAL MEDICINE (U23BO2S2B)

Lecture Hours	**: 25**	**Tutorial Hours**	**: 05**
Practical Hours	**: -**	**No. of Credit**	**: 02**
Contact Hours per Semester:	**30**		
Contact hours per Week	**: 02hrs**		
Internal Marks	**: 50**		
External Marks	**: -**		
Total Marks	**: 50**		

Objectives of the course

The course aims at giving an overall view of the

- To understand the nuances of medicinal plants and their phytoconstituents of commercial value
- To design and develop medicinal garden.
- To apply the knowledge to cultivate medical plants.
- To know the pharmacological importance of medicinal plants.
- To enlist phytochemicals and secondary metabolites of market and commercial value.

Course Learning Outcomes (for Mapping with Pos and PSOs)

On completion of the course the students should be able to

CO1: Define and describe the principle of cultivation of herbal products.

CO2: Explain about the phytochemistry of economically important medicinal herbs

CO3: Apply techniques for evaluation of drug adulteration through biological testing.

CO4: Formulate the value added processing / storage / quality control for the better use of herbal medicine.

CO5: Develop the skills for cultivation of plants and their value added processing/storage /quality control.

CO-PO and PSO Mapping (Course Articulation Matrix)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	1	2	2	2	1	3	2	1
CO 2	3	3	2	1	2	2	2	2	2	2
CO 3	2	2	2	3	2	2	1	3	2	1
CO 4	3	2	2	2	2	2	3	3	2	3
CO 5	3	3	2	2	1	1	3	3	1	3
Total Contribution of COs to POs	14	12	9	10	9	9	10	14	9	10
Weighted Percentage of COs contribution to POs	93.3	79.9	60	66.6	60	60	66.6	93.3	60	66.6

0-No Correlation; 1-Weak; 2-Moderate; 3-Strong

COURSE CONTENTS

UNIT I: Introduction (L 5 + T-1 Hours)

Importance and Relevance of Herbal drugs in Indian System of Medicine, Pharmacognosy – Aim and scope.

UNIT II: Medicinal gardening (L 5 + T-1 Hours)

Gardens in the Hills and plains; House gardens; plants for gardening – Poisonous plants – Types of plant poison; action of poisons; treatment for poisons, some poisonous plants; their toxicity and action.

UNIT III: Adulteration (L 5 + T-1 Hours)

Adulteration of crude drugs and its detection – methods of adulteration; types of adulteration. Medicinal plants of export values; rejuvenating herbs; Medicinal uses of Non-flowering plants.

UNIT IV: Botanical description (L 5 + T-1 Hours)

Botanical description and active principles of Root drugs; Rhizomes woods and bark drugs (Two examples for each plant organs).

UNITV:Botanical description and active principles (L 5 + T-1 Hours)

Botanical description and active principles of leaves; Flowers; Fruits seed and entire plants as drugs. Taxonomic study of some selected herbals (Two examples for each plant organs).

Extended Professional Component (is a part of internal component only,Not to be included in the External Examination questionpaper)

Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC–CSIR/GATE/TNPSC/others to be solved (To be discussed during the Tutorial hour).

Skills acquired from this course:

Knowledge, ProblemSolving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill.

Recommended Texts:

1. Somasundaram, S. 1997. Medicinal botany (Maruthuvar Thavaraviyal) – (Tamil Medium Book).
2. Wallis, T.E. 1967. Text Books of Pharmacognosy. J. & A. Churchill Ltd., London,
3. Jains, S.K.. 1996. Medicinal Plants. Deep Publications, New Delhi.
4. Srivastava, A.K. 2006, Medicinal Plants, International Book Distributors, Dehradun.
5. Agarwal,O.P. 1985, Vol. II, Chemistry of organic – natural products. S Chand & Company, New Delhi.
6. Gamble, J.S. and Fisher, 1921, CEC I, II, III Flora of the Presidency, Madras Volumes.
7. Mathew K.M., 1988, Flora of the Tamilnadu and Carnatic.

References Books:

1. Nair, N.C and Henrry, A.N. 1983, Flora of Tamil Nadu, India, Botanical Survey of India.
2. Chopra, R.N., Nagar S.L., and Chopra, I.C. 1956, Glossary of Indian Medicinal Plants.
3. Chopra, R.N., Chopra, I.C., Handa, K.L., and Kapur L.D., 1994, Indigenous drugs of India.
4. Chopra, R.N., Badhuvar R.L and Gosh, G. 1965. Poisonous plants in India.
5. Miller, L and Miller, B. 2017. Ayurveda & Aromatherapy: The Earth Essential Guide to Ancient Wisdom and Modern Healing. *Motilal Banarsidass, Fourth edition.*
6. Patri, F and Silano, V. 2002. Plants in cosmetics: Plants and plant preparations used as ingredients for cosmetic products - Volume 1. ISBN 978-92-871-8474-0, pp 218.

Web Resources:

1. https://www.barnesandnoble.com/b/free-ebooks/nook-books/alternative-medicine-natural-healing/herbal-medicine/_/N-ry0Z8qaZ11iu
2. https://www.springer.com/gp/book/9783540791157
3. https://www.gpatonline.com/gpat/book-reference-pharmacognosy
4. https://www.researchgate.net/publication/334670695_Book_review Herbal_Drug_Technology
5. http://www.eurekaselect.com/node/173492/herbal-medicine-back-to-the-future.

NON-MAJOR ELECTIVE-II

3. GLOBAL CLIMATE CHANGE (U23BO2S2C)

Lecture Hours	**: 25**	**Tutorial Hours**	**:05**
Practical Hours	**: -**	**No. of Credit**	**:02**
Contact Hours per Semester: 30			
Contact hours per Week	**: 02hrs**		
Internal Marks	**: 50**		
External Marks	**: -**		
Total Marks	**: 50**		

Objectives of the course

The course aims at giving an overall view of the

- To gain insights on the impact of greenhouse effect on global climate change and mitigation measures.
- To understand the implications of carbon and ecological footprint.
- To apply the knowledge to greenhouse effects.
- To know the rain and its effects on plants.
- To know about Global Environmental change issues.

Course Learning Outcomes (for Mapping with Pos and PSOs)

On completion of the course the students should be able to

CO1: Relate to the anthropogenic pressure on the environment and carbon footprint.

CO2: Explain about the physical basis of natural green gas house effect on man and materials.

CO3: Evaluate human influenced driver of our climate system and its applications.

CO4: Analyze the causes and effects of depletion of the stratospheric ozone layer.

CO5: Develop new strategies to mitigate issues of global environmental change.

CO-PO and PSO Mapping (Course Articulation Matrix)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	1	3	2	1	2	2	1	3
CO 2	3	2	1	2	3	3	2	3	1	2
CO 3	2	2	3	1	1	2	3	2	3	1
CO 4	3	3	3	2	1	1	3	2	3	2
CO 5	3	2	2	3	2	3	1	2	2	3
Total Contribution of COs to POs	14	12	10	10	9	10	11	11	10	11
Weighted Percentage of COs contribution to POs	93.3	79.9	66.6	66.6	60	66.6	73.2	73.2	66.6	73.2

0-No Correlation; 1-Weak; 2-Moderate; 3-Strong

COURSE CONTENTS

UNIT I: Introduction (L 5 + T-1 Hours)

Global Environmental change issues. UNFCC, IPCC, Koyoto protocol, CDM, Carbon footprint and ecological footprint.

UNIT II: Stratospheric ozone layer: (L 5 + T-1 Hours)

Evolution of ozone layer; Causes of depletion and consequences; Effects of enhanced UV-B on plants, microbes, animals, human health and materials; Global efforts for mitigation ozone layer depletion.

UNIT III: Climate change: (L 5 + T-1 Hours)

Greenhouse effects; causes; Greenhouse gases and their sources; Consequences of climate, oceans, agriculture, natural vegetation and humans; International efforts on climate change issues.

UNIT IV: Atmospheric deposition: (L 5 + T-1 Hours)

Past and present scenario; Causes and consequences of excessive atmospheric deposition of nutrients and trace elements; Eutrophication.

UNIT V: Acid rain (L 5 + T-1 Hours)

Acid rain and its effects on plants, animals, microbes and ecosystems.

Extended Professional Component (is a part of internal component only,Not to be included in the External Examination questionpaper)

Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC–CSIR/GATE/TNPSC/others to be solved (To be discussed during the Tutorial hour).

Skills acquired from this course:

Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill.

Recommended Texts:

1. Adger, N. Brown, K and Conway, D. 2012. Global Environmental Change: Understanding the Human Dimensions. The National Academic Press.
2. Turekian. K. K. 1996. Global Environmental Change-Past, Present, and Future. Prentice-Hall.
3. Eugene Odum, 2017. Fundamentals of Ecology 5th Ed. Cengage, Bengaluru.
4. Sharma P.D. 2019. Plant ecology and phytogeography, Rastogi Publications, Meerut.
5. Neeraj Nachiketa. 2018 Environmental & Ecology A Dynamic approach. 2nd Edition GKP Access Publishing.

References Books:

1. Matthew. R.A. 2009. Jon Barnett, Bryan McDonald. Global Environmental Change and Human Security. MIT Press., USA.
2. Hester, R.E and Harrison, R.M. 2002. Global Environmental Change. Royal Society of Chemistry.
3. Keddy, P.A. 2017. Plant Ecology: Origins, processes, consequences. 2nd ed. Cambridge University Press. ISBN. 978-1107114234.
4. Krishnamurthy, K.V. 2004. An Advanced Text Book of Biodiversity- Principles and Practices. Oxford and IBH Publications Co. Pvt. Ltd. New Delhi.
5. Kormondy, E.J. 2017. Concepts of Ecology. Prentice Hall, U.S.A. 4th edition.

Web Resources:

1. https://www.ebooks.com/en-us/subjects/the-environment-climate-change-ebooks/2074/
2. http://www.ebooks-for-all.com/bookmarks/detail/Climate-Change/onecat/Electronic-books+Environment-and-nature/0/all_items.html
3. https://www.smashwords.com/books/category/4727/newest/0/free/any
4. https://www.free-ebooks.net/environmental-studies-academic/Global-Warming
5. https://www.nap.edu/catalog/14673/climate-change-evidence-impacts-and-choices-pdf-booklet

SKILL ENHANCEMENT COURSE 3 (Discipline Specific)

BOTANICAL GARDEN AND LANDSCAPING (U23BO2S3)

Lecture Hours	**: 25**	**Tutorial Hours**	**: 5**
Practical Hours	**: -**	**No. of Credit**	**: 2**
Contact Hours per Semester:	**30**		
Contact hours per Week	**: 2hrs**		
Internal Marks	**: -**		
External Marks	**: 50**		
Total Marks	**: 50**		

Objectives of the course

The course aims at giving an overall view of the

- To know about the fundamental concepts of gardening and landscaping.
- To provide an overview of various gardening styles and its scope in recreation and bio-aesthetic planning.
- To illustrate the significance of garden adornments and propagation structures.
- To inculcate entrepreneurial skills in students for creative landscaping design using CAD software.
- To create the design outdoor and indoor gardens and inculcate entrepreneurial skills for landscaping.

Course Learning Outcomes (for Mapping with Pos and PSOs)

On completion of the course the students should be able to

CO1: Recognize fundamental concepts of gardening and landscaping.

CO2: Explain about significance of garden adornments and propagation structures.

CO3: Apply techniques of landscaping for aesthetic purposes and gardening for recreation.

CO4 : Distinguish between formal, informal and free style gardens and their applications.

CO5: Develop and design outdoor and indoor gardens and inculcate entrepreneurial skills for landscaping.

CO-PO and PSO Mapping (Course Articulation Matrix)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	1	3	2	1	1	2	3	1
CO 2	3	3	2	2	2	3	2	3	3	2
CO 3	2	2	3	2	1	2	1	3	2	3
CO 4	3	3	2	3	2	2	3	3	3	2
CO 5	3	3	2	3	2	3	2	3	3	2
Total Contribution of COs to POs	14	14	10	13	9	11	9	14	14	10
Weighted Percentage of COs contribution to POs	93.3	93.3	66.6	86.5	60	73.2	60	93.3	93.3	66.6

0-No Correlation; 1-Weak; 2-Moderate; 3-Strong

COURSE CONTENTS

UNIT I: Principles of Gardening (L 5 + T-1 Hours)

Principles of gardening, garden components, adornments, lawn making, methods of designing rockery, water garden, etc. Special types of gardens, their walk-paths, bridges, constructed features. Greenhouse. Special types of gardens, trees, their design, values in landscaping, propagation, planting shrubs and herbaceous perennials. Importance, design values, propagation, plating, climbers and creepers, palms, ferns, grasses and cacti succulents.

UNIT II: Flower arrangement: (L 5 + T-1 Hours)

Importance, production and cultural operations, constraints, postharvest practices. Bioaesthetic planning, definition, need, round country planning, urban planning and planting avenues, schools, villages, beautifying railway stations, dam sites, hydroelectric stations, colonies, river banks, planting material for play grounds.

UNIT III: Types of Gardens (L 5 + T-1 Hours)

Vertical gardens, roof gardens. Culture of bonsai, art of making bonsai. Parks and public gardens. Landscape designs, Styles of garden, formal, informal and free style gardens, types of gardens, Urban landscaping, Landscaping for specific situations, institutions, industries, residents, hospitals, roadsides, traffic islands, damsites, IT parks, corporate.

UNIT IV : Establishment and maintenance (L 5 + T-1 Hours)

special types of gardens, Bio-aesthetic planning, ecotourism, theme parks, indoor gardening, therapeutic gardening, non-plant components, water scaping, xeriscaping, hardscaping

UNIT V: Designing (L 5 + T -1 Hours)

Computer Aided Designing (CAD) for outdoor and indoorscaping Exposure to CAD (Computer Aided Designing).

Extended Professional Component (is a part of internal component only, not to be included in the External Examination question paper)

Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC–CSIR/GATE/TNPSC/others to be solved (To be discussed during the Tutorial hour).

Skills acquired from this course:

Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill.

Recommended Texts:

1. Acquaah, J. 2009. Horticulture – principles and practices, 4th edition, PHI learning Pvt. Ltd.
2. Rao Manibhushan K. 1991. Textbook of horticulture. MaC Millan India Ltd.
3. Gangulee H. C. and Kar A. K. 2004. College Botany Vol II, New Central Book Agency
4. Sharma V. K. 1999. Encyclopaedia of Practical Horticulture, Vol I –IV, Deep And Deep Publ. Pvt. Ltd.
5. Singh, J. 2018. Fundamentals of Horticulture. Kalyani Publishers.

References Books:

1. Berry, F. and Kress, J. 1991. Heliconia: An Identification Guide . Smithsonian Books.
2. Butts, E. and Stensson, K. 2012.Sheridan Nurseries: One hundred years of People,Plans, and Plants. Dundurn Group Ltd.
3. Russell, T. 2012. Nature Guide: Trees: The world in your hands (Nature Guides).
4. Acquaah, J. 2009. Horticulture – principles and practices, 4th edition, PHI learning Pvt. Ltd.
5. Edment Senn Andrews. 1994. Fundamentals of Horticulture. Tata. McGraw Hill Publishing Co., Ltd., Delhi.

Web Resources:

1. https://www.amazon.in/Gardening-Landscape-Design-and-Botanical-Garden/s?rh=n%3A1318122031%2Cp_27%3Aand+Botanical+Garden
2. https://www.overdrive.com/subjects/gardening

3. https://www.scribd.com/book/530538456/Opportunities-in-Landscape-Architecture-Botanical-Gardens-and-Arboreta-Careers
4. https://www.scribd.com/book/305542619/Botanic-Gardens
5. https://www.overdrive.com/subjects/gardening