KAMARAJ COLLEGE
(AUTONOMOUS)
Accredited with A+ Grade by NAAC
Among Top 150 Colleges in India - NIRF Ranking 2024
இந்து நாடார் சங்கங்களால் 1966-ல் தொடங்கப்பட்ட கல்லூரி
(Affiliated to Manonmaniam Sundaranar University, Tirunelveli)
THOOTHUKUDI - 628 003.

B.Sc., Botany

Syllabus

(With effect from the Academic Year 2025 – 2026 onwards)

Department profile

Name of the Programme	:	**B.Sc.,Botany**
Programme Code	:	**03009**
Year of establishment	:	**198586**

Vision :

To prepare students for lifelong learning by introducing them to the vast world of plant knowledge and the methodology of academic inquiry.

Mission :

To impart knowledge of science, develop scientific attitude, and make students aware of the importance of the environment and natural resources.

College Mail ID: kamarajcoll@gmail.com

College Website https://kamarajcollege.ac.in/

Undergraduate degree programme

1. Introduction

Programme Outcome, Programme Specific Outcomes and Course Outcomes Students completing this programme will be able to present their core under-graduate discipline clearly and precisely, make abstractive as precise by formulating them in the language of the specific discipline, describe relate did from multiple perspectives and explain fundamental concepts. Completion of this programme will also enable the learners to join teaching profession, enhance their employability for government jobs, jobs in various other public and private enterprises.

ELIGIBILITY:

A pass in Higher Secondary examinations or its equivalent in Science stream with Biology/ Botany/Zoology/Microbiology as one of the course or a course from general stream course (Biotechnology, Biochemistry, and Microbiology) is eligible to apply.

Learning outcomes- Based curriculum frame work guidelines based Regulations For Under Graduate Programme	
Programme:	B.Sc.(Botany)
Programme Code:	03009
Duration:	3 Years (UG)
Programme Outcomes:	
PO1	**Disciplinary knowledge**: Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that for ma part of an undergraduate Programme of study.
PO2	**Communication Skills**: Ability to express thoughts and ideas effectively in writing and orally; Communicate with others using appropriate media; confidently share one's views and express herself/himself; demonstrate the ability to listen carefully, read and write analytically, and present complex information in a clear and concise manner to different groups.

PO3	**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.
PO4	**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 learning to real life situations.
PO5	**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.
PO6	**Research-related skills:** A sense of inquiry and capability for asking relevant/appropriate questions, problem arising, synthesizing and articulating; Ability to recognize cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyses, interpret and draw conclusions from data, establish hypotheses, predict cause-and-effect relationships; ability to plan, execute and report the results of an experiment or investigation
PO7	**Cooperation/Team work:** Ability to work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group, and act to gather as a group or a team in the interests of a common cause and work efficiently as a member of a team
PO8	**Scientific reasoning:** Ability to analyses, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective.

Programme Specific Outcomes On successful completion of Bachelor of (chemistry) programme, the student should be able to:
Disciplinary Knowledge:
Critical Thinking:
Problem Solving
Analytical & Scientific Reasoning:
Research related skills:

Methods of Evaluation		**Marks**	
Internal Evaluation	Continuous Internal Assessment Test	15	25
	Assignment (PPT) and Seminar	5	
	Group Discussion and Viva	5	
External Evaluation	End Semester Examination		75
	Total		100Marks
Methods of Assessment			
Recall (K1)	Simple definitions, MCQ, Recall steps, Concept definitions		
Understand/ Comprehend (K2)	MCQ, True/False, Short essays, Concept explanations, Short summary or Overview		
Application (K3)	Suggest idea/concept with examples, Suggest formulae, Solve problems, Observe, Explain		
Analyze (K4)	Problem- Solving questions, Finish a procedure in many steps, Differentiate Between various ideas, Map knowledge		
Evaluate (K5)	Longer essay/Evaluation essay, Critique or justify with pros and cons		

Total credits Under–Graduate Courses including Lab Hours -2025 to 2026

Semester	Hours	Credits	Additional Credits	Extra Credits
I	30	23	2	3
II	30	23	2	3
III	30	23	2	3
IV	30	24	2	3
V	30	25	3	3
VI	30	22	3	3
Total		**140**	**14**	**18**

****Extra Credit will be given on the basis of student's performances**

Written Examination: Theory Paper (Bloom's Taxonomy based) Question paper Model

Assessment Pattern

Continuous Internal Assessment (CIA) & End Semester Examination (ESE)

- CIA: 25
- ESE:75

Theory Course:

For theory courses there shall be two tests conducted by the faculty concerned and the average of the best two can be taken as the Continuous Internal Assessment (CIA).CIAisfor50 marks max and will be converted in to 15 marks. The duration of each test shall be 2 Hrs.

Continuous Internal Assessment (Writing)	15marks
Assignment (PPT) & Seminar	5marks
Viva & Group Discussion	5marks

For theory Papers:

- Part A (10×1=10) Marks –Answer all questions (Multiple choice)
- Part B (5×5 =25) Marks – Choosing either (a) or (b)
- Part C (5×8=40) Marks – Choosing either (a) or (b)

Total =75marks

Laboratory Courses Assessment

- CIA- 40 marks
- ESE-60 marks
- Mandatory Record submission, attendance and class participation.
- Two CIA for 40 marks max. The average of the best two can be taken as the Continuous Internal Assessment.
- The duration of each test shall be 3hours

In order to avoid pull the scored own of each PO, it is suggested that the usage –Low (1) to the minimum. The S, M, Lis based on the Course out comes. The mapping is based on their vised Bloom's Taxonomy Verbs used to describe your Course outcomes.

- Remember and Understanding–Lower level
- Apply and Analyze –Medium Level
- Evaluate and Create–Strong Level

Course Structure for Science Stream

(With effect from the academic year 2025 to 2026 onwards)

Semester I	Course Code	Name of the Course	Hours / Week	Credit	Duration of ESE (Hrs.)	Marks Allotted		
						CIA	ESE	Total
Part I	25ULTL11	பொதுத்தமிழ்: தமிழ் இலக்கிய வரலாறு - I	6	4	3	25	75	100
Part II	25ULEN11	General English - I	6	4	3	25	75	100
Part III Core I	25UMBO11	Part-III-Core-Plant Diversity I- Algae	5	4	3	25	75	100
Core II– Lab- I	25UMBOL1	Part-III-Core-Plant Diversity I– Algae – Practical I	3	2	3	50	50	100
EC 2 Discipline /Generic	25UEZO11	Part-III-Allied: Zoology Paper–I	4	3	3	25	75	100
	25UEZOL1	Allied practical	2	2	3	50	50	100
Part-IV SEC 1 (Select anyone)	25USBO11 25USBO12 25USBO13	1.Organic farming 2.Environmental Biotechnology 3.Nurseryand Landscaping	2	2	3	25	75	100
FC	25UFBO11	Basics of Botany	2	2	3	25	75	100
		Total	30	23				

****SEC-Skill Enhancement Course**
****CIA-Continuous Internal Assessment**
****EC–Elective Course**
****ESE-End Semester Examination**
****FC-Foundation course**

Plant Diversity algae

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="7">Plant Diversity algae</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="7">Core I</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2" colspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours Per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>3</td><td colspan="2">2</td><td colspan="2">--</td><td colspan="2">5</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="7">Students should be familiar with the basics of different classes of Algae.</td></tr>
<tr><td colspan="9">Learning Objectives</td></tr>
<tr><td>LO 1</td><td colspan="8">To provide a comprehensive knowledge on the biology of algae.</td></tr>
<tr><td>LO 2</td><td colspan="8">To provide a basis for better understanding of the all us organization in various algal groups</td></tr>
<tr><td>LO 3</td><td colspan="8">To understand methods of reproduction and life histories of different algae groups</td></tr>
<tr><td>LO 4</td><td colspan="8">To understand the methods of large scale cultivation algae</td></tr>
<tr><td>LO 5</td><td colspan="8">To comprehend the beneficial role of algae.</td></tr>
</table>

Unit	Contents
I	General characters, distribution, Classification (Fritsch-1935-1945),
II	Thallus organization (unicellular- Chlorella, colonial-Volvox, filamentous-Spirogyra, siphonous- Caulerpa, parenchymatous- Gracilaria).
III	Reproduction-Vegetative, asexual, sexual reproduction and life histories (haploidic- Chara ., diplontic- Sargassum, diplohaplontic - Ulva)
IV	Algal cultivation methods - Cultivation Methods of Gracilaria and Sargassum -Floating Raft System, Longline System, Off-bottom Method , Net Method.
V	Algae as food and feed: Agar-agar, Alginic acid , Application of algae as fuel, bio fertilizer and pharmaceutical. Role of algae as indicator of water pollution.

Extended Professional Component (is apart 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/JAM /TNPSC and others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill

Recommended Texts:

1	Dehradun. Edward lee, R.2018. Phycology, 5thEd.CambridgeUniversityPress, London.
2	Kumar, H.D.1999.Introductory Phycology. Affiliated East West Press, Delhi
3	Singh, Pandey and Jain. 2020. A text book of Botany, Publication, Meerut. 5thEdition, Rastogi
4	Vashishta, P.C.2014.S.Chand & Company Ltd, New Delhi.
5	Ian Morris.1977.Anintroductiontothealgae. 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.TheAlgae.AlphaNumera.
4	Fritsch, F.E.1945. Structure and reproduction of Algae. Cambridge University press..
5	Round, FE. 1984. The Ecology of Algae. Cambridge University Press.

Web Resources:

1	https://www.crcpress.com/Therapeutic-and-Nutritional-Uses-of-Algae/Pereira/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-BiodiversityTaxonomy-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

Course Outcomes	On completion of this course, students will be able to	Cognitive Level
CO1	Recall and identify algae using key characters.	K1
CO2	Demonstrate practical skills in preparation off rash mount and identification of algal forms from algal mixture	K2
CO3	Describe the internal structure of algae prescribed in the syllabus	K3
CO4	Decipher the algal diversity in fresh/marine water and their economic significance	K4
CO5	Identify algae in natural habitats	K5

Mapping with programme outcomes and programme specific Outcomes

CO /PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	S	S	M	S	S	M	S	S
CO2	M	S	S	S	M	S	S	M
CO3	S	S	S	M	S	S	S	M
CO4	S	S	S	S	S	S	S	S
CO5	S	M	S	S	M	S	S	M

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

CO/ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Pedagogy:

- Quiz with MCQ
- Case Study
- Projects with Models
- Assignment (PPT & Seminar Presentations)
- Group Discussions etc.,

Plant Diversity-Botany Practical's

<table>
<tr><td>Title of the Course</td><td colspan="7">Plant Diversity-Botany Practical's</td></tr>
<tr><td>Paper Number</td><td colspan="7">Core-Major Practical-I</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td></td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours Per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td>Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>-</td><td colspan="2">--</td><td>3</td><td colspan="2">3</td></tr>
</table>

Learning Objectives	
LO 1	To develop skills to identify algae based on habitat, thralls structure and the internal organization
LO 2	To identify micro algae in a mixture.
LO 3	To developed skills to prepare the micro slides of algae.
LO 4	To study the economic importance of species of algae.
LO 5	To understand importance of algae to animals and humans

Practical

1. Micro-preparation 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) Cattle Feed (iii) Bio fertilizers (iv) SCP

   (v)Agar-Agar (vi) Alginic acid.
5. Field visit to study fresh water/marine water algal habitats.

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. Kumar, H.D. 1999.Introductory Phycology. Affiliated East-West Press, Delhi. 2. Bendre, M. Ashok and Ashok Kumar, A. 2020.TextBookofPracticalBotany-1(10th Ed). Rastogi Publications, Meerut. 3. Round, FE.1984.TheEcology 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-. 5. Singh, Pandey and Jain.2020.A text book of Botany, 5th Edition, Rastogi Publication, and Meerut...
Reference Books	1. Nancy SerediakandM.Huynh.2011.Algae identification lab Guide. Accompanying 2. Manu alto 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 4thEdition, Cambridge University Press, New York. 5. Dehradun. Edward lee, R.2018. Phycology,5th Ed., Cambridge University Press, London
Web sources	**Web References:** 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 4. https://www.ebooks.com/en-in/book/210152662/algae/sachin-kumar-mandotra/ https://books.google.co.in/books/about/Algae.html?id=s1P 855ZWc0kC&redir_esc=y

Course outcomes: CO	On completion of this course, the students will be able to	Cognitive Level
CO1	Recall and identify algae using key characters.	K1
CO2	Demonstrate practical skill sin preparation of fresh mount and identification of algal forms from algal mixture.	K2
CO3	Describe the internal structure of algae prescribed in the syllabus	K3
CO4	Decipher the algal diversity in fresh/marine water and their economic significance	K4
CO5	Identify algae in natural habitats	K5

Mapping with programme outcomes and programme specific Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	S	S	M	S	S	M	S	S
CO2	M	S	S	S	M	S	S	M
CO3	S	S	S	M	S	S	S	M
CO4	S	S	S	S	S	S	S	S

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

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3

Pedagogy:

- Quiz with MCQ
- Case Study
- Projects with Models
- Assignment (PPT & Seminar Presentations)
- Group Discussions etc.,

Elective allied botany-I

Title of the Course		**Elective allied botany -I**					
Paper Number		**CORE I**					
Category	Core	**Year**	I	**Credits**	3	**Course**	
		Semester	I			**Code**	
Instructional Hours Per week		**Lecture**	**Tutorial**		**Lab Practice**	**Total**	
		4	1		--	4	
Pre-requisite		To study the basics of botany.					

Learning Objectives	
LO 1	To study morphological and anatomical features of algae
LO 2	To familiarize with the general characters and economic uses of fungi, bacteria and virus
LO 3	To familiarize with the general characters and life histories of bryophytes, pteridophytes and gymnosperms
LO 4	To comprehend on the ultra- structure of cell organelles
LO 5	To explain the concept of genetics and plant biotechnology

Unit	Contents
I	**Algae:** General characters of algae-Structure, reproduction and lifecycle of the following genera- Gracilaria, economic importance of algae.
II	**Fungi, Bacteria and Virus:** General characters of fungi, structure, reproduction and lifecycle of the following genera– Penicillium and economic importance of fungi. **Bacteria**-General characters, ultrastructure and reproduction–Vegetative and sexual reproduction in Bacteria, Economic importance. **Virus**-General characters, structure of TMV.
III	**Bryophytes, Pteridophytes and Gymnosperms:** **Bryophytes -** General characters of Bryophytes, Structure and life cycle of Marchantia **Pteridophytes**- GeneralcharactersofPteridophytes,StructureandlifecycleofLycopodium **Gymnosperms**- General characters of Gymnosperms, Structure and lifecycle of Cycas.
IV	**Cell Biology**: Prokaryotic and Eukaryotic cell - structure. Cell organelles-ultrastructure and function of chloroplast, mitochondria and nucleus.
V	**Genetics and Plant Biotechnology: Mentalism -** Law of dominance, Law of segregation, Law of independent assortment. Monohybrid and dihydric cross - Test cross - Back cross. **Planttissueculture**– Scopeandimportanceofplanttissueculture,Totipotencyofcells,Tissue Culture laboratory and application in Bio technology.

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/JAM /TNPSC and others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Texts:	
1	Dehradun. Edward lee, R .2018. Phycology, 5th Ed., Cambridge University Press, London.
2	Kumar,H.D.1999.IntroductoryPhycology.AffiliatedEastWestPress, 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.
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	MihirKumar,D.2010.AlgalBiotechnology.DayaPublishingHouse,New Delhi
3	Chapman V.J. and Chapman D.J, 2013. The Algae. Alpha Numeral.
4	Fritsch, F.E. 1945. Structure and reproduction of Algae. Cambridge University press...
5	Round, FE. 1984. The Ecology of Algae. Cambridge University Press.

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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-BiodiversityTaxonomy-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

Course outcomes	**On completion of this course, students will be able to**	**Cognitive Level**
CO1	Recall and identify algae using key characters.	K1
CO2	Demonstrate practical skills in preparation of fresh mount and identification of algal forms from algal mixture	K2
CO3	Describe the internal structure of algae prescribed in the syllabus	K3
CO4	Decipher the algal diversity in fresh/marine water and their economic significance	K4
CO5	Identify algae in natural habitats	K5

Mapping with programme outcomes and programme specific Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	S	S	M	S	S	M	S	S
CO2	M	S	S	S	M	S	S	M
CO3	S	S	S	M	S	S	S	M
CO4	S	S	S	S	S	S	S	S
CO5	S	M	S	S	M	S	S	M

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

CO/ PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Pedagogy:

- Quiz with MCQ
- Case Study
- Projects with Models
- Assignment (PPT & Seminar Presentations)
- Group Discussions etc.,

Elective allied botany practical's

Title of the Course		Elective allied botany practical's					
Paper Number		Allied Practical's-I					
Category	Core	**Year**	I	**Credits**	2	**Course**	
		Semester	I			**Code**	
Instructional Hours Per week		**Lecture**	**Tutorial**		**Lab Practice**	**Total**	
		-	--		2	2	

Learning Objectives	
LO 1	To develop skill- based detection of the morphology and micro structure of different plant groups
LO 2	To comprehend the ultra- structure of various cell organelles
LO 3	To be familiar with the basic concepts of mend Elian genetics
LO 4	To Understand the laws of in heritance.
LO 5	To Understand the methods involved in plant tissue culture

Practical	
1. Make suitable micro preparation prescribed in the syllabus Alage, Fungi, Lichen, Bryophytes, Pteriodophytes and gymnosperms. 2. Observation of slides Specimen of the types prescribed in Algae and Fungi 3. Identifying the micro slides /relevant to the syllabus virus and photographs lichen. 4. Identifying the micro slides / photography's relevant to the syllabus bryophytes, pteridophytes and gymnosperms. Field trip (Minimum 2 days) to places under the guidance of teachers to study plants in their natural habitat and submit a report.	
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	Sharma, O.P. 2017.Bryophyta, MacMillan India Ltd, New Delhi
2	Sharma, O.P. 2012. Pteridophyta, Tata McGraw-Hills Ltd, New Delhi.
3	Subramaniam, N.S. 1996. Laboratory Manual of Plant Taxonomy. Vikas Publishing House Pvt. Ltd., New Delhi.
4	Benjamin, A. Pierce. 2012. Genetics-A conceptual Approach. W.H. Freeman and Company, New York, England.
5	Noggle G. Rand G.J. Fritz. 2002. Introductory Plant Physiology. Prentice Hall of India, New Delhi.

References Books:	
1	Strick berger, 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 Agrifood Canada publisher.
3	Mohammed Gufran Khan, Shite Gatew and Bedilu Bekele. 2012. Practical manual for Bryophytes and Pteridophytes. Lambert Academic Publishing.
4	Aler Gingauz.2001.MedicinalChemistry.OxfordUniversityPress&Wiley Publications.
5	Steward,F.C.2012.PlantPhysiologyAcademicPress,US
Web Resources:	
1	https://www.amazon.in/Practical-Manual-Pteridophyta-Rajan-Sundara/dp/8126106883
2	https://www.google.co.in/books/edition/Gymnosperms/3YrT5E3Erm8C?hl=en&gbpv=1&dq=gymnosperms&printsec=frontcover
3	https://www.amazon.in/Computational-Phytochemistry-Satyajit-Dey-Sarker-
4	ebook/dp/B07CV96NZJ4.https://medlineplus.gov/genetocs/understanding/basics/cell/
5	https://apan.net/meetings/apan45/files/17/17-01-01-01.pdf
6	http://www.cuteri.eu/microbiologia/manuale_microbiologia_pratica.pdf
7	https://www.amazon.in/Manual-Practical-Bryophyta-Suresh-

Course outcomes	On completion of this course, students will be able to	Cognitive Level
CO1	Gain knowledge on the internal organization of various plant groups.	K1
CO2	Develop critical understanding on morphology, anatomy and reproduction of Bryophytes, Pteridophytes and Gymnosperms.	K2
CO3	Analyse the ultra-structure of different cell organelles	K3
CO4	Understand the fundamental concepts of Genetics	K4
CO5	Apply the methods in plant tissue culture	K5

Mapping with programme outcomes and programme specific Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	S	S	M	S	S	M	S	S
CO2	M	S	S	S	M	S	S	M
CO3	S	S	S	M	S	S	S	M
CO4	S	S	S	S	S	S	S	S

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

CO/ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3

Pedagogy:

- Quiz with MCQ
- Case Study
- Projects with Models
- Assignment (PPT & Seminar Presentations)
- Group Discussions etc.,

Non major elective- Organic farming

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">Non major elective-Organic farming</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">Elective- I</td></tr>
<tr><td>Category</td><td>Core</td><td>Year</td><td>I</td><td>Credits</td><td>2</td><td>Course</td><td></td></tr>
<tr><td></td><td></td><td>Semester</td><td>I</td><td></td><td></td><td>Code</td><td></td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours Per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td>2</td><td colspan="2">---</td><td colspan="2">--</td><td>2</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">Students to gain knowledge on the scope of organic farming and its significance.</td></tr>
</table>

Learning Objectives	
LO 1	To enable students to gain knowledge on the properties and importance of soil
LO 2	To impart practical in sights sustainable agriculture, green manuring-recycling and composting.
LO 3	To understand the significance of organic and green manures
LO 4	To know about the importance of bio fertilizers
LO 5	To study methods of recycling of bio degradable wastes.

Unit	Contents
I	Soil–physical, chemical properties. Ill effects of soil, chemicals–fertilizers, pesticide and herbicides
II	Organic farming–definition, basic concept of organic farming, Sustainable agriculture practices-crop rotation, mixed cropping.
III	Management of organic wastes and green manures: Farm manures, Composts and Mulches importance of organic manure, importance of green manure, oil cake. Vermin compost-methods, production and utilization.
IV	Bio fertilizers –definition, importance and advantages, Mass mass cultivation, inoculant formulations and application method of Rhizobium, Azolla production and application.
V	Recycling of bio-degradable municipal, agricultural and Industrial wastes–bio compost making methods.

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questionsrelatedtotheabovetopics,fromvariouscompetitiveexaminationsUPSC/ 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	NIIR Board. 2012. The complete Technology Book on Bio fertilizer and organic farming. 2nd Edition. NIIR Project Consultancy Services.
2	Sa the, T.V. 2004.Vermiculture and Organic Farming. Daya publishers.
3	SubbaRaoN.S.2017.BiofertilizersinAgricultureandForestry.Fourth Edition. Med tech.
4	Vayas, S.C, Vayas, S. and Modi, H.A. 1998.Bio-fertilizers and organic Farming Akta Prakashan, Nadiad.
5	Dongarjal, R.PandZade,S.B.2019.Insect Ecology and Integrated Pest Management Akinik Publications, New Delhi

References Books:	
1	Vayas, S.C, Vayas, Sand Modi, H.A. 1998.Bio-fertilizers and organic Farming Akta Prakashan, Nadiad.
2	Sathe,T.V. 2004. Vermi culture and Organic Farming. Day a publishers
3	Subha Rao, N.S. 2000. Soil Microbiology, Oxford & IBH Publishers, New Delhi
4	Reddy,S.R.2019.FundamentalsofAgronomyKalyaniPublications,UttarPradesh
5	Tolanur, S. 2018. Fundamentals of Soil Science 2nd Edition, 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=7263656357513Assessment-and-Biotechnology/Pereira-Neto/p/book/9781466581678Vashishta-Dr-A-K-Sinha-Dr-V-P-Singh

Course outcomes	On completion of this course, students will be able to	Cognitive Level
CO1	Recognize the different forms of soils and ill effects of chemical fertilizers	**K1**
CO2	Explain and interpret the components, patterns, and processes of Organic maturing and composting	**K2**
CO3	Apply techniques for synthesizing green manure and develop strategies to increase crop yield.	**K3**
CO4	Analyze and decipher the significance of bio fertilizers	**K4**
CO5	Develop new strategies for recycling of solid organic wastes	**K5**

Mapping with programme outcomes and programme specific Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	S	S	M	S	S	M	S	S
CO2	M	S	S	S	M	S	S	M
CO3	S	S	S	M	S	S	S	M
CO4	S	S	S	S	S	S	S	S
CO5	S	M	S	S	M	S	S	M

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

CO/ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Pedagogy:

- Quiz with MCQ
- Case Study
- Projects with Models
- Assignment (PPT & Seminar Presentations)
- Group Discussions etc.,

Environmental Biotechnology

Title of the Course		Environmental biotechnology					
Paper Number		Non-Major Elective-I					
Category	Core	**Year**	I	**Credits**	2	**Course**	
		Semester	I			**Code**	
Instructional Hours Per week		**Lecture**	**Tutorial**		**Lab Practice**	**Total**	
		2	---		--	2	
Pre-requisite		To understand the various applications of environmental biotechnology.					

Learning Objectives	
LO 1	To introduce the student to the various developed and applications of Environmental biotechnology.
LO 2	To provide knowledge about the scope of bio remediation and bioleaching Using GMOs.
LO 3	To study about pollution of water bodies
LO 4	To know about bio remediation.
LO 5	To study about bio mineralization.
Unit	**Contents**
I	Introduction: The environment-soil, water and air Pollution and its causes (outline only)
II	Source and treatment of polluted waters and effluents: Pollutionofwaterbodiesbyheavymetalsandpesticides–removalofheavymetals and pesticides by Bio sorption. Removal of oils pills by using microbes. Biological treatment of sewage–characteristics of sewage and objectives in sewage treatment– Anaerobic digestion.
III	Soil and air pollution and their treatment: SoilpollutionbyXenobiotic.DegradationofXenobiotic–pathwaysofphenol, pentachlorophenol and polychlorinated biphenyl degradation.
IV	Bioremediation: Introduction to bio remediation, exist and insist bioremediation.
V	Bio metallurgy and related topics: Bio mineralization–bioleaching-Bio films and bio corrosion.

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questionsrelatedtotheabovetopics,fromvariouscompetitiveexaminationsUPSC/TR B/NET/UGC–CSIR/GATE/TNPSC/otherstobesolved(Tobediscussedduringthe Tutorial hour)
Skills acquired from this course	Knowledge,ProblemSolving,Analyticalability,ProfessionalCompetency,Professional Communication and Transferrable Skill
Recommended Texts:	
1	Alan Scragg. 1999. Environmental Bio technology. Pearson Education Limited
2	Dubey R.C. 2004. A text book of Bio technology aspects of microbiology, British Sun Publication.
3	Joseph C. Deniel. 1996. Environmental aspects of microbiology, British Sun Publication.
4	Keeshav Thehan. 1997. Bio technology, New age international)P) Limited, New Delhi.
5	Chandra, A. M and Ghosh, S.K. 2010. Remote sensing and Geographical Information System, Nares a Publishing House Pvt. Ltd. New Delhi.
References Books:	
1	SsSharma, P.D. 2005. Environmental Microbiology, Narosa Publishing House Pvt. Ltd., New Delhi.
2	RainaMaierM.IranPepperL.,CharlesP.Gerba,2000, Environmental Microbiology, Academic press, U.K.
3	AlexanderN.GlazerandHiroshiNikaido.1994.MicrobialBiotechnology.
4	Special issue on Bioremediation and bio degradation. 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. 2nded. Cambridge University Press. ISBN. 978-1107114234.

Web Resources:	
1	https://www.elsevier.com/books/environmental-biotechnology/vallero/978-0-12-
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

Course outcomes	**On completion of this course, students will be able to**	**Cognitive Level**
CO1	Recognize the various causes of pollution and control measures.	**K1**
CO2	Explain about the beneficially role of GMO son environment.	**K2**
CO3	Reflect upon various sustainable environmental protection strategies...	**K3**
CO4	Analyze the different methods of air, water, and soil quality monitoring process.	**K4**
CO5	Evaluate the implications of international legislations and policies for environmental protection.	**K5**

Mapping with programme outcomes and programme specific Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	S	S	M	S	S	M	S	S
CO2	M	S	S	S	M	S	S	M
CO3	S	S	S	M	S	S	S	M
CO4	S	S	S	S	S	S	S	S
CO5	S	M	S	S	M	S	S	M

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

CO/ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Pedagogy:

- Quiz with MCQ
- Case Study
- Projects with Models
- Assignment (PPT & Seminar Presentations)
- Group Discussions etc.,

Nursery and Landscaping

Title of the Course		Nursery and Landscaping					
Paper Number		Non-Major Elective-I					
Category	Core	**Year**	I	**Credits**	2	**Course**	
		Semester	I			**Code**	
Instructional Hours Per week		**Lecture**	**Tutorial**		**Lab Practice**	**Total**	
		2	---		--	2	
Pre-requisite		Students should know about the fundamental concepts of nursery and landscaping.					
Learning Objectives							
LO 1	To recognize the importance of growing plants in nursery and their role in landscaping.						
LO 2	To study and practice the methods of propagation						
LO 3	To gain knowledge on the types of garden						
LO 4	To know about the types of structures in nursery.						
LO 5	To learn about composting methods.						

Unit	Contents
I	Introduction, prospects and scope of nursery and landscaping.
II	Methods of Propagation– cutting, layering, grafting, budding, Floriculture–Rose, Chrysanthemum, Jasmine – cultivation.
III	Gardening – formal garden, informal garden, vegetable garden, landscaped layout designing – formation and maintenance of lawn.
IV	Nursery structures–Greenhouse–garden implements – spade, pruning scissor water can, digging fork–Topiary, Bonsai culture.
V	Manures, composting–vermicomposting.

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/TR B/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 Land scaping, M/s IBD Publishers, New Delhi
2	Butts, Eand 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.

References 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.FundamentalsofHorticulture.KalyaniPublishers
5	SharmaV.K.1999.EncyclopediaofPracticalHorticulture,VolI–IV,DeepAndDeep 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-Amarnathbiotechnology/vallero/978-0-12-
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

Course outcomes	On completion of this course, students will be able to	Cognitive Level
CO1	Recognize the basic principles and nursery and landscaping	**K1**
CO2	Explain and practice plant propagation techniques.	**K2**
CO3	Apply techniques for design various types of gardens according to the culture and art of bonsai.	**K3**
CO4	Analyse the importance of plant growing structures	**K4**
CO5	Explain the methods of composting	**K5**

Mapping with programme outcomes and programme specific Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	S	S	M	S	S	M	S	S
CO2	M	S	S	S	M	S	S	M
CO3	S	S	S	M	S	S	S	M
CO4	S	S	S	S	S	S	S	S
CO5	S	M	S	S	M	S	S	M

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

CO/ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Pedagogy:

- Quiz with MCQ
- Case Study
- Projects with Models
- Assignment (PPT & Seminar Presentations)
- Group Discussions etc.,

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/UGCCSIR/GATE/TNPSC/otherstobesolved(Tobediscuss edduringthe Tutorial hour)
Skills acquired from this course	Knowledge,ProblemSolving,Analyticalability,ProfessionalCompetency ,Professional Communication and Transferrable Skill

Recommended Texts:

1	Singh, V., Pande, P. CandJain, D.K. 2021. A Text Book of Botany. Rastogi Publications, Meerut.
2	Bhatnagar, S.P and AlokMoitra. 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, S. Chand and Co. New Delhi.
6	Rao, K., Krishnamurthy, K.VandRao, G.S.1979. Ancillary Botany, S.Viswanathan Pvt. Ltd., Madras.

References 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.
5	Vashishta, P.C.2014. Botany for Degree Students Algae.2014. Chand & Company Ltd, Delhi.
6	Parihar, N.S.2013. An introduction to Embryophyta– Bryophytes-,Surjeet Publications, 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
6	https://www.us.elsevierhealth.com/medicine/cell-biology
7	https://www.us.elsevierhealth.com/medicine/genetics
8	https://www.kobo.com/us/en/ebook/plant-biotechnology-1

Course outcomes	On completion of this course, students will be able to	Cognitive Level
CO1	Develop acritical understanding on the distinguishing traits, geographic distribution lichens, and bryophytes	**K1**
CO2	Compare the structure and function of prokaryotic and eukaryotic cell	**K2**
CO3	Develop critical understanding on morphology of various plant parts	**K3**
CO4	Understand the basic concepts of genetics	**K4**
CO5	Understand the core concepts and fundamentals of plant physiology	**K5**

Mapping with programme outcomes and programme specific Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	S	S	M	S	S	M	S	S
CO2	M	S	S	S	M	S	S	M
CO3	S	S	S	M	S	S	S	M
CO4	S	S	S	S	S	S	S	S
CO5	S	M	S	S	M	S	S	M

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

CO/ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Pedagogy:

- Quiz with MCQ
- Case Study
- Projects with Models
- Assignment (PPT & Seminar Presentations)
- Group Discussions etc.,

Plant diversity

Title of the Course	Plant diversity II						
Paper Number	Core III						
Category	Core	**Year**	I	**Credits**	4	**Course**	
		Semester	I			**Code**	
Instructional Hours Per week		**Lecture**		**Tutorial**	**Lab Practice**	**Total**	
		3		2	--	5	
Pre-requisite	Students should be familiar with the basics of fungi, bacteria, Viruses and lichens.						

Learning Objectives	
LO 1	To describe the general characteristics of fungi as being heterotrophic, Unicellular/multicellular.
LO 2	To understand the biology of fungi and to discuss the importance of fungi in various ecological roles
LO 3	To learn the structure and reproduction in Bacteria and viruses
LO 4	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
LO 5	To identify the main groups of plant pathogens, their symptoms various types of plant diseases.

Unit	Contents
I	**Fungi** Characteristic features of Fungi, Classification of fungi (Alexopoulos and Mims, 1979),.thallusorganization,modeofnutrition,structure,reproductionandlife-history of Zygomycotina - Mucor, Ascomycotina - Peziza, Basidiomycotina - Puccinia and Deuteromycotina - Cercospora.
II	**Economic importance of fungi:** Fungi as food; Fungi in agriculture application–bio-fertilizers; Mycotoxins-bio pesticides; Production of industrially important products from fungi--ethanol, Organic acids- citric acid, Applications of fungi in pharmaceuticals-Penicillin. Importance of VAM fungi. Harmful effects of Fungi (any five)
III	**Bacteria, Virus:** Classification-outline(Bergey,1994),Ultrastructureandreproduction-vegetative andsexualinbacteria.,Viruses:generalcharacters,structureandreproductionof Bacteriophage.
IV	**Plant pathology:** General symptoms of plant diseases; Disease cycle. Prevention and control of the following plant diseases: Bacterial diseases-Citrus canker and Bacterial wilt of Banana Viral diseases-Tobacco Mosaic and Vein clearing of Ladies finger. Fungal diseases - Blast disease in rice and Tikka disease of Groundnut.
V	**Lichen:** Classification (Hale, 1969). Habitat, nature of association, Study of growth forms of lichens (crustose, foliose and fruticose). Structure, distribution and re production of Usnea. Economic importance of Lichens.-Food, Medicine, Dye, Ecological importance.

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/TR B/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. Bio technology for agro-Industrial residues utilization. Springer.
4	Satyanarayana T and J ohri B.N.2005. Microbial diversity, Current Perspectives and Potential Applications, IK International.
5	Nair, L.N.2007. Topicsin 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 Hand book of Lichens Vedamse Books (P)Ltd. New Delhi.
7	Pelzer, M.J., Chan, E.C.SandKrieg, 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 BotanyI: Including Algae, Fungi, Lichens, Bacteria, Viruses, Plant Pathology, Industrial Microbiology and Bryophyta. SChand & 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

Course outcomes	On completion of this course, students will be able to	Cognitive Level
CO1	Recognize the general characteristics of fungi	K1
CO2	Develop an understanding on the economic uses of fungi	K2
CO3	Comprehend the structure and reproduction in bacteria and virus	K3
CO4	Analyze the structure and reproduction in Lichens and their role in agricultural and pharmaceutical applications.	K4
CO5	Identify the common plant diseases and device control	K5

Mapping with programme outcomes and programme specific Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	S	S	M	S	S	M	S	S
CO2	M	S	S	S	M	S	S	M
CO3	S	S	S	M	S	S	S	M
CO4	S	S	S	S	S	S	S	S
CO5	S	M	S	S	M	S	S	M

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

CO/ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Pedagogy:

- Quiz with MCQ
- Case Study
- Projects with Models
- Assignment (PPT & Seminar Presentations)
- Group Discussions etc.,

Plant diversity II

Title of the Course		**Plant diversity II**					
Paper Number		Core-Major Practical's-II					
Category	Core	**Year**	I	**Credits**	2	**Course**	
		Semester	I			**Code**	
Instructional Hours Per week		**Lecture**	**Tutorial**		**Lab Practice**	**Total**	
		1	--		2	3	

Learning Objectives	
LO 1	To enable students to identify micros copic and macros copic fungi.
LO 2	To know about the economic uses of fungi
LO 3	To know the ultra- structure of bacteria and virus through photomicrographs
LO4	To identify the lichens based on the morphology, and micro slides.
LO 5	To identify the symptoms of plant diseases caused by microbes

Practicals

Micro preparation of vegetative and reproductive structures of fungi prescribed in the syllabus.

Study of economically important products obtained from fungi: Fungal bio fertilizers, bio pesticides,, edible mushroom/ Yeast, organic acids(citric acid), and antibiotics(Penicillin)

Mycorhiza: Eecto- mycorhiza and endow- mycorrhiza (Photographs) Grams staining procedure for identification of bacteria.

Microphotograph for ultrastructure of Bacteria and Bacteriophage

Vegetative and reproductive structure of Usnea-Micro-preparation Visit to agricultural Farms.

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/TR B/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:	Chmielewski, J. Gand Krayesky, D.2013. General Botany laboratory Manual. Author House, Bloomington, USA. Das, S and S aha, R.2020. Microbiology Practical Manual. CBS Publishers and Distributors (P) Ltd., New Delhi, India.

	Webster, J and Weber, R.2007. Introduction to Fungi, 3rd Ed. Cambridge University Press, Cambridge. Nair, L.N. 2007.TopicsinMycologyand Pathology, New Central Book agency, Kolkata.5.Nair, L.N.2007. Topics In Mycology and Pathology, New Central Book agency, Kolkata.
References Books:	Dehradun. Edward lee, R.2018. Alexopoulos, J and Mims, W. 1985. Introductory Mycology, Wiley Eastern Limited New Delhi. Bendre, M.Ashok and Ashok Kumar, A.2020.Text Book of Practical Botany 1 (10th ed).Rastogi Publications, Meerut. Singh, R and U.C. Singh 2020. Modern mushroom cultivation, 3d Edition A grobios (India), Jodhpur. PoonamSinghandAshokPandey.2009.Biotechnologyforagro-Industrial residues utilization. Springer.SatyanarayanaTandJohriB.N.2005.Microbialdiversity,Current Perspectives and Potential Applications, IK International.Phycology,5th Ed., Cambridge University Press, London
Web sources:	Web References: https://www.amazon.in/Practical-Manual-Fungi-Fungicides/dp/B0025AEFP4 https://books.google.co.in/books/about/Practical_Mycology.html?id=5ycJAQAAMAAJ&redir_esc=yhttps://www.flipkart.com/colour-handbook-practical-plant-pathology/p/itmefsn6dyhfhs9b https://books.google.co.in/books/about/Practical_Botany.html?id=T5narQEACAAJ&redir_esc=yhttps://www.kobo.com/us/en/ebook/introduction-to-fungi

Course outcomes CO	On completion of this course, students will be able to	Cognitive Level
CO1	Develop practical skills for Identifying fungi using key characters	**K1**
CO2	Access the useful role of fungi in agriculture and pharmaceutical industry	**K2**
CO3	Identify the type of bacteria through grams staining procedure.	**K3**
CO4	Analyze the characteristics of various types of lichens pathogens	**K4**
CO5	Recognize the symptoms of plant diseases caused by pathogens	**K5**

Mapping with programme outcomes and programme specific Outcomes

CO /PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	S	S	M	S	S	M	S	S
CO2	M	S	S	S	M	S	S	M
CO3	S	S	S	M	S	S	S	M
CO4	S	S	S	S	S	S	S	S

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

CO/ PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3

Pedagogy:

- Quiz with MCQ
- Case Study
- Projects with Models
- Assignment (PPT & Seminar Presentations)
- Group Discussions etc.,

Allied Zoology -I

<table>
<tr><td>Title of the Course</td><td colspan="7">Allied Zoology -I</td></tr>
<tr><td>Paper Number</td><td colspan="7">Elective</td></tr>
<tr><td>Subject code</td><td colspan="7">25UEB011</td></tr>
<tr><td rowspan="2">Category</td><td>C ore</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2">EC1</td></tr>
<tr><td></td><td>Semester</td><td>I</td></tr>
<tr><td rowspan="2">Instructional Hours Per week</td><td colspan="2">Lecture</td><td>Tutorial</td><td>Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td colspan="2">4</td><td></td><td></td><td colspan="3">4</td></tr>
</table>

Learning Objectives	
CO1	To acquire a basic knowledge of diversity and organization of Protozoa, Coelenterata, Helminthes and Annelida
CO2	To acquire a basic knowledge of diversity and organization of Arthropoda, Mollusca and Echinodermata
CO3	To comprehend the taxonomic position and diversity among Protochordata, Pisces and Amphibia
CO4	To comprehend the taxonomic position and diversity among Reptilia, Aves and Mammalia
CO5	To acquire detailed knowledge of select invertebrate and chordate forms

UNIT: 1 **12 Hours**

Diversity of Invertebrates–I Principles of taxonomy. Criteria for classification–Symmetry and Coelom–Binomial Nomenclature. Classification of Protozoa, Coelenterata, Helminthes and Annelida upto classes with two examples.

UNIT: 2 **12 Hours**

Diversity of Invertebrates–II Classification of Arthropoda, Mollusca and Echinodermata upto class level with examples

UNIT: 3 **12 Hours**

Diversity of Chordates–I Classification of Prochordata, Pisces and Amphibia upto orders giving two examples

UNIT: 4 **12 Hours**

Diversity of Chordates–II Classification of Reptilia, Aves and Mammalia up to orders giving two examples

UNIT: 5 **12 Hours**

Animal organization Structure and organization of (i) Earthworm (ii) Rabbit (iii) Prawn

Pedagogy:

- Chalk-Talk and Classroom Activities
- PPT& Seminar
- Teaching aids

Textbooks

1. Ekambaranatha Iyer, 2000. A Manual of Zoology, 10th edition, Viswanathan, S., Printers & Publishers Pvt Ltd
2. Jordan, E.L. and Verma P.S, 1995. Invertebrate Zoology, 12th edn. S. Chand& Co. 3
3. Kotpal, R.L, 1992. Protozoa, Porifera, Coelenterata, Annelida, Arthropoda, Mollusca, Echinodermata.

Reference Books

1. Ruppert and Barnes, R.D. (2006). Invertebrate Zoology, VIII Edition. Holt Saunders International Edition.
2. Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). The Invertebrates: A New Synthesis, III Edition, Blackwell Science
3. Barrington, E.J.W. (1979). Invertebrate Structure and Functions, II Edition, E.L.B.S. and Nelson
4. Hyman L.H, 1955. The invertebrates - Vol. I to Vol. VII – Mc Graw Hill Book Co.
5. Parker, J. and Haswell, 1978. A text book of Zoology Vol. I - Williams and WilliamsCourse

Web Resources

1. https://www.nationalgeographic.com/animals/invertebrates/
2. https://www.britannica.com/science/parasitic-disease
3. https://www.nio.res.in/
4. https://greatbarrierreef.org

Learning Outcomes

Cours outcomes: CO	On completion of this course, the students will be able to	Cognitive Level
CO1	Recall the characteristic features invertebrates and chordates	**K3**
CO2	Classify invertebrates up to class level and chordates up to order level	**K3**
CO3	Explain and discuss the structural and functional organisation of some invertebrates and chordates	**K3**
CO4	Relate the adaptations and habits of animals to their habita	**K3**
CO5	Analyse the taxonomic position of animals	**K3**

Mapping with Programme Out Comes and Programme Specific Outcome

CO /PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	3	3	2	3	3
CO2	2	3	3	3	2	3	3	2
CO3	3	3	3	2	3	3	3	2
CO4	3	3	3	3	3	3	3	3
CO5	3	2	3	3	2	3	3	2

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

CO /PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Pedagogy:

- Chalk-Talk and Classroom Activities
- PPT& Seminar
- Teaching aids

Lab on Allied Zoology -I

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">Lab on Allied Zoology -I</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">Elective</td></tr>
<tr><td colspan="2">Subject code</td><td colspan="6">25UEBOL1</td></tr>
<tr><td rowspan="2">Category</td><td>Core</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td rowspan="2">EC2</td></tr>
<tr><td></td><td>Semester</td><td>I</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours Per week</td><td>Lecture</td><td>Tutorial</td><td>Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td></td><td></td><td>2</td><td colspan="3">2</td></tr>
</table>

Unit	Contents
I	**Dissection:** 1. Cockroach – digestive system 2. Cockroach – nervous system 3. Fish – digestive system (sardine or any other fish)
II	**Mounting: 1**. Mouth Parts – Cockroach 2. Mouth Parts – Mosquito/ Honey bee 3. Scales– Placoid, Cycloid and Ctenoid 4. Prawn appendages
III	**Spotters:** Paramecium, Plasmodium, Scypha, Leucosolenia, Corals. Taenia solium –entire, Ascaris male and female. Earthworm, Prawn ,Scorpion, Pila, Starfish, Amphioxus, Shark, Frog, Calotes, Pigeon feather and Rabbit
IV	Field visit – Study of fauna on the campus
V	Record / Observation Note (Submission Is Mandatory)

Textbooks

1. Ekambaranatha Iyyar and T. N. Ananthakrishnan, 1995 A manual of Zoology Vol.I (Part 1, 2) S. Viswanathan, Chennai
2. Ganguly, Sinha and Adhikari, 2011. Biology of Animals: Volume I, New Central Book Agency; 3rd revised edition. 1008 pp.
3. Sinha, Chatterjee and Chattopadhyay, 2014. Advanced Practical Zoology, Books & Allied Ltd; 3rd Revised edition, 1 07 0 pp.
4. Lal, S. S, 2016. Practical Zoology Invertebrate, Rastogi Publications.
5. Verma, P. S. 2010. A Manual of Practical Zoology: Invertebates, S Chand, New Delhi
6. Lal S S, (2009). Practical Zoology Vertebrate, Rajpal and Sons Publishing

Reference Books

1. Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). The Invertebrates: A New Synthesis, III Edition, Blackwell Science
2. Barnes, R.D. (1982). Invertebrate Zoology, V Edition. Holt Saunders International Edition.
3. Barrington, E.J.W. (1979). Invertebrate Structure and Functions. II Edition, E.L.B.S. and Nelson
4. Boradale, L.A. and Potts, E.A. (1961). Invertebrates: A Manual for the use of Students. Asia Publishing Home
5. Lal, S.S. 2005. A text Book of Practical Zoology: Invertebrate, Rastogi, Meeru

Web Resources

1. https://nbb.gov.in/
2. https://www.agshoney.com/training.htm
3. https://icar.org.in/
4. http://www.csrtimys.res.in/
5. http://csb.gov.in/
6. https://nisa.icar.gov.in/
7. https://www.nationalgeographic.com/animals/invertebrates/

Learning Outcomes

Course outcomes: CO	On completion of this course, the students will be able to	Cognitive Level
CO1	Compare and distinguish the dissected internal organs of lower and higher animals	**K3**
CO2	Prepare and develop the mounting procedure of important invertebrate and chordate anatomical parts and to appreciate the structure, function and mode of life	**K3**
CO3	Identify and label the external features of different groups of invertebrate animals	**K3**

Mapping with Programme Out Comes and Programme Specific Outcome

CO /PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	3	3	2	3	3
CO2	2	3	3	3	2	3	3	2
CO3	3	3	3	2	3	3	3	2

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

CO /PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3

Pedagogy:

- Chalk-Talk and Classroom Activities
- PPT& Seminar
- Teaching aids

Blue Print – End Semester Examinations Semester – I

Class: U.G. /P.G.   Time: 3 Hours   Max. Marks: 75

Section A **(10 x 1 = 10)**

Answer all questions.
Choose the correct answer. (With four options)

	Unit I	Unit II	Unit III	Unit IV	Unit V
Question Nos.	1 & 2	3 & 4	5 & 6	7 & 8	9 & 10

Section B **(5 x 5 = 25)**

Answer all questions choosing either (a) or (b).
Answer should not exceed 250 words

	Unit I	Unit II	Unit III	Unit IV	Unit V
Question Nos.	11 (a) & 11 (b)	12 (a) & 12 (b)	13 (a) & 13 (b)	14 (a) & 14 (b)	15 (a) & 15 (b)

Section C **(5 x 8 = 40)**

Answer all questions choosing either (a) or (b).
Answer should not exceed 500 words

	Unit I	Unit II	Unit III	Unit IV	Unit V
Question Nos.	16 (a) & 16 (b)	17 (a) & 17 (b)	18 (a) & 18 (b)	19 (a) & 19 (b)	20 (a) & 20 (b)