

# (Affiliated Colleges) 206 - B.Sc. Botany

# Programme Structure and Scheme of Examination (under CBCS) (Applicable to the candidates admitted from the academic year 2023 -2024 onwards)

Part	Course Code	Code Study Components & Course Title	Credit	Hours/ Week	Maximum Marks		
Рагі					CIA	ESE	Total
		SEMESTER – I					
Ι	23UTAML11 23UHINL11 23UFREL11	Language– I பொது தமிழ் – I: <b>தமிழிலக்கிய வரலாறு</b> -1/ Hindi-I (or) French-I	3	6	25	75	100
II	23UENGL12	General English - I	3	6	25	75	100
	23UBOTC13	Core – I: Plant Diversity I Algae	5	5	25	75	100
	23UBOTP14	Core – II: Practical – I: (Covering 23UBOTC13)	5	4	25	75	100
III	23UZOOE15 23UZOOEP1	Elective – I Zoology – I Zoology Practical – I	2	3 2	25 25	75 75	100 100
23UTAMB16 23UTAMA16		Skill Enhancement Course – I*  NME-I /  Basic Tamil – I (or)  Advanced Tamil – I	2	2	25	75	100
	23UBOTF17	Foundation Course: Basics of Botany	2	2	25	75	100
		Total	23	30			800
		SEMESTER – II					
I	23UTAML21 23UHINL21 23UFREL21	Language– II பொது தமிழ் – II: <b>தமிழிலக்கிய வரலாறு</b> -2/ Hindi-II (or) French-II	3	6	25	75	100
II	23UENCL22	General English – II	3	6	25	75	100
	23UBOTC23	Core – III: Plant Diversity – II: Fungi, Bacteria, Viruses, Plant Pathology and Lichens	5	5	25	75	100
III	23UBOTP24	Core – IV: Practical – II: Fungi, Bacteria, Viruses, Pathology and Lichens Practical	5	4	25	75	100
	23UZOOE25 23UZOOEP2	Elective – I : Zoology - II Zoology Practical - II	2 1	3 3	25 25	75 75	100 100
	23UTAMB26 23UTAMA26	Skill Enhancement Course – II*  NME-II/ Basic Tamil – II / Advanced Tamil - II	2	2	25	75	100
IV	23USECG27	Skill Enhancement Course – III Internet and its Applications (Common Paper)	2	2	25	75	100
	23UNMSD01	Language Proficiency for employability: Overview of English Communication**	2	-	25	75	100
		Total	25	30			900

Part	Course Code	Study Components & Course Title	Credit	Hours	Maxi	mum M	
Part	Course Code	Study Components & Course Title	Credit	nours	CIA	ESE	Total
		SEMESTER – III					
I	23UTAML31 23UHINL31 23UFREL31	Language –III பொது தமிழ் – III: தமிழக வரலாறும், பண்பாடும்/ Hindi-III / French-III	3	6	25	75	100
II	23UENGL32	English - III	3	6	25	75	100
	23UBOTC33	<b>Core</b> – <b>V:</b> Plant Diversity III - Bryophytes and Pteridophytes	5	5	25	75	100
III	23UBOTP34	<b>Core –VI:</b> Plant Diversity III Bryophytes and Pteridophytes – Practical-III	5	4	25	75	100
	23UCHEE35	Elective-III: Chemistry for Biological Sciences - I	2	3	25	75	100
	23UCHEEP3	Chemistry Practical for Biological Sciences – I	1	2	25	75	100
	23UBOTS36	<b>Skill Enhancement Course (SEC- 4):</b> Entrepreneurial opportunities in botany	1	1	25	75	100
IV	23UBOTS37 Skill Enhancement Course (SEC-5): Herbal Technology			2	25	75	100
		Environmental Studies	-	1			
		Total	22	30			800
		SEMESTER – IV					
Ι	23UTAML41/ 23UHINL41/ 23UFREL41	Language –IV பொது தமிழ் – IV: <b>தமிழும் அறிவியலும்/</b> Hindi-IV / French-IV	3	6	25	75	100
II	23UENGL42	English –IV	3	6	25	75	100
	23UBOTC43	<b>Core – VII:</b> Gymnosperms, Paleobotany and Evolution	5	5	25	75	100
III	23UBOTP44	Core –VIII: Practical –IV: Gymnosperms, Paleobotany and Evolution	5	3	25	75	100
	23UCHEE45	Elective-IV: Chemistry for Biological Sciences - II	2	3	25	75	100
	23UCHEEP4	Chemistry Practical for Biological Sciences – II	1	2	25	75	100
	23UBOTS46	Skill Enhancement Course (SEC-6): Fermentation technology	2	2	25	75	100
IV	23UBOTS47	Skill Enhancement Course (SEC-7): Environmental impact analysis	2	2	25	75	100
	23UEVSG48	Environmental Studies	2	1	25	75	100
		Total	25	30			900
		SEMESTER – V  Core – IX: Plant Morphology, Taxonomy and	1				<del> </del>
***	23UBOTC51	Economic Botany	4	5	25	75	100
III	23UBOTC52	Core -X: Plant Anatomy and Embryology	4	5	25	75	100
	23UBOTP53 23UBOTD54	Core –XI: Practical-V Covering Core – IX  Core –XII: Project with viva-voce	4	5	25 25	75 75	100
	230D01D34	Core -AII. Froject with viva-voce	4	J	23	13	100

	23UBOTE55-1 23UBOTE55-2 23UBOTE55-3	Elective-V: Cell Biology, Genetics and Plant Breeding (or) Bio-Analytical Techniques (or) Aquatic Botany	3	4	25	75	100
		Elective-VI:	_				
	23UBOTE56	Entrepreneurial Botany	3	4	25	75	100
IV	23UVALG57	Value Education	2	2	25	75	100
1 4	23UBOTI58 Summer Internship ++		2	-	100	-	100
		Total	26	30			800
		SEMESTER – VI					
	23UBOTC61	Core-XIII: Plant Ecology and Phytogeography	4	6	25	75	100
	23UBOTC62	Core - XIV: Plant Biotechnology and Molecular Biology	4	6	25	75	100
	23UBOTC63	Core – XV: Plant Physiology and Plant Biochemistry	4	6	25	75	100
III	23UBOTE64	Elective - VII: Practical covering – Core XIII, XIV and XV	3	5	25	75	100
		Elective VIII:	3	5	25	75	100
	23UBOTE65-1	Horticulture (or)					
	23UBOTE65-2	Computer application in Botany					
	23UBOTE65-3	Cultivation of Algae					
IV	23UBOTF66	Professional Competency Skill:	2	2	25	75	100
1 V	Botany for Competitive examinations						
V	23UBOTX67	Extension Activity	1	-	100	-	100
		Total	21	30			700
		Grand Total	142				4900

#### Non-major (NME) Electives offered to other Departments

IV	23UBOTN16	Organic Farming	2	2	25	75	100
1 V	23UBOTN26	Mushroom Cultivation	2	2	25	75	100

<sup>\*</sup> PART-IV: NME / Basic Tamil / Advanced Tamil (Any one)

Students who have not studied Tamil upto 12th Standard and have taken any Language other than Tamil in Part-I, must choose Basic Tamil-I in First Semester & Basic Tamil-II in Second Semester.

Students who have studied Tamil upto 10th & 12th Standard and have taken any Language other than Tamil in Part-I, must choose Advanced Tamil-I in First Semester and Advanced Tamil-II in Second Semester.

<sup>\*\*</sup> The course "23UNMSD01: Overview of English Communication" is to be taught by the experts from Naan Mudhalvan Scheme team. However, the faculty members of Department of English should coordinate with the Naan Mudhalvan Scheme team for smooth conduct of this course.

<sup>&</sup>lt;sup>++</sup>Students should complete two weeks of internship before the commencement of V semester.

## Choice Based Credit System (CBCS), Learning Outcomes Based Curriculum Framework (LOCF) Guideline Based Credit and Hours Distribution System for all UG courses including Lab Hours

#### First Year – Semester-I

Part	List of Courses	Credit	No. of
			Hours
Part I	Language – Tamil	3	6
Part II	English	3	6
Part III	Core Theory, Practical & Elective Courses	13	14
	Skill Enhancement Course SEC-1 (NME-I)	2	2
Part IV	Foundation Course	2	2
		23	30

## **Semester-II**

Part	List of Courses	Credit	No. of
			Hours
Part I	Language – Tamil	3	6
Part II	English	3	6
Part III	Core Theory, Practical & Elective Courses	13	14
Part IV	Skill Enhancement Course -SEC-2 (NME-II)	2	2
	Skill Enhancement Course -SEC-3 (Discipline / Subject Specific)	2	2
		23	30

## Second Year – Semester-III

Part	List of Courses	Credit	No. of
			Hours
Part I	Language - Tamil	3	6
Part II	English	3	6
Part III	Core Theory, Practical & Elective Courses	13	14
Part IV	Skill Enhancement Course -SEC-4 (Entrepreneurial Based)	1	1
	Skill Enhancement Course -SEC-5 (Discipline / Subject Specific)	2	2
	E.V.S	-	1
		22	30

## **Semester-IV**

Part	List of Courses	Credit	No. of
			Hours
Part I	Language - Tamil	3	6
Part II	English	3	6
Part III	Core Theory, Practical & Elective Courses	13	13
Part IV	Skill Enhancement Course -SEC-6 (Discipline / Subject Specific)	2	2
	Skill Enhancement Course -SEC-7 (Discipline / Subject Specific)	2	2
	E.V.S	2	1
		25	30

## Third Year Semester-V

Part	List of Courses	Credit	No. of
			Hours
Part III	Core Theory, Practical, Project & Elective Courses	22	28
Part IV	Value Education	2	2
	Internship / Industrial Visit / Field Visit	2	-
		26	30

## Semester-VI

Part	List of Courses	Credit	No. of
			Hours
Part III	Core Theory, Practical & Elective Courses	18	28
Part IV	Professional Competency Skill	2	2
Part V	Extension Activity	1	-
		21	30

## Consolidated Semester wise and Component wise Credit distribution

Parts	Sem I	Sem II	Sem III	Sem IV	Sem V	Sem VI	Total
							Credits
Part I	3	3	3	3	-	-	12
Part II	3	3	3	3	-	-	12
Part III	13	13	13	13	22	18	92
Part IV	4	4	3	6	4	2	23
Part V	-	-	-	-	-	1	1
Total	23	23	22	25	26	21	140

\*Part I. II, and Part III components will be separately taken into account for CGPA calculation and classification for the under graduate programme and the other components Part IV, V have to be completed during the duration of the programme as per the norms, to be eligible for obtaining the UG degree.

## CREDIT DISTRIBUTION FOR U.G. PROGRAMME

Part	Course Details	No. of Courses	Credit per	Total Credits
			course	Creares
Part I	Tamil	4	3	12
Part II	English	4	3	12
Part III	Core Courses	15	4/5	68
	Elective Courses: Generic / Discipline Specific	8	3	24
	(3 or 2+1 Credits)			
	Part I, II and III Credits			116
	Skill Enhancement Courses / NME / Language Courses	7	1/2	15
	Professional Competency Skill Course	1	2	2
Part IV	Environmental Science (EVS)	1	2	2
	Value Education	1	2	2
	Internship	1	2	2
	Part IV Credits			23
Part V	Extension Activity (NSS / NCC / Physical Education)	1	1	1
	Total Credits for the UG Programme	<u> </u>		140

Methods of Evaluation				
	Continuous Internal Assessment Test	25 Marks		
Internal Evaluation	rnal Evaluation Assignments			
	Seminars			
	Attendance and Class Participation			
External Evaluation	End Semester Examination	75 Marks		
	Total	100 Marks		
	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			
Create(K6)	Check knowledge in specific or off beat situations, Discussive Presentations	ssion, Debating or		

#### 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:** 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, synthesising and articulating; Ability to recognise cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyse, 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 together 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 analyse, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective.
- **PO9: Reflective thinking**: Critical sensibility to lived experiences, with self awareness and reflexivity of both self and society.
- **PO10 Information/digital literacy:** Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources; and use appropriate software for analysis of data.
- **PO 11 Self-directed learning**: Ability to work independently, identify appropriate resources required for a project, and manage a project through to completion.
- **PO 12 Multicultural competence:** Possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups.
- PO 13: Moral and ethical awareness/reasoning: Ability toembrace moral/ethical values in

conducting one's life, formulate a position/argument about an ethical issue from multiple perspectives, and use ethical practices in all work. Capable of demonstratingthe ability to identify ethical issues related to one"s work, avoid unethical behaviour such as fabrication, falsification or misrepresentation of data or committing plagiarism, not adhering to intellectual property rights; appreciating environmental and sustainability issues; and adopting objective, unbiased and truthful actions in all aspects of work.

**PO 14:** Leadership readiness/qualities: 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.

**PO 15: Lifelong learning:** Ability to acquire knowledge and skills, including "learning how to learn", that are necessary for participating in learning activities throughout life, through self-paced and self-directed learning aimed at personal development, meeting economic, social and cultural objectives, and adapting to changing trades and demands of work place through knowledge/skill development/reskilling.

#### Programme Specific Outcomes:

On successful completion of Bachelor of Physics with Computer Applications programme, the student should be able to:

**PSO1: Disciplinary Knowledge:** Understand the fundamental principles, concepts, and theories related to physics and computer science. Also, exhibit proficiency in performing experiments in the laboratory.

**PSO2:** Critical Thinking: Analyse complex problems, evaluate information, synthesize information, apply theoretical concepts to practical situations, identify assumptions and biases, make informed decisions and communicate effectively

**PSO3: Problem Solving:** Employ theoretical concepts and critical reasoning ability with physical, mathematical and technical skills to solve problems, acquire data, analyze their physical significance and explore new design possibilities.

**PSO4:** Analytical & Scientific Reasoning: Apply scientific methods, collect and analyse data, test hypotheses, evaluate evidence, apply statistical techniques and use computational models.

**PSO5:** Research related skills: Formulate research questions, conduct literature reviews, design and execute research studies, communicate research findings and collaborate in research projects.

**PSO6: Self-directed & Lifelong Learning:** Set learning goals, manage their own learning, reflect on their learning, adapt to new contexts, seek out new knowledge, collaborate with others and to continuously improve their skills and knowledge, through ongoing learning and professional development, and contribute to the growth and development of their field.

PO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
PO1	✓					
PO2		✓				
PO3			✓			
PO4				<b>✓</b>		
PO5					✓	
PO6						✓

SEMESTER - I
PART – III

23UBOTC13: CORE PAPER I : PLANT DIVERSITY I
ALGAE

CREDITS: 5
HOURS: 75

#### **COURSE OBJECTIVES**

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

#### UNIT - I:

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

#### UNIT - II

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

#### UNIT - III

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

#### UNIT - IV:

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

#### UNIT - V

Algae as food and feed: Agar-agar, Alginic acid and Carrageenan; Diatomite.

Resource potential of algae: Application of algae as fuel, agriculture and pharmaceutical.

Phycoremediation. Role of algae in CO<sub>2</sub> sequestration, Algae as indicator of water pollution, algal bioinoculants, Bioluminescence.

#### **Text Books**

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

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#### Reference Books

- 1. Aziz, F and Rasheed, R. 2019. A Course Book of Algae. Publisher: University of Sulaimani.ISBN: 978-9922-20-391-1.
- 2. Mihir Kumar, D. 2010. Algal Biotechnology. Daya Publishing House, New Delhi
- 3. Chapman V.J. and Chapman D.J, 2013. The Algae. Alpha Numera..
- 4. Fritsch, F.E. 1945. Structure and reproduction of Algae. Cambridge University press.
- 5. Round, FE. 1984. The Ecology of Algae. Cambridge University Press.
- 6. Lee, R.D. 2008. Phycology 4th Edition, Cambridge University Press, New York.

#### Web resources

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

#### COURSE OUTCOMES

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

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

#### **OUTCOME MAPPING**

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

SEMESTER –		CREDITS: 5
I	23UBOTP14 : Core paper II – Practical I	HOURS: 60
PART – III		HOURS: 00

## **Course Objectives**

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

#### EXPERIMENTS TO BE CARRIED OUT

#### ALGAE

Micro-preparation of the types prescribed in the syllabus.

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

#### Botanical excursion for collection of algae

## Bonafide record of practical work done should be submitted for the practical examination Course outcomes:

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

- 1. Recall and identify algae, fungi using key identification characters.
- 2. Demonstrate practical skills in preparation of fresh mount and identification of algal forms from algal mixture.
- 3. Describe the internal structure of algae, prescribed in the syllabus.
- **4.** Decipher the algal diversity in fresh/marine water, algae, fungi, bacteria, virus lichens, bryophytes and pteridophytes. and their economic importance
- **5.** Evaluate the various techniques used to culture algae for commercial purposes.

#### Recommended texts

- 1. L. 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<sup>th</sup> 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, 5<sup>th</sup> Ed., Cambridge University Press, London.

#### Web Resources

- 1. https://www.amazon.in/Practical-Manual-Algae-Sundara-Rajan/dp/8126106492
- 2. <a href="https://books.google.co.in/books/about/Practical\_Manual\_of\_Algae.html?id=8d5DAAAACAAJ&redir\_esc="https://books.google.co.in/books/about/Practical\_Manual\_of\_Algae.html?id=8d5DAAAACAAJ&redir\_esc="https://books.google.co.in/books/about/Practical\_Manual\_of\_Algae.html?id=8d5DAAAACAAJ&redir\_esc="https://books.google.co.in/books/about/Practical\_Manual\_of\_Algae.html?id=8d5DAAAACAAJ&redir\_esc="https://books.google.co.in/books/about/Practical\_Manual\_of\_Algae.html?id=8d5DAAAACAAJ&redir\_esc="https://books.google.co.in/books/about/Practical\_Manual\_of\_Algae.html?id=8d5DAAAACAAJ&redir\_esc="https://books.google.co.in/books/about/Practical\_Manual\_of\_Algae.html?id=8d5DAAAACAAJ&redir\_esc="https://books.google.co.in/books/about/Practical\_Manual\_of\_Algae.html?id=8d5DAAAACAAJ&redir\_esc="https://books.google.co.in/books/about/Practical\_Manual\_of\_Algae.html?id=8d5DAAAACAAJ&redir\_esc="https://books.google.co.in/books/about/Practical\_Manual\_of\_Algae.html?id=8d5DAAAACAAJ&redir\_esc="https://books.google.co.in/books.googl
- 3. https://freebookcentre.net/biology-books-download/Concepts-of-Botany-Algae-(PDF-21P).html

#### **OUTCOME MAPPING**

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

## **MAJOR BOTANY PRACTICAL I**

Time: 3 Hours  PRACTICAL QUESTION PAPER	Max. M	arks : 75
1. Make suitable micro preparations of the given specimens A and B. Submit the slides for valuation. Identify the specimens, draw diagram (Identification – 2, diagram – 3, Reasons – 4, Slide -4) (13 X 2)	s and give rea	asons. (26)
2. Identify the any TWO / THREE species from the given algal mixture (Identification – 2, diagram – 4, Reasons – 3)	e C. (9)	
3. Identify the given specimens D and E and write their economic importance-4) (2 X 5)	oortance.	(10)
4. Spotters – F, G, H, and I (Identification – 1, diagram – 2, Reasons –2) (4 X 5)		(20)
	Total = Record =	- 65 10
Gran	nd Total =	75
KEY & SCHEME OF VALUATION		
<ol> <li>A and B – Algae : Caulerpa, Sargassum, Ulva,</li> <li>(Any two – based on the availability of the specimens)</li> <li>(Identification – 2, diagram – 3, Reasons – 4, Slide -4) (13 X 2)</li> </ol>		(26)
2. Algal mixture - C : <i>Chlorella, Volvox, Anabaena, Oedogonium</i> (Any two/three species – based on the availability of the specimens) (Identification – 2, diagram – 4, Reasons – 3)	(9)	
3. Economic importance – D and E Algae : SCP, food, feed, biofertilizers, seaweed liquid fertilizer, agar (Identification -1, economic importance-4) (2 X 5)		(10)
4. Spotters - F, G, H, and I (any four of the following) (Algae–Unicellular, Filamentous, colonial, parenchymatous, siphonous diagrams or wet preserved jar specimens) (Identification – 1, diagram – 2, Reasons – 2) (5 X 4)	s -permanent	slides, book
	Total = Record =	65 10

<b>SEMESTER: I</b>	23UZOOE15	Credit: 2	
PART: III	Zoology – I	Hours: 3	

#### **Course Objectives**

The main objectives of this course are:

1	To acquire a basic knowledge of diversity and organization of Protozoa, Coelenterata, Helminthes and Annelida
2	To acquire a basic knowledge of diversity and organization of Arthropoda, Mollusca and Echinodermata
3	To comprehend the taxonomic position and diversity among Protochordata, Pisces and Amphibia
4	To comprehend the taxonomic position and diversity among Reptilia, Aves and Mammalia
5	To acquire detailed knowledge of selected invertebrate and chordate forms

#### Unit - I: 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 - II: Diversity of Invertebrates-II

Classification of Arthropoda, Mollusca and Echinodermata upto class level with examples.

#### Unit - III: Diversity of Chordates-I

Classification of Prochordata, Pisces and Amphibia upto orders giving two examples.

#### Unit - IV: Diversity of Chordates-II

Classification of Reptilia, Aves and Mammalia upto orders giving two examples.

#### Unit -V: Animal organization

Structure and organization of (i) Earthworm, (ii) Rabbit/Rat, (iii) Prawn/Fish

#### **Expected Course Outcomes**

On completion of this course, students will:

1	Recall the characteristic features invertebrates and chordates.
2	Classify invertebrates up to class level and chordates up to order level
3	Explain and discuss the structural and functional organisation of some invertebrates and chordates
4	Relate the adaptations and habits of animals to their habitat
5	Analyse the taxonomic position of animals.

#### **Text Books (Latest Editions)**

**1.** Ekambaranatha Iyer, - Outlines of Zoology, Viswanathan Publication.

#### References Books

(Latest editions, and the style as given below must be strictly adhered to)

1. Ekambaranatha Iyar and T.N.Ananthakrishnian - A Manual of Zoology Invertebrata–VoI. I: Viswanathan Publishers.

- 2. Ekambaranatha Iyar and T.N. Ananthakrishnan, A Manual of Zoology -Invertebrata–Vol. II: Viswanathan Publishers.
- 3. Ekambaranatha Iyar and T.N.Ananthakrishnan, A Manual of Zoology: Chordata Viswanathan Publishers.
- 4. Jordan E.L. and P.S. Verma-Invertebrate Zoology, S. Chand & Co.

#### Web Resources

- 1. www.sanctuaryasia.com
- 2. www.iaszoology.com

## **Outcome Maping**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	S							
CO 2	M	S						
CO 3				S		S		
CO 4				S	S	M		
CO 5			S					S

S-Strong M-Medium L-Low

SEMESTER: I	23UZOOEP1	Credit: 1
PART: III	Zoology Practical- I	Hours: 2

#### **Course Objectives**

4	To identify the different groups of invertebrate animals by observing their
1	external characteristics.
2	To understand the organs, organ system and their functions in lower animals.
3	To get knowledge about the different modes of life and their adaptation based on
	the environment.
4	Able to dissect and display the internal organs and mount the mouthparts and
	scales of invertebrates.

#### **UNIT – I:** Major Dissection:

Cockroach: Circulatory system, Nervous system, Reproductive system. Leech: Nervous System, Reproductive system. Earthworm: Nervous System, Reproductive system. *Pila globosa*: Nervous system. Prawn: Nervous system (including Appendages).

#### **UNIT – II: Minor Dissection:**

Cockroach: Digestive system. Earthworm: Viscera, Lateral hearts.

Pila globosa: Digestive system (Including radula). Freshwater Mussel: Digestive system.

## **UNIT – III: Mounting:**

Earthworm: Body setae; Pineal setae. Pila globosa: Radula. Freshwater muscle: Pedal ganglia.

#### **UNIT - IV: Mounting:**

Cockroach: Salivary apparatus, Mouth parts - Honey Bee, House fly and Mosquito mouth parts.

#### UNIT - V: Spotters :(i).

Protozoa: Amoeba, Paramoecium, Paramoecium Binary fission and Conjugation, Vorticella, Entamoeba histolytica, Plasmodium vivax (ii). Porifera: Sycon, Spongilla, Euspongia, Sycon - T.S & L.S, Spicules, Gemmule (iii). Coelenterata: Obelia – Colony & Medusa, Aurelia, Physalia, Velella, Corallium, Gorgonia, Pennatula (iv). Platyhelminthes: Planaria, Fasciola hepatica, Fasciola larval forms – Miracidium, Redia, Cercaria, Echinococcus granulosus, Taenia solium, Schistosoma haematobium (v). Nemathelminthes: Ascaris(Male & Female), Drancunculus, Ancylostoma, Wuchereria (vi). Annelida: Nereis, Aphrodite, Chaetopteurs, Hirudinaria, Trochophore larva (vii). Arthropoda: Cancer, Palaemon, Scorpion, Scolopendra, Sacculina, Limulus, Peripatus, Larvae - Nauplius, Mysis, Zoea, Mouth parts of male & female Anopheles and Culex, Mouthparts of Housefly and Butterfly. (viii). Mollusca: Chiton, Pila, Unio, Pteredo, Murex, Sepia, Loligo, Octopus, Nautilus, Glochidium larva (ix). Echinodermata: Asterias, Ophiothrix, Echinus, Clypeaster, Cucumaria, Antedon, Bipinnaria larva

#### **Expected Course Outcomes**

On completion of this course, students will;

1	Identify and label	the external features	of different	groups of invertebrate
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	animals.				
2	Illustrate and examine the circulatory system, nervous system and				
	reproductive system of invertebrate animals.				
	Differentiate and compare the structure, function and mode of life of				
3	various groups of animals.				
4	To compare and distinguish the dissected internal organs of lower animals.				
5	Prepare and develop the mounting procedure of economically important				
	invertebrates.				

#### **Text Books**

#### (Latest Editions)

- 1. Ekambaranatha Iyyar and T. N. Ananthakrishnan, 1995 A manual of Zoology Vol.I (Part 1, 2) S. Viswanathan, Chennai.
- 2. Ganguly, Sinha and A dhikari, 2 0 11. Biology of Animals: Volume I, New Central Book Agency; 3rd revised edition. 1008 pp.
- 3. Sinha, Chatterjee and Chattopadhyay, 2 0 1 4. 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, 4 97pp.

#### **References 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, Meerut

#### **Web Resources**

- 1. <a href="https://nbb.gov.in/">https://nbb.gov.in/</a>
- 2. <a href="http://www.agshoney.com/training.htm">http://www.agshoney.com/training.htm</a>
- 3. https://icar.org.in/
- 4. <a href="http://www.csrtimys.res.in/">http://www.csrtimys.res.in/</a>
- 5. <a href="http://csb.gov.in/">http://csb.gov.in/</a>
- 6. <a href="https://iinrg.icar.gov.in/">https://iinrg.icar.gov.in/</a>
- 7. https://www.nationalgeographic.com/animals/invertebrates/

**Mapping with Programme Outcomes:** 

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	S			S	S	S	M	
CO 2	M	S			M		L	
CO 3			M	S		S		
CO 4	S			S	S	M	S	
CO 5			S			S		S

S-Strong(3)

M-Medium (2)

L-Low (1)

SEMESTER - I	23UBOTF17: BASICS OF BOTANY	CREDITS: 2
PART – IV	(Foundation Course)	HOURS: 30

#### **COURSE OBJECTIVES**

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

#### UNIT - I:

#### **BIODIVERSITY**

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

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, Plastids, Ribosomes.

#### UNIT - III

#### PLANT MORPHOLOGY

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

#### UNIT - IV:

#### GENETICS

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

#### UNIT - V

#### PLANT PHYSIOLOGY

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

#### **Text Books**

- 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,
  - S.Chand and Co. New Delhi.
    - 6. Rao, K., Krishnamurthy, K.V and Rao, G.S. 1979. Ancillary Botany, S. Viswanathan Pvt. Ltd., Madras.

#### Reference Books

- 1. Singh, V., Pande, P.C and Jain, D.K. 2021. A Text Book of Botany. Rastogi Parihar, N.S. 2012. An introduction to Embryophyta –Pteridophytes Surject 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. Surject 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 -, Surject 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. <a href="http://scitec.uwichill.edu.bb/bcs/bl14apl/bryo1.htm">http://scitec.uwichill.edu.bb/bcs/bl14apl/bryo1.htm</a>
- 4. https://www.toppr.com/guides/biology/plant-kingdom/pteridophytes/
- 5. https://www.us.elsevierhealth.com/medicine/cell-biology
- 6. <a href="https://www.us.elsevierhealth.com/medicine/genetics">https://www.us.elsevierhealth.com/medicine/genetics</a>
- 7. <a href="https://www.kobo.com/us/en/ebook/plant-biotechnology-1">https://www.kobo.com/us/en/ebook/plant-biotechnology-1</a>

#### **COURSE OUTCOMES**

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

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

#### **OUTCOME MAPPING**

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

II	23UBOTC23 : Core paper III : PLANT DIVERSITY – II: FUNGI, BACTERIA, VIRUSES, PLANT PATHOLOGY AND LICHENS	CREDITS: 5 HOURS: 75	
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#### **COURSE OBJECTIVES**

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

#### UNIT - I:

#### **FUNGI**

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

#### UNIT - II

## **ECONOMIC IMPORTANCE OF FUNGI:**

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

#### UNIT - III

#### **BACTERIA, VIRUS:**

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

#### UNIT-IV:

#### **PLANT PATHOLOGY:**

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

Bacterial diseases – Citrus canker and Bacterial wilt of Banana

**Viral diseases** – Tobacco Mosaic and Vein clearing of Papaya

Fungal diseases – Blast disease in rice and Tikka disease

#### UNIT - V

#### LICHENS:

Classification (Hale, 1969). Habitat, nature of association, Structure, Nature of Mycobionts and Phycobionts, Study of growth forms of lichens (crustose, foliose and fruticose), types,

distribution, thallus organization, reproduction and ecological significance of lichens with special reference to *Usnea*.

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

#### **Text Books**

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

#### Reference Books

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

#### Web resources

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

#### **COURSE OUTCOMES**

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

- 1. Recognize the general characteristics of microbes, fungi and lichens and disease symptoms.
- 2. Develop an understanding of microbes, fungi and lichens and appreciate their adaptive strategies based on structural organization

- 3. Identify the common plant diseases, according to geographical locations and device control measures
- 4. Analyze the emerging trends in fungal biotechnology with special reference to agricultural and pharmaceutical applications.
- 5. Determine the economic importance of microbes, fungi and lichens.

#### **OUTCOME MAPPING**

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

SEMESTER -	23UBOTC24 : Core paper IV – Practical II	CREDITS: 5
II	(Covering 23UBOTC23)	
PART – III		HOURS: 60

## **Course Objectives**

- 1. To enable students to identify microscopic and macroscopic fungi..
- 2. To prepare microslides of fungi and lichens...
- 3. To know the presence of pathogen inside the plant tissues through microscopic sections

- 4. To identify the bacteria and viruses based on the morphology, and microslides
- 5. To know the economic importance of the microbes studied...

#### **EXPERIMENTS TO BE CARRIED OUT**

#### **EXPERIMENTS**

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

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

#### **Course outcomes:**

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

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

#### Recommended texts

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

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

#### Reference books

- 1. Smith, G.M. 1955. Cryptogamic Botany Vol.II. Tata McGraw Hill. New Delhi.
- 2. James.W. Byng. 2015. The Gymnosperms practical hand book. A practical guide to extant families and genera of the world. Published by plant Gateway, Tol Bot Street, Herford, SG137BX,

- United Kingdom.
- 3. Sharma, O.P. 2012. Textbook of Pteridophyta, TATA MacMillan India Ltd., New Delhi.
- 4. Chamberlain, C.J. 1934. Gymnosperms: Structure and Evolution. Chicago Reprinted 1950). New York.
- 6. Kirkaldy, J.E. 1963. The study of Fossils. Hutchinson Educational, London.

#### Web Resources

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

#### **OUTCOME MAPPING**

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

#### **MAJOR BOTANY PRACTICAL II**

Time: 3 Hours Max. Marks: 75

#### PRACTICAL OUESTION PAPER

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

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

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

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

Total = 65
Record = 10

Grand Total = 75

# MAJOR BOTANY PRACTICAL II KEY & SCHEME OF VALUATION

- 1. Fungi A and B

  Peziza, Agaricus, Pleurotus, Puccinia, Cercospora

  Any two based on availability

  (Identification –1, diagram 2, Reasons 3, Slide -3) (9 X 2)

  (18)
- 2. Plant pathology C Citrus canker, Bacterial wilt, Tobacco mosaic, vein clearing, Blast disease and Tikka disease (Any one)
  Name the disease (1) and causal organism (2), Write the symptoms (3) and control measures(3)
- 3. Economic importance D and E:
  Fungi: Biopesticide, Trichoderma, mushroom, yeast, vitamin and antibiotic sources
  Lichens: Dye, Perfume
  (Identification -1, economic importance-4) (2 X 5) (10)
- 4. Spotters F, G, H, I, J, K and L (any Seven of the following)
  (Fungi, Bacteria, Virus, Mycoplasma, Lichens, Plant pathology specimens permanent slides, book diagrams or wet preserved jar specimens)
  (Identification 1, diagram 1 Reasons 2) (7 X 4)

  (28)

SEMESTER: II	23UZOOE25	Credit: 2
PART: III	Zoology – II	Hours: 3

1	To enable students to learn basic concepts relating to aspects of respiratory, circulatory, excretory, nervous and sensory physiology.
2	To enable students to comprehend the processes involved during development
3	To enable students to learn basic concepts of immunity and the working of immune organs and familiarize them with the recommended vaccination schedule
4	To enable students to comprehend the basic concepts of human genetics and patterns of inheritance
5	To enable students to learn about aspects of animal behaviour such as foraging, courtship, nest construction, parental care and learning

Unit – I: Respiration- Respiratory pigments and transport of gases. Mechanism of blood clotting. Types of excretory products – Ornithine cycle. Structure of neuron –Conduction of nerve impulse, Mechanism of vision and hearing.

Unit – II: Fertilization, Cleavage, Gastrulation and Organogenesis of Frog; Placentation in mammals

Unit – III: Innate and Acquired - Active and Passive; Antigens and Antibodies; Immunological organs–responses in humans; Vaccination schedule

Unit – IV: Human Genetics: Human Chromosomes – Sex Determination in Humans; Patterns of Inheritance: Autosomal Dominant, Autosomal Recessive, X-linked, Y-linked, Mitochondrial, Multiple Allelic and Polygenic; Genetic Counseling

Unit - V: Animal Behaviour: Foraging, Courtship Behaviour, Shelter and Nest Construction, Parental Care, Learning Behaviour

## **Expected Course Outcomes**

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

	the contract of the contract o				
1	Recall the parts and working of body organs and developmental stages, name the patterns of inheritance and list different types of animal behaviour				
2	Analyse the different developmental stages				
3	Analyse the working of body and immune systems				
4	Analyse the different patterns of inheritance				
5	Relate the behaviour of animals to physiology. Analyse the different types of behaviour				

## **Text Books (Latest Editions)**

1. Verma P.S. & Agarwal - Developmental Biology, Chordata embryology S. Chand & Co.

#### **References Books**

## (Latest editions, and the style as given below must be strictly adhered to)

- 1. Owen, J. A., Punt, J. & Stranford, S. A. Kuby Immunology. New York: W.H. Freeman & Company.
- 2. Klug, W. S., Cummings, M. R. & Spencer, C Concepts of Genetics. (12th ed.). New Jersey: Pearson Education.
- 3. Mathur, R. Animal Behaviour. Meerut: Rastogi.
- 4. Verma P.S. & Agarwal Developmental Biology, Chordata embryology. S.Chand & Co.

**Outcome Maping** 

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	S		S		M		S	S
CO 2	M	S						
CO 3		S	M	S		S	M	
CO 4	S			S	S	M		
CO 5			S					S

S-Strong M-Medium L-Low

SEMESTER: II	23UZOOEP2	Credit: 1
PART: III	<b>Zoology Practical – II</b>	Hours: 2

### Course Objectives:

1	To learn basic concepts relating to various physiological aspects of animals.
2	To comprehend the processes involved during development
3	To learn basic concepts of immunity and familiarize on immune organs.
4	To know the basic concepts of human genetics and patterns of inheritance
5	To learn about aspects of animal behaviour.

#### **Practicals:**

- 1. Qualitative detection of excretory products (Ammonia, Urea, Uric acid).
- 2. Frog Egg, Blastula and Gastrula.
- 3. Demonstration of lymphoid organs.
- 4. Identification of ABO blood groups
- 5. Identification of human syndroms from karyotyping
- 5. Vital staining of chick blastoderm
- 7. Study of behavioural adaptations of animals

## **Expected Course Outcomes**

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

	To the first term of the term
1	Recall the parts and working of body organs
2	Analyse the different developmental stages
3	Analyse the functioning of body and immune systems
4	Analyse the different patterns of inheritance
5	Understand the different types of behaviour

## Text Book(s)

- 1 Arumugam N. (2013). Developmental Zoology, Saras Publication, Nagercoil, Tamilnadu, India.
- 2 Das S. (2020). Microbiology Practical Manual, CBS Publication, Delhi.
- 3 Jayasurya, Arumugam N, Dulsy Fatima. (2013). Practical Zoology Vol 3, Saras Publication, Nagercoil, Tamilnadu, India.
- 4 Singh HR and Neerajkumar. (2014). Animal Physiology and Biochemistry, Vishal Publishing Co. Jalandhar, Delhi.

## **Outcome Maping**

_	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	S	M		M	M	S		S
CO 2	M	S	M		S		M	
CO 3	S	M		S		S		M

CO 4	S	S		S	S	M		
CO 5	S	S	S				S	S

S-Strong M-Medium L-Low

## NON-MAJOR ELECTIVE-I 23UBOTN16: ORGANIC FARMING

Title of	ORGANI	C FARMING						
the								
Course								
Paper	Non-Majo	r Elective-I						
Number								
Category	Elective	Year	I	Credits	1	CourseCode		
1	ı	Semester	I					
Instructional Hours		Lecture	T	Cutorial	Lab Practice Total		<u> </u>	
per week		2		-	-	2		
Pre-requis	ite	Students to gai	ts to gain knowledge on the scope of organic farming and its significance.					
Learning (	Objectives							
C1	To ena	ble students to	gain kno	wledge on the sco	pe of organic farmi	ng and its		
	signific	cance.	_		-			
C2	To im	part practical i	nsights	sustainable agrice	ulture, green manı	aring, recycling an	d	
		composting.						
C3	To und	lerstand the phy	sical and	d chemical propert	ties of soil.			
<b>C4</b>	To stud	dy sustainable a	gricultui	re.				
C5		•	•	of biofertilizers.				

Course outcomes:	Programme Outcomes
On completion of this course, the students will be able to:	
CO	
1. Recognize the different forms of biofertilizers and their uses.	<b>K</b> 1
2. Explain and interpret the components, patterns, and processes of bacteria for	<b>K2</b>
growth in crop production.	
3. Apply techniques for synthesizing green manure and develop strategies to	К3
increase crop yield.	
4. Analyze and decipher the significance of biofertilizers in soil fertility.	K4
5. Develop new strategies to enhance growth and quality check of medicinal	K5
herbs considering the practical issues pertinent to India.	

UNIT	CONTENTS
	Soil – physical, chemical properties. Soil pollution – oil, chemicals –fertilizers, pesticide and herbicide,
	non-degradable solids, biomagnification, consequences of land pollution – damage to soil and crops.
Ι	
	Organic farming – definition, basic concept of organic farming, integrated plant nutrient supply
	management, integrated insect pest and disease management, integrated soil and water
II	management. Sustainable agriculture practices-crop rotation, mixed cropping.
	Management of organic wastes and green manures: Farm manures, Composts, Mulches and
	pest control, importance of organic manure, importance of green manure, crops of green
III	manure, oil cake. Animal based organic manure—cow dung, vermicompost-methods, production
	and utilization.
	Biofertilizers-classification, nitrogen fixers-Rhizobium, Cyanobacteria, Azolla and Vesicular
IV	Arbuscular Mycorrhiza.
	Recycling of bio-degradable municipal, agricultural and Industrial wastes – biocompost making
$\mathbf{V}$	methods.

	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	Knowledge, Problem Solving, Analytical ability, Professional
course	Competency, Professional Communication and Transferrable Skill
Recommended Texts	<ol> <li>NIIR Board. 2012. The complete Technology Book on Biofertilizer and organic farming. 2nd Edition. NIIR Project Consultancy Services.</li> <li>Sathe, T.V. 2004. Vermiculture and Organic Farming. Daya publishers.</li> <li>Subba Rao N.S. 2017. Biofertilizers in Agriculture and Forestry. Fourth Edition.Medtech.</li> <li>Vayas,S.C, Vayas, S. and Modi, H.A. 1998. Bio-fertilizers and organic Farming Akta Prakashan, Nadiad.</li> <li>Dongarjal, R.P and Zade, S.B. 2019. Insect Ecology and Integrated Pest Management Akinik Publications, New Delhi.</li> </ol>
Reference Books	<ol> <li>Vayas,S.C, Vayas, S and Modi, H.A. 1998. Bio-fertilizers and organic Farming Akta Prakashan, Nadiad.</li> <li>Sathe, T.V.2004. Vermiculture and Organic Farming. Daya publishers.</li> <li>Subha Rao, N.S.2000. Soil Microbiology, Oxford &amp; IBH Publishers, New Delhi.</li> <li>Reddy, S.R. 2019. Fundamentals of Agronomy Kalyani Publications, Uttar Pradesh</li> <li>Tolanur, S. 2018. Fundamentals of Soil Science IIndEdition ,</li> </ol>

	CBS Publishers , New Delhi
Web Resources	1. <a href="https://www.amazon.com/Beginners-Practical-botanical-">https://www.amazon.com/Beginners-Practical-botanical-</a>
	horticulture-landscape-ebook/dp/B00MOURUNY
	2. <a href="https://www.e-booksdirectory.com/listing.php?category=323">https://www.e-booksdirectory.com/listing.php?category=323</a>
	3. <a href="http://www.freebookcentre.net/Biology/Agriculture-Books.html">http://www.freebookcentre.net/Biology/Agriculture-Books.html</a>
	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=msndesks
	tdin-21&ref=pd_sl_6sbf0qtxcy_b

## **Mapping with Programme Outcomes:**

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	1	3	2	1	2	2	2	2
CO 2	3	3	2	1	2	3	2	3	2	3
CO 3	2	2	3	3	1	2	2	3	2	3
CO 4	3	2	1	1	2	3	2	3	2	3
CO 5	3	3	2	3	1	2	3	3	3	3

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

## NON-MAJOR ELECTIVE-II 23UBOTN26: MUSHROOM CULTIVATION

Title of the Course	Non-Major Elective-II							
Paper Number								
Category	Elective	Year	Ι	Credits	1	CourseCode		
		Semester	II					
Instructional Hours		Lecture		  utorial	Lab Practice	Total		
per week		2		-	_	2		
Pre-requisite		Basic knowledge on structure and function of various groups of mushrooms.						
Course Obje	ectives	•						
C1		To learn and develop skills in mushroom cultivation.						
C2		To understand and appreciate the role of mushrooms in Nutrition, Medicine and health.						
C3		To cultivate mushroom cultivation in small scale industry.						
C4		To learn about diseases and post harvest technology.						
C5		To study new methods and strategies to contribute to mushroom production.						

Course outcomes:	Programme Outcomes	
On completion of this course, the students will be able to:		
CO		
1. Recall various types and categories of mushroom.	K1	
2. Explain about various types of food technologies associated with	K2	
mushroom industry.		
3. Apply techniques studied for cultivation of various types of	K3	
mushroom.		
4. Analyze and decipher the environmental factors and economic value	K4	
associated with mushroom cultivation		
5. Develop new methods and strategies to contribute to mushroom	K5 & K6	
production.		

UNIT	CONTENTS					
I	Introduction: Morphology, Types of Mushroom, identification of edible and poisonous mushroom, Nutritive values, life cycle of common edible mushrooms.					
II	Mushroom cultivation, prospects and scope of Mushroom cultivation in small scale Industry.					
III	Life cycle of <i>Pleurotus spp</i> and <i>Agaricus spp</i> .					

	Spawn production, growth media, spawn running and harvesting of mushrooms
IV	and marketing.
	Diseases and post harvest technology, Insect pests, nematodes, mites, viruses,
$\mathbf{V}$	fungal competitors and other important diseases.

Extended Professional	Questions related to the above topics, from various competitive
Component (is a part of	examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC
internal component only,	/others to be solved
Not to be included in the	(To be discussed during the Tutorial hour)
External Examination	
question paper)	Vnoveledge Broblem Colving Analytical ability Brafassional
Skills acquired from this	Knowledge, Problem Solving, Analytical ability, Professional
course	Competency, Professional Communication and Transferrable Skill
<b>Recommended Texts</b>	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. Verma, 2013. Mushroom: edible and medicinal:
	cultivation conservation, strain improvement with their
	marketing. Daya Publishing House.
Reference 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. Bappeo, The
	Bangalore Printing and Publishing Co. Ltd., No. 88, Mysore Road,
	Bangalore - 560018.
	4. Nita Bahl. 2002. Handbook on Mushroom 4 <sup>th</sup> 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. <a href="http://agricoop.nic.in/sites/default/files/ICAR_8.pdf">http://agricoop.nic.in/sites/default/files/ICAR_8.pdf</a>
	4. <a href="http://www.agrimoon.com/mushroom-culture-horticulture-icar-">http://www.agrimoon.com/mushroom-culture-horticulture-icar-</a>
	<u>pdf-book/</u>
	5. <a href="https://books.google.co.in/books/about/Mushroom_Cultivation_in">https://books.google.co.in/books/about/Mushroom_Cultivation_in</a>
	<u>India.html?id=6AJx99OGTKEC&amp;redir_esc=y</u>

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	S			S	M	L	M	M
CO 2	S			M		S	M	S
CO 3	M			S		M		S
CO 4	S	S	S	S		M		S
CO 5	S	S	M				S	S

## **Second Year**

SEMESTER -III	23UBOTC33: CORE – V: PLANT	Credits: 5
PART – III	DIVERSITY-III BRYOPHYTES AND	H/W: 5
CORE - V	PTERIDOPHYTES	

Pre-requisite	Students should be familiar with the basi	cs of Bryophytes and										
•	Pteridophytes.	, , ,										
Learning Obj	ectives											
C1	To enable the students to have an overview	w of Non-vascular and										
	Vascular cryptogams.											
C2	To understand the morphological diversity	y of Bryophytes and										
	Pteridophytes.											
C3		o know the evolution of Bryophytes and Pteridophytes.										
C4	Pteridophytes.	To understand the economic importance of the Bryophytes and Pteridophytes.										
C5	To understand anatomy and reproduction	n of Bryophytes and										
	Pteridophytes.											
	e outcomes:	Programme Outcomes										
	on of this course, the students will be able to:CO	174										
<ol> <li>Recognize</li> <li>Pteridoph</li> </ol>	re morphological variations of Bryophytes and hytes.	K1										
2. Explain	the anatomy and reproduction of Bryophytes and	K2										
Pteridop	•											
•	e and contrast the variations in the internal	K3										
	organization, gametophyte and sporophyte of											
	tes and Pteridophytes.											
	r the stages of plant evolution and their to land habitat.	K4										
	ne useful role of Bryophytes and Pteridophytes.	K5										
UNIT	EXPERIMENTS	1.0										
I	BRYOPHYTES											
	General characters of Bryophytes, classification	(Watson, 1971) (up to										
	family). Economic importance of Bryophytes -	Ecological importance										
	(Pollution indicators and monitoring), Medicin	nal uses, horticulture,										
	industrial uses and absorbent bandages.											
II	Structure, reproduction and life histories of the following	ng classes each with a										
	suitable example: Hepaticopsida (Marchantia); Anthoc	erotopsida (Anthoceros)										
	and Bryopsida (Funaria). (Examples may be changed	•										
	availability of the specimens). Evolution of Bryophytes											
III	PTERIDOPHYTES  Construction of Pteridophytes Classification (F	Daiman 4054) A										
	General Characters of Pteridophytes - Classification (F	keimer, 1954). Apogamy										
IV	and apospory, homospory and heterospory.  Morphology, anatomy and reproduction of reproduction	on of the taxa helonging										
1 V	morphology, anatomy and reproduction of reproductive	on or the taxa belonging										

	to each	of the follo	wing classes: Psilotopsida ( <i>Psilotum</i> ), Lycopsida					
			sida ( <i>Equisetum</i> ), Pteropsida ( <i>Marsilea</i> ). (Examples					
			ing to the availability of the specimens).					
V	•		Pteridophytes. Stelar Evolution. Economic importance					
Extended Dr	of Pterido		Quantiana related to the above tonice from various					
Extended Pr		•	Questions related to the above topics, from various					
(is a part of in		•	competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved					
Examination	ciuu <del>c</del> u iii	ine External						
	\r\		(To be discussed during the Tutorial hour)					
question pape Skills acquired		COURSE	Knowledge, Problem Solving, Analytical ability,					
Citino doquiros		course	Professional					
			Competency, Professional Communication and					
			Transferrable Skill					
	nmended		, O.P. 2017. Bryophyta, MacMillan India Ltd. Delhi.					
'	exts		A. 2020. Contemporary Research on Bryophytes					
			Series: Recent Advances in Botanical Science.					
			1/97898114337881200101.					
			anderpoorten. 2009. Introduction to Bryophytes, 1st Cambridge University Press.					
		20.00.1,	James and James					
		4. Chopra	, R. N. 2005. Biology of bryophytes. New Age					
			ional (P) Ltd. New Delhi, India.					
			Puri. 2001. Bryophytes– morphology growth and					
D (			ntiation. Atma Ram & Sons. Lucknow, India.					
Reference E	SOOKS		nes, A. 1963. Morphology of lower vascular plant,					
			w Hill, Chennai. . N.S. 1967. An introduction of Embryophyta, Vol.III					
			odophyta, Central book depot, Allahabad.					
			G.M. 1955. Cryptogamic Botany, Volume-II-					
			w Hill, Chennai					
			e, K.L. 1976. Morphology of Pteridophytes, 4th					
		· ·	B.I. Publication. Chennai.					
			i, E.V. 1963. The structure and Life of Bryophytes.					
			ison & Co, UK.					
		6. Parihar Allahab	, N.S. 1991. Bryophytes. Central Book Depot,					
			ad. , N.S. 1996. The Biology and Morphology of					
			phytes.Central Book Depot, Allahabad.					
Web Resour	rces:		www.bryoecol.mtu.edu/					
			//www.amazon.in/Introduction-Bryophytes-Alain-					
		-	erpoorten-ebook/dp/B007NWFWQK					
			scitec.uwichill.edu.bb/bcs/bl14apl/bryo1.htm					
			www.bsienvis.nic.in/Database/Pteridophytes-in-					
			23432.aspx					
		-	www.botany.ubc.ca/bryophyte/mossintro.html					
		b. <u>ae HU</u>	C&redir_esc=y					

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	2	1	2	2	1	2
CO 2	3	3	3	2	3	2	2	3	2	2
CO 3	2	2	3	3	1	2	2	1	2	2
CO 4	3	3	3	3	3	2	3	3	2	3
CO 5	3	3	2	2	2	1	3	3	1	3

SEMESTER -III	23UBOTP34: PRACTICAL-III : PLANT	Credits: 5
PART – III	DIVERSITY III: BRYOPHYTES AND	H/W: 5
CORE - VI	PTERIDOPHYTES -	

Pre-requisite	Students should be familiar with the basics of E Pteridophytes.	Bryophytes and									
Learning Obje	1 7										
C1	C1 To enable students gain expertise in hand sectioning technique.										
C2	To study diversity of Bryophytes and Pteridophytes.										
C3	To understand the anatomical structure of the Bryophytes Pteridophytes.	and									
C4	Develop comprehensive skills in sectioning and micro pre	paration.									
C5	Describe the structure of fossil forms prescribed in the syl	labus.									
Course	e outcomes:	Programme									
	cessful completion of this course the student will be able to:	Outcomes									
CO											
1.Recognize	the major groups of Non-vascular and Vascular	K1									
cryptogams											
2.Describe the	structure of Bryophytes and Pteridophytes forms prescribed in	K2									
the syllabus.	the syllabus.										
•	3.Identify and illustrate the morphological and anatomical features of K3										
bryophytes and Pteridophytes.											
	Develop comprehensive skills in sectioning and micro preparation.										
5.Interpret the Pteridophytes.	interpret the significance of reproductive structures in Bryophytes and K5										

#### **EXPERIMENTS**

#### **Bryophytes**

- 1. Study of morphology, anatomy and structure of the vegetative and reproductive organs of Bryophytes genera included in the theory syllabus.
- 2. Hepaticopsida *Marchantia*); Anthocerotopsida (*Anthoceros*) and Bryopsida (*Funaria*) (Examples may be changed according to the availability of the specimens) (need not study developmental aspects).

#### **Pteridophytes**

- 3. Study of morphology, anatomy and structure of the vegetative and reproductive organs of Pteridophytes genera and fossils included in the theory syllabus. Psilotopsida (*Psilotum*), Lycopsida (*Selaginella*), Sphenopsida (*Equisetum*), Pteropsida (*Marsilea*). (Examples may be changed according to the availability of the specimens).
- 4. Identifying the micro slides relevant to the syllabus.
- 5. Botanical excursion.

Extended	Questions	related	to	the	above	topics,	from	various	competitive
Professional	examination	ns UPSC	/TF	RB/N	IET / UG	C - CSI	R / GAT	ΓΕ / TNPS	SC /others to
Component (is a	be solved								
part of internal component only, Not	(To be disc	ussed du	ring	the T	utorial ho	our)			
component only, Not	`					,			

to be included in the External	
Examination	
question paper)	
Skills acquired from	Knowledge, Problem Solving, Analytical ability, Professional
this course	Competency, Professional Communication and Transferrable Skill
Recommended	1. Sharma, O.P. 2017. Bryophyta, MacMillan India Ltd, New Delhi.
Texts	2. Sharma, O.P. 2012. Pteridophyta, Tata McGraw-Hills Ltd, New Delhi.
	3. Ashok, M. Bendre and Kumar. 2010. A text book of Practical Botany,
	Algae, Fungi, Lichen, Bryophyta, Pteridophyta, Gymnosperms and
	Palaeobotany. Revised edition. Published by Rakesh Kumar Rastogi
	publication.
	4. Prem Puri. 2001. Bryophytes– morphology growth and
	differentiation. Atma Ram & Sons. Lucknow, India.
	5. Tuba Z., Slack N.G. and Stark L.R. 2011. Bryophyte Ecology and Climate
	Change. Cambridge university press, Cambridge.
Reference Books	1. Ashok, M. Bendre and Kumar. 2010. A text book of Practical Botany,
	Algae, Fungi, Lichen, Bryophyta, Pteridophyta, Gymnosperms and
	Palaeobotany. Revised edition. Published by Rakesh Kumar Rastogi
	publication.
	2. Mohammed Gufran Khan, Shite Gatew and Bedilu Bekele. 2012.
	Practical manual for Bryophytes and Pteridophytes. Lambert
	Academic Publishing.
	3. Puri, P. 1980. Bryophytes. Atma Ram and Sons, New Delhi.
	4. Sporne, K.R. 1991. The Morphology of Pteridophytes. B.I. Publ. Pvt.
	Ltd. Chennai.
	5. Vashista.P.C. 1971. Botany for Degree students: Pteridophyta.
	S.Chand & Co. New Delhi.
Web resources	1. <a href="https://www.amazon.in/Manual-Practical-Bryophyta-Suresh-">https://www.amazon.in/Manual-Practical-Bryophyta-Suresh-</a>
	Kumar/dp/B0072GNFX4
	2. <a href="https://www.amazon.in/Practical-Manual-Pteridophyta-Rajan-">https://www.amazon.in/Practical-Manual-Pteridophyta-Rajan-</a>
	Sundara/dp/8126106883
	3. <a href="http://www.eeb.uconn.edu/people/goffinet/Classificationmosses.ht">http://www.eeb.uconn.edu/people/goffinet/Classificationmosses.ht</a>
	<u>ml</u>
	4. https://www.vitalsource.com/products/introduction-to-bryophytes-alain-
	vanderpoorten-v9780511738951?duration=perpetual
	5. https://www.toppr.com/guides/biology/plant-
	kingdom/pteridophytes/

ivia	Mapping with Frogramme Outcomes.											
COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5		
CO1	3	3	1	3	2	1	2	2	1	2		
CO 2	3	3	2	2	3	3	2	3	3	2		
CO 3	2	2	3	3	1	2	1	3	2	1		
CO 4	3	3	3	3	3	2	3	2	2	3		

CO 5	3	3	2	3	2	3	3	3	3	3

Title of the Course	CHEMISTRY FOR BIOLOGICAL SCIENCES I (FOR BOTANY AND ZOOLOGY STUDENTS)						
Course Code	23UCHE	E35					
Category	Generic	Year	II	Credits	2	Course	
Curegory	Elective	Semester	III	Creates	_	Code	
Instructional	Lecture	Tutorial		Practice	Tot		
hours per week	3	-	-		3		
Prerequisites	Higher seco	ndary chemistr	y		ı		
Objectives of the	This course	aims at providi	ng kno	owledge on			
course	• ba	sics of atomic	c orb	itals, chen	nical	bonds, hyb	ridization and
	fui	ndamentals of o	organi	c chemistry	/		
		clear chemistry			mistry	7	
		portance of spe	•	_			
	• sep	paration and pur	ification	on technique	es.		
Course Outline	UNIT I						
	Chemica	al Bonding an	d Nuc	clear Chen	nstry		
	Chemical Bonding: Molecular Orbital Theory-bonding, antibonding and non-bonding orbitals. M. O diagrams for Hydrogen, Helium, Nitrogen; discussion of bond order and magnetic properties.  Nuclear Chemistry: Fundamental particles - Isotopes, Isobars, Isotones and Isomers-Differences between chemical reactions and nuclear reactions- group displacement law. Nuclear binding energy - mass defect - calculations. Nuclear fission and nuclear fusion - differences – Stellar energy. Applications of radioisotopes - carbon dating, rock dating and medicinal applications.  Unit II  Industrial Chemistry  Fuels: Fuel gases: Natural gas, water gas, semi water gas, carbureted water gas, producer gas, CNG, LPG and oil gas (manufacturing details not required).  Silicones: Synthesis, properties and uses of silicones.  Fertilizers: Urea, ammonium sulphate, potassium nitrate NPK fertilizer, superphosphate, triple superphosphate.  UNIT III  Fundamental Concepts in Organic Chemistry  Hybridization: Orbital overlap hybridization and geometry of CH4, C2H4, C2H2 and C6H6. Polar effects: Inductive effect and						
					ng details not PK fertilizer, of CH4,		

_	
	consequences on Ka and K <sub>b</sub> of organic acids and bases, electromeric, mesomeric, hyper conjugation and steric-examples and explanation.
	Reaction mechanisms: Types of reactions- aromaticity-aromatic
	electrophilic substitution; nitration, halogenation, Friedel-Craft's
	alkylation and acylation.
	Heterocyclic compounds: Preparation, properties of pyrrole and
	pyridine.
	UNIT IV
	Drugs and Speciality Chemicals
	Definition, structure and uses: Antibiotics viz., Penicillin,
	Chloramphenicol and Streptomycin; Anaesthetics viz., Chloroform
	and ether; Antipyretics viz., aspirin, paracetamol and ibuprofen;
	Artificial Sweeteners viz., saccharin, Aspartame and cyclamate;
	Organic Halogen compounds viz., Freon, Teflon.
	UNIT V:
	Analytical Chemistry
	Introduction qualitative and quantitative analysis. Principles of volumetric
	analysis. Separation and purification techniques: extraction, distillation and crystallization. Chromatography: principle and application of column, paper
	and thin layer chromatography.
Extended	Questions related to the above topics, from various competitive
Professional	examinations UPSC/ JAM /TNPSC others to be solved
Component (is a	(To be discussed during the Tutorial hours)
part of internal	
component only,	
Not to be included	
in the external	
examination	
question paper)	
Skills acquired	Knowledge, Problem solving, Analytical ability, Professional
from this course	Competency, Professional Communication and Transferable skills.
Recommended	1. V. Veeraiyan, Textbook of Ancillary Chemistry; High mount
Text	publishing house, Chennai, first edition, 2009.
	2. S.Vaithyanathan, Text book of Ancillary Chemistry; Priya
	Publications, Karur,2006.
	3. ArunBahl, B.S.Bahl, Advanced Organic Chemistry; S.Chand
	and Company, New Delhi, twenty third edition,2012.
	4. P.L.Soni, H.M.Chawla, Text Book of Inorganic Chemistry;
	Sultan Chand & sons, New Delhi, twenty ninth edition, 2007.

# P.L.Soni, Mohan Katyal, Text book of Inorganic chemistry; Sultan Chand and Company, New Delhi, twentieth edition, 2007. B.K,Sharma, Industrial Chemistry; GOEL publishing house, Meerut, sixteenth edition, 2014. Jayashree gosh, Fundamental Concepts of Applied Chemistry; Sultan & Chand, Edition 2006.

## Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the course the students should be able to

- **CO1:** state the theories of chemical bonding, nuclear reactions and its applications.
- **CO 2:** evaluate the efficiencies and uses of various fuels and fertilizers.
- **CO 3:** explain the type of hybridization, electronic effect and mechanism involved in the organic reactions.
- **CO 4:** demonstrate the structure and uses of antibiotics, anaesthetics, antipyretics and artificial sugars.
- **CO 5:** analyse various methods to identify an appropriate method for the separation of chemical components.

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
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to PSOs	3.0	3.0	3.0	3.0	3.0

#### Level of Correlation between PSO's and CO's

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
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PO's and CO's

Title of the Course	CHEMISTRY PRACTICAL FOR BIOLOGICAL SCIENC (for Botany and Zoology II Year/III Semester)							
Course Code	23UCHEEP3							
Category	Generic	Year	I/ II	Credits	1	Course		
	Elective	Semeste r	I/III			Code		
Instructional	Lecture	Tutorial	Lab	Practice		Total	•	
hours per week	-	-	2			2		
Prerequisites								
Objectives of the	This	course aims	to prov	ide knowl	edge	on the		
course	• ba	asics of prepa	ration	of solution	s.			
	<ul> <li>principles and practical experience of volumetric analysis</li> </ul>					lysis		
Course Outline	ourse Outline VOLUMETRIC ANALYSIS							
	1	. Estimation carbonate.		odium hyo	lroxio	de using standa	ard sodium	
	2	. Estimation	of hy	drochloric	acid ı	using standard o	xalic acid.	
			-			ing standard Mo		
	4	Estimation	of oxa	alic acid us	sing s	tandard ferrous	sulphate.	
	5. Estimation of potassium permanganate using standard sodium hydroxide.					g standard		
	6. Estimation of magnesium using EDTA.							
				_	_	iphenyl amine a	as indicator.	
Reference Books	V. Venkateswaran, R. Veerasamy, A.R. Kulandaivelu, Basic Principles of Practical Chemistry; Sultan Chand & sons, Second edition, 1997.				•			
Course Learning Or					go >			

## Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO 1: gain an understanding of the use of standard flask and volumetric pipettes, burette. CO 2: design, carry out, record and interpret the results of volumetric titration.

CO 3: apply their skill in the analysis of water/hardness.

CO4: analyze the chemical constituents in allied chemical products

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
Weightage	12	12	12	12	12
Weighted percentage of Course Contribution to PSOs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

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
Weightage	12	12	12	12	12
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PO's and CO's

SEMESTER -III	SKILL ENHANCEMENT COURSE (SEC-4):	Credits: 1
PART – IV	23UBOTS36: ENTREPRENEURIAL	H/W: 1
SEC: 4	OPPORTUNITIES IN BOTANY	

Pre-requisite	To understand the concept of Entrepreneurial Opportunities in Botany.							
<b>C</b> 1	ventures after graduates in Botany usin	To enable students to understand about establishment of various ventures after graduates in Botany using medicinal plants, Biotechniques and marketing of bioproducts.						
C2		To create a mindset among students to start their own companies for						
<b>0</b> -	income generation.	on own companies for						
C3	The students may understand about various fields	s of botany.						
C4	To develop the concept of Entrepreneurial Opport							
C5	Describe the new strategies to describe ma management strategy.	rketing and business						
Course outcomes: On completion of this course, the students will be able to: CO  Programme Outcomes								
	o how various fields of botany could be understood repreneurial approach.	K1						
	the concept of Entrepreneurial Opportunities in	K2						
3. Make of the knowledge gained to start new venture using K3 Plant tissue culture and plant products for commercial exploitations								
4. Decipher effective ways of making bioproducts like organic acids, solvents, beverages, enzymes, antibiotics, mushrooms, biogas and etc.								
5. Develop new strategies to describe marketing and business management strategy including the role of IPR and bioethics regulations for licensing.								
UNIT	CONTENTS							
I	INTRODUCTION TO ENTREPRENEURSHIP Introduction to Entrepreneurship, Scope and identification of new ventures using plant resources, Mechanism of product selection and commercialization, General concept about the Govt. formalities, rules & regulation, Entrepreneurship skill development.							
II	TOOLS AND TECHNIQUES  Production of commercially viable plants through Plant tissue culture technique, Production of secondary metabolites, solvents, organic acids, beverages, enzymes, antibiotics.							
III	NEW VENTURE CREATION  Production of Biofertilizers, Vermicompost, Establishment of medicinal, herbal and zodiac gardens, Terrace & Kitchen garden, Spirulina and Azolla cultivation, Mushroom cultivation, Bonsai, Bouquet making, Terrarium.							

N/	PRODUCT DEVELOPMENT AND COMMERCIALIZATION  Product commercialization and business strategy, Dyes, Cosmetics and						
IV			atex, Areca Leaf Plates, cups & bags, Jute				
	Products.	Products.					
	BIO-BUSINESS PLANS, IPR AND BIOETHICS						
V			nagement strategy, Bank loan, Intellectual				
		•	Bioethics and current legal issues, Marketing luct development – Technology licensing and				
		concerns.	rect development Teermology heerising and				
		Component (is a part	Questions related to the above topics, from				
		t only, Not to be Examination	various competitive examinations UPSC / TRB /				
question par		LXamination	NET / UGC – CSIR / GATE / TNPSC /others to be solved				
	•		(To be discussed during the Tutorial hour)				
Skills acquir	red from thi	S	Knowledge, Problem Solving, Analytical				
course			ability, Professional				
			Competency, Professional Communication and Transferrable Skill				
Recommen	ded		ni. 2004. Bio-Business in Asia: How countries				
Texts		Hall, New Delhi, I	the Life Science Revolution, Pearson Prentice				
		2. Karthikeyan, S. and Arthur Ruf. 2009. Biobusiness, MJP					
			Publications. Chennai, India.				
			er. 2000. The coming Biotech age: The Business				
			IcGraw Hill Publications, New York, USA. Banford, K.M. and Early, M.P. 1993. Principles				
		of Horticulture.	zamera, rama ana zamy, min i 1000. i miospioo				
			04. Vermiculture and Organic farming, Daya				
		Publishers.					
Reference I	books	1. Robin Low	e and Sue Marriott 2009. Enterprise:				
			and Innovation: Concepts, Contexts and				
			n, Routledge Publisher, London, UK.				
		<ol> <li>Peter F.Drucker, 2009. Innovation and Entrepreneurship, Harper Collins Publisher, New York, US.</li> </ol>					
		3. Russell, T. 2012. Nature Guide: Trees: The world in your					
		hands(Nature Guides). Mukherjee D. Gardening in India, Oxford					
		IBH publishing co	, New Deini. 197. Introduction to Horticulture, Rajalakshmi				
Publications, Na 5. Webster, J a			· · · · · · · · · · · · · · · · · · ·				
			d Weber, R. 2007. Introduction to Fungi, 3rd				
Ed. Cambridge UniversityPress,							
Web source	25	Cambridge  1 https://www.bra	inkart.com/article/Entrepreneurial-				
TTOD SOUICE		Botany_38321/	mikaraooni, araoio, Enaopronoanai-				
2.https://www.youtube.com/watch?v=hnBl							
	3.https://www.slideshare.net/krishnashah5891004/ram-powe						

point-presentation
4.http://www.brainkart.com/article/Economically-Useful-Plants-
andEntrepreneurial-Botany_38301
4. https://www.ebooks.com/en-us/subjects/gardening/
5. <a href="https://www.amazon.in/Preservation-Techniques-Publishing-Technology-">https://www.amazon.in/Preservation-Techniques-Publishing-Technology-</a>
Nutrition-ebook/dp/B00RXCXB3Q

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	1	1	2	1	2	2	1	2
CO 2	3	3	2	2	3	1	2	3	1	2
CO 3	2	2	3	1	2	2	1	3	2	1
CO 4	3	3	1	2	3	2	3	3	2	3
CO 5	3	3	2	3	1	3	3	3	3	3

SEMESTER -III PART – IV	SKILL ENHANCEMENT COURSE (SEC-5): 23UBOTS37: HERBAL TECHNOLOGY	Credits: 2 H/W: 2
SEC: 5		

Pre-requisit	To understand the importance of herbal technology	nv				
-	Objectives	3).				
C1		the quality of				
61	To provide students with knowledge of herbal drug industry, the quality of raw material, and guidelines for quality maintenance.					
C2						
\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	To gain an insight into the commercially important secondary products and significance of bioprospecting.					
C3	To understand various plants based drugs used in ayu	rvedha, unani,				
	homeopathy, siddha etc.	,				
C4	To apply the knowledge to cultivate medical plants.					
C5	To know the pharmacological importance of medicinal	plants.				
Course or	utcomes:					
On comple	etion of this course, the students will be able to:	Programme				
CO		Outcomes				
1. Define a	nd describe the principle of cultivation of herbal products.	K1				
	najor herbs, their botanical name and chemical	K2				
constituent		1/2				
	chniques for monitoring drug adulteration through the	K3				
biological te	<u> </u>	17.4				
-	and decipher the significance of various methods of	K4				
	drying and storage of medicinal herbs.	K5 & K6				
•	5. Develop the skills for cultivation of plants and their value added processing / storage K5 & K6					
UNIT	CONTENTS					
<u> </u>	Herbal Technology: Definition and scope; Herbal medicin	es: history and				
ı	scope; Traditional systems of medicine, and overvie					
•	(Traditional Indian Systems of Medicine); Cultivation					
	processing - storage of herbs and herbal products.	J				
	Value added plant products: Herbs and herbal product	cts recognized				
II	in India; Major herbs used as herbal medicines, i	nutraceuticals,				
	cosmeticals and biopesticides, their Botanical name	s, plant parts				
	used, major chemical constituents.					
	Pharmacognosy - Systematic position, botany of the p	lant part used				
III	and active principles of the following herbs: Tulsi, Gin					
	Fenugreek, Indian Gooseberry, Catharanthus roseus, Withania					
	somnifera, Centella asiatica, Achyranthes aspera, Ka					
	(Tinospora), Saravar. Herbal foods, future of pharmaco	gnosy.				
	Analytical pharmacognosy: Morphological and					
IV	examination of herbs, Evaluation of drug adultera					
	methods of drug evaluation - Biological testing of h					
	Phytochemical screening tests for secondary metaboli					
	flavonoids, steroids, triterpenoids, phenolic compounds	,				
	, , , , , , , , , , , , , , , , , , , ,	,				

V	processing / storage / o	ultivation of Plants and their value added quality control for use in herbal formulations,		
	, ,	of Tissue culture and Micro propagation of Withania somnifera, neem and tulsi),		
Extended	Professional Component	Questions related to the above topics, from		
	of internal component	various competitive examinations UPSC / TRB		
•	to be included in the	/ NET / UGC - CSIR / GATE / TNPSC /others		
External Ex		to be solved		
question pa	aper)	(To be discussed during the Tutorial hour)		
Skills acqu	ired from this	Knowledge, Problem Solving, Analytical		
course		ability, Professional		
		Competency, Professional Communication and		
		Transferrable Skill		
	Pocoi	mmandad Tayts		

#### **Recommended Texts**

- 1. AYUSH (www.indianmedicine.nic.in). About the systems—An overview of Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homeopathy. New Delhi: Department of Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homoeopathy (AYUSH), Ministry and Family Welfare, Government of India.
- Evans, W.C. 2009: Trease and Evans PHARMACOGNOSY. 16th Edition, SAUNDERS / Elsevier.
- 3. Sivarajan, V.V. and India, B. 1994. Ayurvedic Drugs and Their Plant Sources.. Oxford & IBH Publishing Company, 1994 Herbs 570 pages.
- 4. Miller, L. and Miller, B. 2017. Ayurveda & Aromatherapy: The Earth Essential Guide to Ancient Wisdom and Modern Healing. Motilal Banarsidass,; Fourth edition.
- 5. Kokate, C.K. 2003. Practical Pharmacognosy. Vallabh Prakashan, Pune.

#### **Reference Books**

- 1. Agarwal, P., Shashi, Alok., Fatima, A. and Verma, A. 2013. Current scenario of Herbal Technology worldwide: An overview. Int J Pharm Sci Res; 4(11): 4105-17.
- 2. Arbe r, Agnes. 1999. Herbal Plants and Drugs. Mangal Deep Publications, Jaipur.
- 3. Varzakas, T., Zakynthinos, G, and Francis Verpoort, F. 2016. Plant Food Residues as a Source of Nutraceuticals and Functional Foods. Foods 5: 88.
- 4. Aburjai, T. and Natsheh, F.M. 2003. Plants Used in Cosmetics. Phytotherapy Research 17 987-1000
- 5. 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.kopykitab.com/Herbal-Science
- https://kadampa.org/books/free-ebook-downloadhowtotyl?gclid=CjwKCAiA6vXwBRBKEiwAYE7

iS5t8yenurClUCTdV9olKo9TbyAh4fsoFqPYWGs5qBTbytD22z7lo0BoCYnUQAvD\_BwE

- 3. <a href="https://www.barnesandnoble.com/b/free-ebooks/nook-books/alternative-medicine-natural-healing/herbal-medicine/">https://www.barnesandnoble.com/b/free-ebooks/nook-books/alternative-medicine-natural-healing/herbal-medicine/</a> N-ry0Z8qaZ11iu
- 4. http://cms.herbalgram.org/heg/volume8/07July/HerbalEBooks.html?t=1310004932&ts=1579066352&signature=1dd0d5aef818b19bcdcd6c063a78e404
- 5. https://www.dattanibookagency.com/books-herbs-science.html
- 6. https://www.springer.com/gp/book/9783540791157

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3	3	3	2	3	2
CO 2	3	3	3	3	3	3	3	1	3	1
CO 3	3	3	3	3	3	3	3	2	3	2
CO 4	3	3	3	3	3	3	3	1	3	1
CO 5	3	3	3	3	3	3	3	1	3	1

SEMESTER -III	ENVIRONMENTAL STUDIES	CREDITS:
PART – IV		HOURS: 01

#### **Semester-IV**

SEMESTER -IV	23UBOTC43: CORE – VII:	Credits: 5
PART – III	GYMNOSPERMS, PALEOBOTANY AND	H/W: 5
CORE - VII	EVOLUTION	

Pre-requisite	Students should know about the fundaments of Gym	nosperms fossil					
i re-requisite	records and evolution.	1103pc1113, 103311					
Learning Object							
C1	To enable the students to understand thallus organization,						
C2	To enable the students to understand trains organization,  To enable the students to understand internal and the reproductive structures						
\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	of Gymnosperms and the importance of evolution.						
C3	to acquaint students with evidences of the past history of p	lant groups and					
	significance of the fossilization.	9					
C4	To know the scope of pleobotany, types of fossils and geol	logical time scale.					
C5	Understand the various fossil genera representing different						
Course	outcomes:	Programme					
On completion	of this course, the students will be able to: CO	Outcomes					
	e general characteristics of Gymnosperms and fossil forms	K1					
	pout the morphology and anatomy Gymnosperms.	K2					
	nd contrast the reproductive structures of Gymnosperms &	K3					
fossil forms							
4. Analyze	the anatomy and reproduction Gymnosperms along	K4					
with their of	ecological and economical importance.						
5. Determine	the various fossilization methods and their significance in	K5					
paleobotan							
UNIT	CONTENTS						
	GYMNOSPERMS						
I	Classification of Gymnosporms (Sporno 1954) (up to	family) Conoral					
	Classification of Gymnosperms (Sporne, 1954) (up to family). General characteristics, Economic importance of Gymnosperms with special						
	reference to oil, resin, timber, etc.	iiiis witti speciai					
	GYMNOSPERMS						
II	Morphology, anatomy and reproduction of the taxa bel	longing to each of					
•	the following orders: Cycadales (Cycas), Coniferales	0 0					
	` , , , , , , , , , , , , , , , , , , ,	(Fillus). Grietales					
	(Gnetum).						
	FALLOBOTANT	<u> </u>					
I III	Introduction to fossile and fossilization processes sur	ch as compression					
III	Introduction to fossils and fossilization processes successes, molds, petrification, impressions and coal ba						
III	casts, molds, petrification, impressions and coal ba	Ils. Geological time					
III	casts, molds, petrification, impressions and coal ba scale. Radiocarbon dating. Contribution of Birbal Sal	Ils. Geological time					
IV	casts, molds, petrification, impressions and coal ba	Ils. Geological time nni					
	casts, molds, petrification, impressions and coal ba scale. Radiocarbon dating. Contribution of Birbal Sal PALEOBOTANY	Ils. Geological time nni					
	casts, molds, petrification, impressions and coal ba scale. Radiocarbon dating. Contribution of Birbal Sale PALEOBOTANY Study of the following fossils: Rhynia, Lepidodend	Ils. Geological time					
	casts, molds, petrification, impressions and coal ba scale. Radiocarbon dating. Contribution of Birbal Sale PALEOBOTANY Study of the following fossils: Rhynia, Lepidodend Calamites and Williamsonia sewardiana.	Ills. Geological time nni Iron, Lepidocarpon,					
IV	casts, molds, petrification, impressions and coal ba scale. Radiocarbon dating. Contribution of Birbal Sal PALEOBOTANY Study of the following fossils: Rhynia, Lepidodend Calamites and Williamsonia sewardiana.	Ills. Geological time nni Iron, Lepidocarpon, nces (any five).					

	species - Allopatric and sympatri	
	essional Component (is a part of	Questions related to the above topics,
•	nent only, Not to be included in the	from various competitive examinations
External Exami	nation	UPSC / TRB / NET / UGC - CSIR /
question paper)		GATE / TNPSC /others to be solved
		(To be discussed during the Tutorial hour)
Skills	Knowledge, Problem Solving, Ar	alytical ability, Professional
acquired from	Competency, Professional Commur	nication and Transferrable Skill
this course		
		osperms (2 <sup>nd</sup> Edition) Shiva Lal Agarwala
Texts	& Co., Agra.	
	1	perms, S.Chand & Co. New Delhi.
	1	, A. 1996. Gymnosperms. New Age
	International Publishers, New	
		rms. S. Chand & Company Pvt. Ltd. New
	Delhi.	5
		ra. 2013. Gymnosperms. Publisher: New
D (	Age International Pvt Ltd Pub	
Reference	1. Sporne, K.R.1991. The	Morphology of Gymnosperme. B.I.
Books	Publications, New Delhi.	
		A. 1996. Gymnosperms, New Age Int.
	Pvt. Ltd., New Delhi.	all O.M. 4000 Dalashatani and the
	1	ell, G.W. 1993. Paleobotany and the
	Evolution of Plants. Camb	3
		Stanley. 2004. Principles of paleontology.
	San Francisco: W.H. Freema	· ·
		tra. 2013. Gymnosperms. Publisher: New
Web	Age International Pvt Ltd Pu	
		ks?hl=en&lr=&id=Pn7CAAAQBAJ&oi=fn
Resources		o+Gymnosperms&ots=sfYSzCL02&sig=y
	uction%20to%20Gymnosperm	4XU8&redir_esc=y#v=onepage&q=Introd
	1	ks/about/Botany_for_Degree_Gymnospe
	<ol><li>https://books.google.co.in/boo rm_Multicolor.html?id=HTdFY</li></ol>	
	'	-
	s. https://books.google.co.ii/bo	ks/about/Gymnosperms.html?id=4dvyNc
		/wp-content/uploads/2013-70-4-beyond-
	<ol> <li>https://arboretum.harvard.edu/ pine-cones-an-introduction-to-</li> </ol>	•
	5. https://www.palaeontologyonli	
	o. <u>mips.//www.palaeomologyomi</u>	HG.COH!

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	2	1	1	2	2	2	2
CO 2	3	3	2	2	3	3	2	3	2	3
CO 3	3	3	2	2	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	2	1	3	1	3

SEMESTER -IV
PART – III
CORE - VIII

#### 23UBOTP44: PRACTICAL-IV : GYMNOSPERMS, PALEOBOTANY AND EVOLUTION -

Credits: 5 H/W: 5

Pre-requisite	Students should be familiar with the fundamentals of	Gymnosperms.					
	Paleobotany.	, -, -,					
Learning Obj	<u> </u>						
C1	To enable students observe and record the morphological features species of Gymnosperms.	s of selected					
C2	To enable students observe and record the anatomical features of species of Gymnosperms.	selected					
C3	To develop the skill of preparation of microslides of the gymnosper	rm samples.					
C4	C4 To enable students to gain insights into the basics of paleobotany and methods of fossilization.						
C5	To understand the anatomy of the fossil plants through microscopy	/.					
Course	e outcomes:	Programme					
On completic	on of this course, the students will be able to: CO	Outcomes					
1. Analyze	and observe and record the morphological features of	K1					
selected	selected species of Gymnosperms						
Describe the structure of fossil forms prescribed in the syllabus.  K2							
Identify and Illustrate the morphological and anatomical features of K3 gymnosperms.							
•	the significance of reproductive structures in gymnosperms.	K5					
=><======							

#### **EXPERIMENTS**

- 1. Study of morphology, anatomy and structure of the vegetative and reproductive organs of *Cycas, Pinus* and *Gnetum.*
- 2. Identifying the micro slides relevant to the syllabus.
- 3. Field visit to study the habitat (Hill station).

Study the following fossil members: *Rhynia*, *Lepidodendron*, *Lepidocarpon*, *Calamites* and *Williamsonia sewardiana* through permanent slides.

2. Photograph of evolution scientists.

Extended Professional Component (is a part of	Questions related to the above topics, from
internal component only, Not to be included in the	various competitive examinations UPSC / TRB /
External Examination question paper)	NET / UGC - CSIR / GATE / TNPSC /others to
	be solved
	(To be discussed during the Tutorial hour)
Skills acquired from this	Knowledge, Problem Solving, Analytical
course	ability, Professional
	Competency, Professional Communication and
	Transferrable Skill

Recommended	Sharma O.P and S, Dixit. 2002. Gymnosperms. Pragati Prakashan.								
Texts	<ol> <li>Gangulee, H.C and A.K. Kar. 2013. College Botany. Vth Edition. S. Chand</li> <li>Sharma, O.P. 2012. Textbook of Pteridophyta, TATA MacMillan Indi Ltd., New Delhi.</li> <li>Chamberlain, C.J. 1934. Gymnosperms: Structure and Evolution. Chicago Reprinted 1950). New York.</li> </ol>								
	9. Bhatnagar, S.P and Moitra, A. 1996. Gymnosperms. New Age International Publishers, New Delhi, India.								
Reference Books	<ol> <li>Smith, G.M. 1955. Cryptogamic Botany Vol.II. Tata McGraw Hill. Ne Delhi.</li> </ol>								
	<ol> <li>James.W. Byng. 2015. The Gymnosperms practical hand book. A practical guide to extant families and genera of the world. Published by plant Gateway, Tol Bot Street, Herford, SG137BX, United Kingdom.</li> <li>Sharma, O.P. 2012. Textbook of Pteridophyta, TATA MacMillan India Ltd., New Delhi.</li> <li>Chamberlain, C.J. 1934. Gymnosperms: Structure and Evolution. Chicago Reprinted 1950). New York.</li> </ol>								
Web resources	<ol> <li>Kirkaldy, J.E. 1963. The study of Fossils. Hutchinson Educational, London.</li> <li><a href="https://www.google.co.in/books/edition/Gymnosperms/3YrT5E3Erm8C?hl=en&amp;g">https://www.google.co.in/books/edition/Gymnosperms/3YrT5E3Erm8C?hl=en&amp;g</a></li> <li><a href="https://www.google.co.in/books/edition/Gymnosperms/3YrT5E3Erm8C?hl=en&amp;g">https://www.google.co.in/books/edition/Gymnosperms/3YrT5E3Erm8C?hl=en&amp;g</a></li> <li><a href="https://www.google.co.in/books/edition/Gymnosperms/3YrT5E3Erm8C?hl=en&amp;g">https://www.google.co.in/books/edition/Gymnosperms/3YrT5E3Erm8C?hl=en&amp;g</a></li> <li><a 3yrt5e3erm8c?hl="en&amp;g&lt;/a" books="" edition="" gymnosperms="" href="https://www.google.co.in/books/edition/Gymnosperms/3YrT5E3Erm8C?hl=en&amp;g&lt;/a&gt;&lt;/li&gt;     &lt;li&gt;&lt;a href=" https:="" www.google.co.in=""></a></li> <li><a 3yrt5e3erm8c?hl="en&amp;g&lt;/a" books="" edition="" gymnosperms="" href="https://www.google.co.in/books/edition/Gymnosperms/3YrT5E3Erm8C?hl=en&amp;g&lt;/a&gt;&lt;/li&gt;     &lt;li&gt;&lt;a href=" https:="" www.google.co.in=""></a></li> <li><a 3yrt5e3erm8c?hl="en&amp;g&lt;/a" books="" edition="" gymnosperms="" href="https://www.google.co.in/books/edition/Gymnosperms/3YrT5E3Erm8C?hl=en&amp;g&lt;/a&gt;&lt;/li&gt;     &lt;li&gt;&lt;a href=" https:="" www.google.co.in=""></a></li> <li><a 3yrt5e3erm8c?hl="en&amp;g&lt;/a" books="" edition="" gymnosperms="" href="https://www.google.co.in/books/edition/gymnosperms/3YrT5E3Erm8C?hl=en&amp;g&lt;/a&gt;&lt;/li&gt;     &lt;li&gt;&lt;a href=" https:="" www.google.co.in=""></a></li> <li><a 3yrt5e3erm8c?hl="en&amp;g&lt;/a" books="" edition="" gymnosperms="" href="https://www.google.co.in/books/edition/gymnosperms/3YrT5E3Erm8C?hl=en&amp;g&lt;/a&gt;&lt;/li&gt;     &lt;li&gt;&lt;a href=" https:="" www.google.co.in=""></a></li> <li><a 3yrt5e3erm8c?hl="en&amp;g&lt;/a" books="" edition="" gymnosperms="" href="https://www.google.co.in/books/edition/gymnosperms/3YrT5E3Erm8C?hl=en&amp;g&lt;/a&gt;&lt;/li&gt;     &lt;li&gt;&lt;a href=" https:="" www.google.co.in=""></a></li> <li><a books="" edition="" gy<="" gymnosperms="" href="https://www.google.co.in/books/edition/gymnosperms/3YrT5E3Erm8C?hl=en&amp;g&lt;/a&gt;&lt;/li&gt;     &lt;li&gt;&lt;a href=" https:="" th="" www.google.co.in=""></a></li></ol>								
	2. <a href="https://www.amazon.in/Paleobotany-Biology-Evolution-Fossil-Plants/dp/0123739721">https://www.amazon.in/Paleobotany-Biology-Evolution-Fossil-Plants/dp/0123739721</a>								
	3. <a href="https://books.google.co.in/books/about/Paleobotany.html?id=HzYUA">https://books.google.co.in/books/about/Paleobotany.html?id=HzYUA</a> <a href="QAAIAAJ">QAAIAAJ</a>								
	4. https://trove.nla.gov.au/work/11471742?q&versionId=46695996								
	5. <a href="http://www.freebookcentre.net/Biology/Evolutionary-Biology-Books.html">http://www.freebookcentre.net/Biology/Evolutionary-Biology-Books.html</a> .								

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	2	1	2	2	2	3
CO 2	3	3	2	2	3	3	2	3	2	2
CO 3	2	2	3	3	1	2	1	3	3	3
CO 4	3	3	3	3	3	2	2	3	3	3
CO 5	3	3	2	2	3	3	2	3	2	2

Title of the Course	CHEMISTRY FOR BIOLOGICAL SCIENCES II							
		(FOR BOTANY AND ZOOLOGY STUDENTS)						
Code	23UCHE							
Category	Generic	Year		Credits	2	Course		
T 4 4 1	Elective	Semester	IV	D 4'		Code		
Instructional hours per week	Lecture 3	Tutorial	Lab	Practice		Total 4		
Prerequisites		ry for Biolog	gical S	Sciences I		4		
Objectives of the	This cours	se aims to pro	vide kr	nowledge o	on			
course	• no	menclature of	coordi	nation con	npou	nds and carbohy	drates.	
	• Ar	nino Acids ar	nd Esse	ential elem	ents	of biosystem		
	• un	derstand the co	oncepts	s of kinetic	s and	d catalysis		
	• pro	ovide fundame	entals c	of electroch	emis	stry and photoch	nemistry	
Course Outline	UNIT I	nation Cham	ictus,	and Wate	T	ahnalagy		
		nation Chemic	•				James alatum	
			•			rms - IUPAC N		
	- Werne	er'stheory -	EAN	rule - l	Pauli	ing's theory -	– Postulates -	
	Applicat	ions to [N	i(CO)	4], [Ni(C	'N)4	] <sup>2-</sup> ,[Co(CN)6] <sup>3-</sup>	Chelation -	
	Biologic	al role of H	emogl	obin and	Chl	orophyll (elem	nentary idea) -	
	Applicat	ions in qualita	ative a	nd quantita	ative	analysis.		
	Water T	echnology: H	Hardne	ess of wat	er,	determination	of hardness of	
	water usi	ing EDTA me	ethod,	zeolite me	ethoc	l-Purification te	echniques –	
	BOD an	d COD.						
	Unit II Carbohydrates							
	C	Classification,	prep	aration a	ınd	properties of	glucose and	
	fructose.	Discussion	of op	en chain	rin	g structures o	of glucose and	
	fructose.	Glucose-fruct	ose int	erconversi	ion. l	Preparation and	properties	
	of sucros	e, starch and c	cellulos	se.				

	UNIT III
	Amino Acids and Essential elements of biosystem
	Classification - preparation and properties of alanine,
	preparation of dipeptides using Bergmann method - Proteins-
	classification – structure - Colour reactions – Biological functions –
	nucleosides -nucleotides - RNA and DNA - structure. Essentials of
	trace metals in biological system-Na, Cu, K, Zn, Fe, Mg.
	UNIT IV
	Electrochemistry
	Galvanic cells - Standard hydrogen electrode - calomel electrode -
	standard electrode potentials -electrochemical series. Strong and weak
	electrolytes - ionic product of water -pH, pKa, pKb. Conductometric
	titrations - pH determination by colorimetric method – buffer solutions and
	its biological applications - electroplating - Nickel and chrome
	plating – Types of cells -fuel cells-corrosion and its prevention.
	UNIT V
	Photochemistry
	Grothus - Drapper's law and Stark-Einstein's law of photochemical
	equivalence, Quantum yield - Hydrogen -chloride reaction.
	Phosphorescence, fluorescence, chemiluminescence and
	photosensitization and photosynthesis (definition with examples).
Extended	Questions related to the above topics, from various competitive examinations
Professional Component (is a	UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
part of internal	(10 be discussed during the Tutorial hours)
component only,	
Not to be included	
in the external	
examination	
question paper)	
Skills acquired	Knowledge, Problem solving, Analytical ability, Professional
from this course	Competency, Professional Communication and Transferable skills.

Recommended	1. V. Veeraiyan, Textbook of Ancillary Chemistry; High mount
Text	publishing house, Chennai, first edition, 2009.
	<ol> <li>S.Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur, 2006.</li> </ol>
	3. Arun Bahl, B.S.Bahl, Advanced Organic Chemistry; S.Chand
	and Company, New Delhi, twenty third edition, 2012.
	4. P.L.Soni, H.M.Chawla, Text Book of Organic Chemistry; Sultan
	Chand & sons, New Delhi, twenty ninth edition, 2007.
Reference Books	1. Arun Bahl, B.S.Bahl, Advanced Organic Chemistry; S.Chand
	and Company, New Delhi, twenty third edition, 2012.
	2. P.L.Soni, H.M.Chawla, Text Book of Organic Chemistry;
	Sultan Chand & sons, New Delhi, twenty ninth edition, 2007.
	P.L.Soni, Mohan Katyal, Text book of Inorganic chemistry;
	Sultan Chand and Company, New Delhi, twentieth edition, 2007.
	4. B.R.Puri, L.R.Sharma, M.S.Pathania, Text book Physical
	Chemistry; Vishal Publishing Co., New Delhi, forty seventh
	edition, 2018.
	5. B.K,Sharma, Industrial Chemistry; GOEL publishing house, Meerut, sixteenth edition, 2014.

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
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to	3.0	3.0	3.0	3.0	3.0
PSOs					

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
Weightage	15	15	15	15	15
Weighted percentage of	3.0	3.0	3.0	3.0	3.0
Course Contribution to POs	3.0	3.0	3.0	5.0	3.0

Level of Correlation between PO's and CO's

Title of the Course	CHEMISTRY PRACTICAL FOR BIOLOGICAL SCIENCES – II (For Botany and Zoology II year/IV semester)									
Subject Code	23UCHEEP4									
Category	Generi	cYear	II	Credits	1	Course Code				
	Electiv e	Semester	IV							
Instructional	Lecture	Tutorial	Lab	Practice		Total				
hours per week	_	-	2			2				
Prerequisites		•								
Objectives of the course	i	This course aims to provide knowledge on identification of organic functional groups different types of organic compounds with respect to their properties. determination of elements in organic compounds								
	SYSTEMATIC ANALYSIS OF ORGANIC COMPOUNDS  The analysis must be carried out as follows: Functional group tests [phenol, acids (mono & di) aromatic primary amine, amides (mono & di), aldehyde and glucose].  Detection of elements (N, S, Halogens).  To distinguish between aliphatic and aromatic compounds.  To distinguish – Saturated and unsaturated compounds.									

Reference Books	V. Venkateswaran,	R.Veerasamy,	A.R.Kulandaivelu,	Basic	Principles
	ofPractical Chemist	ry; Sultan Chand	& sons, Second editio	n, 1997.	

# Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the course the students should be able to

CO 1: gain an understanding of the use of standard flask and volumetric pipettes, burette. CO 2: design, carry out, record and interpret the results of volumetric titration.

CO 3: apply their skill in the analysis of water/hardness.

CO4: analyze the chemical constituents in allied chemical products

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
Weightage	12	12	12	12	12
Weighted percentage of					
Course Contribution to	3.0	3.0	3.0	3.0	3.0
PSOs					

#### Level of Correlation between PSO's and CO's

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
Weightage	12	12	12	12	12
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PO's and CO's

SEMESTER -IV	SKILL ENHANCEMENT COURSE	Credits: 2
PART – IV	(SEC - 6): 23UBOTS46: FERMENTATION	H/W: 2
SEC - 6	TECHNOLOGY	

Pre-requisite	To students to know about the various fermentation technology.				
Learning Objectives					
C1	To appreciate the significance of microbes synthesizing fermented				
	products.				
C2	To gain insights on safety and quality control in large scale production of fermentative products.				
C3	To design and operation of industrial practices in mass production of fermented products.				
C4	To know about the various fermentation technology.				
C5	To learn about the bioproduct recovery.				
Course ou					
	tion of this course, the students will be able to:  Outcomes				
CO L	erate the significance of industrially useful K1				
microb					
2. Explair	n the design and operation of industrial practices K2				
in mas	s production of fermented products.				
-	n the process of maintenance and preservation of K3 rganisms.				
4. Analyz	4. Analyze the various aspects of the fermentation K4				
	logy and apply for fermentative production.				
	5. Validate the experimental techniques for microbial K5 & K6				
•	ction of enzymes: amylase and protease, bio				
	contents				
UNIT					
ı	Preparation of microbial culture, Preparation and sterilization of fermentation media. Isolation and improvement of industrially important microorganisms.				
•	Maintenance and preservation of microorganisms, Metabolic regulations				
l II	and overproduction of metabolites. Kinetics of microbial growth and				
	product formation.				
III	Scope and opportunities of fermentation technology. Principles of fermentation: Submerged, solid state, batch, fed-batch and continuous culture.				
IV	Fermentative production of vinegar, alcohol (ethanol, wine, beer), acids (citric acid and gluconic acid), amino acids (lysine and glutamic acid) and antibiotics (penicillin and streptomycin).				

V Micro	•	mes: Amylase and Protease. Bioproduct		
Extended Profess	onal Component (is a part ent only,Not to be included amination	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)  Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication		
Recommended Texts	<ol> <li>and Transferrable Skill</li> <li>Waites M.J. 2008. Industrial Microbiology: An Introduction, Edition, Blackwell Science, London, UK.</li> <li>Prescott S.C., Dunn C.G., Reed G. 1982. Prescott &amp; Dur Industrial Microbiology, 4th Edition, AVI Pub. Co., USA.</li> <li>Reed G. 2004. Prescott &amp; Dunn's industrial microbiology, Edition, AVI Pub. Co., USA.</li> <li>JR Casida L.E. 2015. Industrial Microbiology, 3rd Edition, N Age International (P) Limited Publishers, New Delhi, India.</li> <li>Waites M.J., Morgan N.L., Rockey J.S. and Higton G. 20 Industrial Microbiology: An Introduction. 1st Edition, Blacky Science, London, UK.</li> <li>Pelczar M.J., Chan E.C.S. and Krieg N.R. 2003. Microbiolo 5th Edition, Tata McGraw-Hill Publishing Company Limit</li> </ol>			
Reference Books	Principles of Fermen Press. UK.  2. Peppler, H. J. Fermentation Techno 3. T. El-Mansi, C. Fermentation Microbi 2006. CRC Press, US 4. Hongzhang Chen. and Practice. 2013. S 5. John E. Smith. E Press.UK. 6. Celeste M. Todard Biochemical Engineer Norwich, NY. 7. Lancini, G. R. Lo	y, Allan Whitaker, Stephen J Hall. 2016. Intation Technology. Butterworth-Heinemann D. Perlman. 2014. Microbial Technology: logy. Academic Press.  Bryce, Arnold L. Demain, A.R. Allman. iology and Biotechnology. Second Edition. SA.  Modern Solid State Fermentation: Theory Springer Press, Germany. Biotechnology. 2009. Cambridge University D., Henry C. Vogel. 2014. Fermentation and Pering Handbook. William Andrew Press. Orenzetti. 2014. Biotechnology of Antibiotics Microbial Metabolites. Springer publications,		

Web resources	1. <a href="https://ebooks.foodtechlearning.xyz/2020/12/principal-of-">https://ebooks.foodtechlearning.xyz/2020/12/principal-of-</a>
	fermentation-technology-by.html
	2. <a href="https://www.amazon.in/Principles-Fermentation-Technology-">https://www.amazon.in/Principles-Fermentation-Technology-</a>
	Peter-Stanbury-ebook/dp/B01LMDYFNQ
	3. <a href="https://www.amazon.in/Principles-Fermentation-Technology-">https://www.amazon.in/Principles-Fermentation-Technology-</a>
	Peter-Stanbury-ebook/dp/B01E3IC73W
	4. <a href="https://www.pdfdrive.com/principles-of-fermentation-">https://www.pdfdrive.com/principles-of-fermentation-</a>
	technology-e189052809.html
	5. https://www.ebooks.com/en-us/book/2698294/principles-of-
	fermentation-technology/peter-f-stanbury/

mapping man regianine catedinesi										
COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	1	3	2	1	2	2	1	2
CO 2	3	3	2	2	1	2	3	2	2	3
CO 3	2	2	3	1	1	1	2	3	1	2
CO 4	3	3	2	1	3	2	1	3	2	1
CO 5	3	3	2	1	2	2	3	3	2	3

SEMESTER -IV	SKILL ENHANCEMENT COURSE	Credits: 2
PART – IV	(SEC - 7): 23UBOTS47: ENVIRONMENTAL	H/W: 2
SEC - 7	MPACT ANALYSIS	

Pre-requisite	To students to know about the environmental impact ass	essment.		
Learning Obj	ectives			
C1	To understand about the theory and practice of environmental impact assessment.			
C2	To develop skills in identifying and solving problems of environmental concerns.			
C3	Define and classify Environmental Impacts and the term	ninology.		
C4	Understands the environmental Impact assessment pro	cedure.		
C5	List and describe environmental audits.			
On completio	Course outcomes: On completion of this course, the students will be able to: CO  Programme Outcomes			
	te the fundamental concepts and significance of all impact assessment.	K1		
2. Explain the	e important steps of EIA process.	K2		
	e environmental appraisal and procedures in India.	K3		
4. Decipher hand federal re	now to prepare the various documents required by state egulations.	K4		
	their own perspectives on impact assessment and be problems related to environment.	K5 & K6		
UNIT	CONTENTS			
I	Origin and Development Purpose and aim, core values and principles, History of EIA development, Environmental Management Plan, Environmental Impact Statement, Scope of EIA in Project planning and Implementation.			
II	EIA Process Components of EIA, EIA Methodology- Screening, Scoping, Baseline data, Impact Identification, Prediction, Evaluation and Mitigation, Appendices and Forms of Application,			
III	Techniques of Assessment-Cost-benefit Analysis, Matrices, Checklist, Overlays, Impact on Environmental component: air, noise, water, land, biological, social and environmental factors. EIA Document.			
IV	Main participants in EIA Process Role of Prenouncemental consultant, PCBs, PCCs, public aparticipation.	and IAA. Public		
V	Environmental Appraisal and Procedures in India and indicators and mitigation, Environmental Audit of differ resources, Risk Analysis, Strategic environmental ecological impact assessment: legislation.	ent environmental		

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper) Skills acquired from this		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)  Knowledge, Problem Solving, Analytical ability, Professional	
course		Competency, Professional Communication and Transferrable Skill	
Recommended Books	<ol> <li>Morris, P. and Therivel, R. 1995. Methods of Environmental Impact Assessment, UCL Press, London.</li> <li>Petts, J. 1999. Handbook of Environmental Impact Assessment, volume 1 and 2, Blackwell Science, Oxford.</li> <li>Therivel, R. and Partidario, M.R. 1996. The Practice of Strategic Environmental Assessment, Earthscan, London.</li> <li>Vanclay, F. and Bronstein, D.A. 1995. Environmental and Social Impact Assessment, Wiley &amp; Sons, Chichester.</li> <li>Rau, J.G. and Wooten, D.C., Environmental Impact Assessment, McGraw Hill Pub. Co., New York, 1996</li> </ol>		
Reference Books	Management, ( 2. Petts, J. 2 Volume 1 and 2 3. Glasson, J. Environmental 4. Canter, W.L Science/ Engin 5. Jain, R.K., U	V. and Ramachandra, T.V. 2006. Environmental Capital Pub. Co. New Delhi. 005. Handbook of Environmental Impact Assessment-2. Blackwell Publishers, UK. Therivel, R. and Chadwick. 2006. A. Introduction to Impact Assessment. Routledge, London. 1995. Environmental Impact Assessment, McGraw-Hill eering/ Math, New York. rban, L.V., Stracy, G.S., Environmental Impact Analysis, Reinhold Co., New York, 1991.	
Web resources	1. https://w Gajbhiye 2. https://w sciences 3. https://w assessn 4. https://lii	ww.amazon.in/Environmental-Impact-Assessment- e-Khandeshwar-ebook/dp/B06XTNQ5PW ww.ikbooks.com/books/book/earth-environmental- es/environmental-impact-assessment/9789382332930/ ww.elsevier.com/books/environmental-impact- nent/mareddy/978-0-12-811139-0 nk.springer.com/book/10.1007/978-3-030-80942-3 nlinelibrary.wiley.com/doi/book/10.1002/0471722022	

**Mapping with Programme Outcomes:** 

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	1	3	2	1	2	2	2	2
CO 2	3	3	2	2	3	3	2	3	2	3
CO 3	2	2	1	3	1	1	2	3	2	3
CO 4	3	3	3	3	2	2	3	3	3	3
CO 5	3	2	2	3	1	3	3	3	3	3

SEMESTER -IV PART - IV	23UEVSG48: ENVIRONMENTAL STUDIES	Credits: 2 H/W: 1

## Third Year : Semester-V

SEMESTER -V	23UBOTC51: PLANT MORPHOLOGY,	Credits: 4
PART – III	TAXONOMY AND ECONOMIC BOTANY	H/W: 5
CORE - IX		

Dra raguiaita	Drier knowledge on merphalogical anotomical characteristics	and upon						
Pre-requisite	<ul> <li>Prior knowledge on morphological, anatomical characteristics of plants.</li> </ul>	and uses						
Learning Ol								
C1	Students will have extensive knowledge of the morpholog	v (vegetative						
	structures and floral structures) of flowering plants.							
C2	Students will know about the basic concepts of classification of pla	ants.						
C3	Understand major evolutionary trends in Angiospermic plants.							
C4	To know the characteristic features of the selected families.							
C5	To know the economic importance of plants.							
	To fallow and decine importanted of planter							
Course ou	tcomes: On completion of this course, the students will be	Programme						
able to:		Outcomes						
СО								
1. Define	the concepts in plant morphology and rules of IUCN in	K1						
botanica	al nomenclature.							
2. Classify	systems of plant classification and recognize the importance	K2						
of herba	rium and virtual herbarium.							
3. Describe	e the core concepts of economic Botany and relate its	K3						
	ions in human life.							
4. Analyze	the characters of the families according to the Bentham and	K4						
	s system of classification.							
	terms and concepts related to Phylogenetic Systematics.	K5						
UNIT	CONTENTS							
	Morphology – root system – modifications. Shoot system – m							
ı	(Aerial, sub-aerial and underground). Leaf-Types-simple and	•						
	phyllotaxy, modifications (phyllode, pitcher), tendrils							
	Inflorescences – definition and types – racemose, cymose	, mixed and						
	special types. Fruits - classification.							
	History of Angiosperm classification – Artificial, Natural and							
II	system of classification. An outline of Bentham and Hooke							
	classification, an overview of APG Classification. Herbarium	•						
	collection, pressing, drying, mounting and preservation of plan							
	digital herbarium. Botanical Survey of India. Botanical nomeno	ciature-rules,						
	typification and author citation.							
	Study of the following families based on the Natural system and th							
Ш	importance: Anonaceae, Nymphaeaceae, Capparidaceae,	Rutaceae,						
	Caesalpinaceae, Cucurbitaceae, Asteraceae, Apocynaceae and Ascl Study of the following families based on the natural system and th							
		aranthaceae,						
	Importance. Convervataceae, Adaminaceae, Lamaceae, Am	araminaccac,						

IV	Euph	norbiace	ae, Liliaceae, (	Orchidaceae and Poaceae.				
V	ecor (Blac spice	Source, cultivation method (brief) and the extraction/processing of the economically important products of the following – Cereal (Rice), Pulses (Black gram), Sugar (Sugarcane), Beverage (Coffee), Oil seed (Groundnut), spices (Cardamom), essential oil (Rose), natural rubber and timber plants (Teak) and Fibre (Cotton).						
Extended Pi	Extended Professional Component (is Questions related to the above topics, from various							
a part of inte	ernal o	•	•	competitive examinations UPSC / TRB / NET / UGC -				
	luded	in th	e External	CSIR / GATE / TNPSC /others to be solved				
Examination				(To be discussed during the Tutorial hour)				
question pap Skills acquire		m this		Knowledge, Problem Solving, Analytical ability,				
course				Professional				
				Competency, Professional Communication and Transferrable Skill				
Recommen	ded	1.	Lawrence,	G.H.M. 1985. An Introduction to Plant Taxonomy,				
Texts				k Depot, Allahabad.				
		2.		. 1982. Taxonomy of Flowering Plants, Eurasia				
				S House, New Delhi				
		3.	_	T. 1970. Principles and Methods of Plant tics. The MacMillan Co-collier-MacMillan Ltd.,				
			London.	tios. The MacMillan Go-coller-MacMillan Etc.,				
		4.		Γ and Solbrig, D.J. 1979. Population Biology and				
			Evolution, A	ddison-Weslley Publicating Co. Ind USA.				
		5.	•	A.L. 1997. Diversity and Classification of Flowering umbia University Press, New York.				
		6.		D.W. 1991. Contemporary Plant Systematics.				
				II. New Jersey.				
		7.	Rajni Gupta	. 2012. Plant Taxonomy: Past, Present and Future.				
				P) Ltd. New Delhi.				
Reference	e	1.		, J. 1973. The Families of Flowering plants , Oxford				
Books		2		press, London.				
		2.		S., Fisher, L.E.F.1967. The Flora of The presidency Vol-III) BSI, Calcutta				
		3.	•	H and Heywood, V.M. 1965. Principles of				
				Taxonomy, Oliver and				
			Boyd Edinb	burgh.				
		4.	Clive AS.	·				
		_	•	and Hall Inc. New York.				
		5.	Harborne,	·				
		6.	•	ematics, Acad. Press, London. G.H. 1955. Taxonomy of Vascular Plants,				
		0.	MacMillan	·				
		7.		. Jr. and Luchsinger, A.E. 1986. Plant Systematics				
				n). McGraw-Hill Book Co., New York.				

Web	Reso	urces
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- https://books.google.co.in/books/about/Plant\_Taxonomy\_2E.html?id= px\_WAwHiZIC&redirhttps://books.google.co.in/books/about/Plant\_Taxonomy\_and\_Biosystematics.html?id=VfQnuwh3bw8C&rediresc=y\_esc=y\_esc=y\_
- 2. <a href="https://books.google.co.in/books/about/PLANT\_TAXONOMY\_2E.html?id=Roi0lwSXFnUC&redir\_esc=y">https://books.google.co.in/books/about/PLANT\_TAXONOMY\_2E.html?id=Roi0lwSXFnUC&redir\_esc=y</a>
- 3. <a href="https://books.google.co.in/books/about/Plant\_Taxonomy.html?id=0">https://books.google.co.in/books/about/Plant\_Taxonomy.html?id=0</a> <a href="https://books.google.co.in/books/about/Plant\_Taxonomy.html?id=0">bYs8F0Mb9gC&redir\_esc=y</a>
- 4. <a href="https://books.google.co.in/books/about/Economic\_Botany.html?id=2ahsDQAAQBAJ&redir\_esc=y">https://books.google.co.in/books/about/Economic\_Botany.html?id=2ahsDQAAQBAJ&redir\_esc=y</a>
- 5. <a href="https://books.google.co.in/books/about/Textbook">https://books.google.co.in/books/about/Textbook</a> Of Economic Bo tany.html?id=XmZFJO\_JHv8C&redir\_esc=y

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	1	3	2	1	2	2	1	2
CO 2	3	3	2	2	3	3	2	3	3	2
CO 3	2	2	3	3	1	2	1	3	2	1
CO 4	3	3	3	3	3	2	3	2	2	3
CO 5	3	3	2	3	2	3	3	3	3	3

SEMESTER -V	23UBOTC52: PLANT ANATOMY AND	Credits: 4
PART – III	<b>EMBRYOLOGY</b>	H/W: 5
CORE - X		

Pre-requisite	To acquire knowledge on the anatomical structur phase of angiosperms.	e and reproductive							
Learning Object	, ,								
C1 ,	To know fundamental concepts of plant anatomy and em	bryology.							
C2	To understand the internal tissue organization of various								
C3	To differentiate normal and abnormal secondary growth.								
C4									
	process of pollination and fertilization.								
C5	To know embryology of plants.								
Course outcom		Programme							
On comp	pletion of this course, the students will be able to:	Outcomes							
CO	·								
	the fundamental concepts of plant anatomy and	K1							
embryology		145							
	e internal tissue organization of various plant organs.	K2							
	e stages of normal and abnormal secondary growth.	K3							
	ne structural organization of flower in relation to the	K4							
	oollination and fertilization.  various anatomical adaptations in plants.	K5							
UNIT	CONTENTS	NO NO							
I	Cell wall - structure, and function. Tissues - Definition, t system - parenchyma, collenchyma and sclerenchyma (for Complex tissue system - xylem and phloem. Meristem: function and classification. Apical organization and theory, Histogen theory and Tunica-Corpus theory. For theory and Korper-Kappe theory.	fibers and sclereids). definition, structure, theories: Apical cell							
II	Primary structure of root and stem (Dicot and monocot). Epidermal tissue								
III	Secondary thickening in monocots and dicots, Secondary thickening in monocot and dicot root. Anomalous secondary growth of stem- Boerhaavia, Nyctanthes and Dracaena. Leaf - anatomy of dicot and monocot leaf. Periderm structure and development: Phellem, Phellogen, Phelloderm, Rhytidome and lenticels. Stomatal types.								
IV	Structure and development of anther - development of Ovule: Structure of mature ovule, types of ovules; fe megasporogenesis (monosporic, bisporic and								

	megagametogenesis ( <i>Poly</i> mature embryo sac.	gonum type); Organization and ultra structure of
V	nuclear, cellular, helobial apomixis, parthenogenes importance.	triple fusion. Endosperm and its types - free I, endosperm haustoria. Polyembryony - types, sis and parthenocarpy. Seed structure and its
part of internal of included in the Equestion paper)	ssional Component (is a component only, Not to be xternal Examination	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 for	rom this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and
		Transferrable Skill
Recommended		and Bhatnagar, S.P. 1994. Embryology of
Texts	Angiosperms (4th r House, New Delhi 3. Burgess, J. 1985. Cambridge Univer 4. Raghavan, V. 199 Springer-Verlag, New York. 5. Vimla Singh and A Experimental Biolo New Delhi. 6. Pandey, B.P.2015 7. Bhatnagar, S.P., D Embryology of Ang Delhi. 8. Waisel, Y., Eshel, The Hidden Hall (2	Bhatnagar, S.P. 2000. The Embryology of revised and enlarged edition). Vikas Publishing
Reference Books	<ol> <li>Cutter, E.G. 198         Publishing Co     </li> <li>Maheswari, P.1         Angiosperms, Ta     </li> <li>Swamy, B.G.L a         Fruits, Tata McG     </li> <li>Dickison, W.C. 2         Academic Press,     </li> <li>Fahn, A. 1974. P</li> </ol>	natomy of Seed Plants –John Willey.  9. Plant Anatomy – Part I – Addison – Wesley  1991. An Introduction to Embryology of ta McGraw Hill Publishing Co. Ltd., and Krishnamoorthy. K.V.1990. From Flower to raw Hill Publishing Co. Ltd.  1000. Integrative Plant Anatomy. Harcourt USA.  1201. USA.  1302. Plant Anatomy. Pergmon Press, USA.  1303. Plant Anatomy. The Benjammin/Cummings

	<ul> <li>Publisher, USA.</li> <li>8. Evert, R.F. 2006. Esau's Plant Anatomy: Meristems, Cells, and Tissues of the Plant Body: Their Structure, Function and Development. John Wiley and Sons, Inc. Any local/state/regional flora published by BSI or any other agency.</li> <li>9. Swamy, B.G.L and Krishnamurthy,K.V.1980. From flower to fruit .Tata McGraw Hill Co. Pvt. Ltd, New Delhi</li> </ul>
Web Resources	<ol> <li>https://www.amazon.in/PLANT-ANATOMY-EMBRYOLOGY-BIOTECHNOLOGY-ebook/dp/B07H5JYFBJ/ref=asc df B07H5JYFBJ/?tag=googleshopdes-2</li> <li>https://www.kobo.com/us/en/ebook/a-textbook-of-plant-anatomy</li> <li>https://archive.org/EXPERIMENTS/plantanatomy031773mbp</li> </ol>
	<ol> <li>https://www.amazon.in/Embryology-Angiosperms-6th-S-P-Bhatnagar-ebook/dp/B00UN5KPQG</li> <li>https://www.worldcat.org/title/embryology-of-angiosperms/oclc/742342811</li> <li>https://books.google.co.in/books/about/Embryology_of_angiosperms.html?id=uYfwAAAAMAAJ&amp;redir_esc=y.</li> </ol>

IVIA	Mapping with Frogramme Outcomes.										
COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	1	3	2	1	2	2	2	1	
CO 2	3	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	

SEMESTER -V	23UBOTC53: PRACTICAL-V : Covering Core IX	Credits: 4
PART – III	(PLANT MORPHOLOGY, TAXONOMY AND	H/W: 5
CORE - XI	ECONOMIC BOTANY)s	

Pre-requisite	e-requisite Theoretical understanding of plant taxonomy as well as basic laboratory					
	skills for the relevant core course.					
Learning Obje	ectives					
<b>C</b> 1	To study morphological characters of the families.					
C2	Able to describe the plant technically using the floral character	ristics.				
C3	To preserve the plants and prepare herbarium sheets.					
C4						
C5	·					
Course outcomes: Programme						
On completion of this course, the students will be able to: CO  Outcome						
Recognize the distinguishing plant morphological characters.  K1						
2. Identify locally available plants to their respective families. K2						
3. Develop comprehensive skills in field identification, collection of specimens, writing technical description, botanical drawings and herbaria preparation.						
4. Construct	floral diagram and write floral formula for a given flower.	K4				
5. Validate t		K5				

#### **EXPERIMENTS**

- 1. Morphology of root, stem and leaf modification, types of inflorescence.
- 2. Plants of local flora included under theory syllabus and family identification and derivation based on reasoning.
- 3. Dissection, identification, observation and sketching the floral parts of the plants belonging to the families included in the syllabus.
- 4. Students must describe the floral parts, draw the L.S., floral diagram and write the floral formula of at least one flower from each family.
- 5. Twenty (20) Herbarium sheets, field notebook and bonafide record to be submitted.
- 6. Study the products of plants mentioned in the syllabus of economic botany with special reference to the morphology, botanical name and family.
- 7. Field trips to places for observation, study and collection of plants prescribed in the syllabus for 2 to 5 days under the guidance of faculties.

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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 1. Subramaniam, N.S. 1996. Laboratory Manual of Plant Taxonomy. Texts Vikas Publishing House Pvt. Ltd., New Delhi. 2. Gokhale, S.B., Kokate, C.K. and Gokhale, A. 2016. Pharmacognosy of Traditional Drugs. Nirali Prakashan, 1st Edition. ISBN: 9351642062. 3. Rendle, A.B. 1980. The Classification of Flowering Plants (Vol. I & II), Vikas Students Education. 4. Pandely, B.P. 1987. Taxonomy of Angiosperms. 5. Nordenstam, B., El Gazaly, G and Kassas, M. 2000. Plant Systematics for 21st Century. Portlant Press Ltd., London. Reference Books 1. Mann J. Davidson, R.S and J.B. Hobbs, D.V. Banthorpe, J.B. Harborne, 1994. Natural Products. Longman Scientific and Technical Essex. 2. Gopalan, C., B.V. Ramasastri and S.C. Balasubramanian. 1985. Nutritive Value of Indian Foods. National Institute of Nutrition, Hyderabad. 3. Grant, W.E. 1984. Plant Biosystematics. Academic Press, London. 4. Harrison, H.J. 1971. New Concepts in Flowering Plant Taxonomy. Rieman Educational Book Ltd., London. 5. Jones, A.D. and Wilbins, A.D. 1971. Variations and Adaptations in Plant Species. Hiemand & Co. Educational Books Ltd. London. Web resources 1. https://www.amazon.in/Practical-Taxonomy-Angiosperms-R-Sinha/dp/9380578210 2. <a href="https://www.wileyindia.com/plant-science/practical-taxonomy-of-angiosperms-">https://www.wileyindia.com/plant-science/practical-taxonomy-of-angiosperms-</a> 2ed.html 3. https://www.flipkart.com/practical-taxonomyangiosperms/p/itm194794e7a76e8 4. https://books.google.co.in/books/about/Plant Taxonomy.html?id=uWg76

Manning with Programme Outcomes:

eBook.

rCaA68C

mapping with a regramme outcomes.										
COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	1	3	2	1	2	2	1	3
CO 2	3	3	2	2	3	3	2	3	2	2
CO 3	2	2	3	3	1	2	1	2	3	3
CO 4	3	3	3	3	3	2	3	3	3	3
CO 5	3	3	2	3	2	3	3	3	2	3

5. <a href="https://www.amazon.in/PLANT-TAXONOMY-Sharma/dp/0070141592">https://www.amazon.in/PLANT-TAXONOMY-Sharma/dp/0070141592</a>
6. <a href="https://www.kopykitab.com/Economic-Botany-By-Manoj-Kumar-Sharma-">https://www.kopykitab.com/Economic-Botany-By-Manoj-Kumar-Sharma-</a>

SEMESTER -V		CREDITS: 4
PART – III	23UBOTD54: PROJECT WITH VIVA VOCE	_
CORE - XII		H/W: 5

(Refer to the Regulations)

SEMESTER -V	23UBOTE55-1: CELL BIOLOGY, GENETICS	Credits: 3
PART – III	AND PLANT BREEDING	H/W: 4
ELECTIVE - V		

Pre-	To acquire knowledge on cell and expose the students a funda	amental of the					
	various techniques used in plant breeding.						
Learning Objectives							
C1	To enable students to gain insights into cell wall organization and its functions.						
C2	To familiarize with various cell organelles and their functions.						
C3	To gain knowledge in classical genetics.						
C4	To know about sex linked inheritance.						
C5	To have knowledge about plant breeding techniques for crop improve	ment.					
Course o	utcomes:	Programme					
On comple	etion of this course, the students will be able to:	Outcomes					
CO							
1. Enume organe	rate the structure and functions of cells, cellular structures and lles.	K1					
2. Explain exampl	about cell cycle, cell division and laws of inheritance with suitable les.	K2					
3. Elucida	te concepts of sex determination and sex linked inheritance.	K3					
4. Analyze levels.	e the importance of genes interactions at population and evolutionary	K4					
· ·	p conceptual understanding of plant genetic resources, plant ng, gene bank and gene pool.	K5					
UNIT	CONTENTS						
	Introduction- scope- cell organisation- Ultra structure of Prokar	yotic cell and					
	Eukaryotic cell. Plant cell structure and function.	•					
	Cell boundaries- cell wall- gross layer i.e. middle lamella,	primary wall,					
I	secondary wall- Structure, chemistry and functions of cell wall,	pits- (simple					
	and bordered), Plasmodesmata. Plasma membrane- occurrer	nce, structure					
	(fluid mosaic model) chemistry, function and origin. Properties	of Cytoplasm					
	Membrane transport - Passive, active and facilitated transport	, endocytosis					
	and exocytosis.						
	Occurrence, structure, function and origin of Endoplasmic ret						
	apparatus, Lysosomes, Ribosomes, Mitochondria, Chloroplas						
	bodies. Semi genetic autonomy of Mitochondria and	Chloroplast.					
II	Ultrastructure and functions of Nucleus, nuclear envelope,	nuclear pore					
	complex, nucleolus, chromosomes structure molecular organization of						
	chromatin, Euchromatin, heterochromatin, Polytene and Lampbrush						
	chromosomes-, Centromere: types. cell inclusion. Cell cycle, Cell division,						
	Mitosis and Meiosis- their significance.						
	Mendelian genetics - monohybrid, dihybrid crosses. Laws of Mendelian						
	cross - Back cross and Test cross. Incomplete dominance - Mil						
	Interaction of factors – Complementary genes, Supplementary gen						
	genes, epistasis (dominant and recessive), duplicate genes and multi	pie alleies.					

III	Multiple alleles. ABO Blood grouping in Human. Chromosome theory of linkage, crossing over, recombinations and mapping of genes on chromosomes. Sex determination in plants.						
IV	Sex linked inheritance – Haemophilia and colour blindness. Polyploidy origin, types and significance. Mutation-types and significance. chromosomal aberration – addition, deletion, inversion, duplication and translocation.  Extra nuclear inheritance and its significance - Male sterility in corn, Maternal inheritance – Plastid Inheritance in <i>Mirabilis jalaba</i> . Genetics of <i>Neurospora</i> . Population genetics – Hardy – Weinberg principle.						
V	Principles involved in plant breeding. Plant introduction and acclimatization. Methods of crop improvement: selection (mass, pure line and clonal), hybridization techniques. Heterosis – Interspecific and intergeneric, causes and effects. Mutation in plant breeding, polyploidy in plant breeding and its applications. Breeding for crop improvement for paddy and sugarcane. Biotechnology in crop improvement: Transgenics – scope and limitations; Bt-Cotton.						
part of inte	Professional Component (is a ernal component only, Not to be the External Examination aper)	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 acqu course	Skills acquired from this Knowledge, Problem Solving, Analytical						
Recomme nded Texts	<ul> <li>Delhi-55.</li> <li>Sinnott, EW., Dunn, L.L and Dobzhansky, T. 1997. Principles of Genetics, Tata Mc Graw Hill Publishing Co. New Delhi.</li> <li>Cohn.N.S.1979, Elements of Cytology, Freeman Book Co.</li> <li>Singh, R. J. 2016. Plant Cytogenetics, 3rd Edition. CRC Press, Boca Raton, Florida, USA.</li> <li>Singh, R.J. 2017. Practical Mannual on Plant Cytogenetics. CRC Press,</li> </ul>						
Reference Books	<ol> <li>Boca Raton, Florida, USA.</li> <li>De Robertis and De Robertis. 1990. Cell and Molecular Biology, Saunders College, Philadelphia, USA.</li> <li>Gardner, E.J., Simmons, M.J and Snustad, D. 1991. Principles of Genetics, John Wiley Sons Inc., 8<sup>th</sup> Edn., New York.</li> <li>Hackett, P.B., Fuchs, J.A and Messing, J.W. 1988. An Introduction to Recombinant. DNA Techniques: Basic Experiments in Gene Manipulation. The Benjamin/Cummings Publishing Co. Inc., Menlo Park, California.</li> <li>Cooper, G.M and Hausman, R.E. 2009. The Cell: A Molecular Approach. 5th edition. ASM Press &amp; Sunderland, Washington, D.C. Sinauer Associates, MA.</li> </ol>						

- Becker, W.M., Kleinsmith, L.J., Hardin. J and Bertoni, G. P. 2009. The World of the Cell. 7th edition. Pearson Benjamin Cummings Publishing, San Francisco.
   Klug, W.S., Cummings, M.R., Spencer, C.A. 2009. Concepts of Genetics.
- Klug, W.S., Cummings, M.R., Spencer, C.A. 2009. Concepts of Genetics. 9th edition. Benjamin Cummings, U.S.A.
- 7. Lewin. 2007. Gene IX. Jones and Barlett Pub. ISBN. O 7637 52223.
- 8. Strickberger, M.W. 1999.Genetics.Prentice Hall of India Pvt Ltd, New Delhi.

# Web

- 1. http://www.freebookcentre.net/Biology/Cell-Biology-Books.html
- Resources 2. https://www.us.elsevierhealth.com/medicine/cell-biology
  - 3. <a href="https://www.amazon.in/Cell-Biology-Thomas-D-Pollard-ebook/dp/B01M7YAL2A">https://www.amazon.in/Cell-Biology-Thomas-D-Pollard-ebook/dp/B01M7YAL2A</a>
  - 4. <a href="http://www.freebookcentre.net/medical\_text\_books\_journals/genetics\_ebooks\_online\_texts\_download.html">http://www.freebookcentre.net/medical\_text\_books\_journals/genetics\_ebooks\_online\_texts\_download.html</a>
  - 5. https://www.us.elsevierhealth.com/medicine/genetics
  - 6. <a href="https://libguides.uthsc.edu/genetics/ebooks">https://libguides.uthsc.edu/genetics/ebooks</a>
  - 7. <a href="https://www.kobo.com/us/en/ebook/principles-of-plant-genetics-and-breeding">https://www.kobo.com/us/en/ebook/principles-of-plant-genetics-and-breeding</a>
  - 8. <a href="http://sharebooks.com/content/plant-breeding-ebooks-raoul-robinson">http://sharebooks.com/content/plant-breeding-ebooks-raoul-robinson</a>

**Mapping with Programme Outcomes:** 

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	1	3	2	1	2	2	3	1
CO 2	3	3	2	2	3	3	2	3	3	2
CO 3	3	3	2	3	1	2	1	3	3	2
CO 4	3	3	3	3	3	2	3	3	3	3
CO 5	3	3	2	3	2	3	3	3	3	2

SEMESTER -V
PART – III
<b>ELECTIVE - V</b>

# 23UBOTE55-2: BIO-ANALYTICAL TECHNIQUES

Credits: 3 H/W: 4

Pre-	To impart expertise about analysis and research.	
requisi		
Learr	ning Objectives	
C1	To understand the principle, operation and maintenance of various to	ools/equipment in
	the laboratory.	
C2	Perform experiments using the laboratory instruments, formulate	experiments for
	project work and evaluate critically the acquisition of data.	
C3	To equip students to collect, analyze and evaluate data generated by their	own inquiries in a
	scientific manner.	
C4	To give an exposure to various forms of field research and data analysis tec	•
C5	To provide an overview on modern equipments that they would he	
	confidences to instantly commence research careers and/or start entreprene	
	se outcomes:	Programme
	empletion of this course, the students will be able to:	Outcomes
CO	ata ta the various hislogical techniques and its importance	1/4
	ate to the various biological techniques and its importance.  Applain the principles of Light microscopy, compound microscopy,	K1 K2
	escence microscopy and electron microscopy.	NZ
	ply suitable strategies in data collections and disseminating research	K3& K6
finding		
4. C	ompare and contrast the significance of different types of chromatography	K4
techni	ques.	
	velop methodologies for extraction and analysis of biochemical compounds.	K5
UNI	CONTENTS	
Т		
	MICROSCOPY:	
1	Principles of microscopy; Light microscopy; compound microscopy, bright	
	dark field microscope, phase-contrast microscope, Fluorescence microscond and Scanning electron microscopy. Microscopic measurements-microscopy.	
	drawing: Camera Lucida.	netry, wiicroscopy
	CHROMATOGRAPHIC PRINCIPLES AND APPLICATIONS:	
II		(TLC), Column
	chromatography, Gas chromatography – Mass spectrometry (GCMS),	, , ,
	Liquid Chromatography (HPLC).	3
	ELECTROPHORESIS AND PH METER:	
III	Basic principle, construction and operation of pH meter. Polyacrylamide	gel electrophoresis
	(PAGE), Agarose Gel Electrophoresis.	
	IV SPECTROPHOTOMETRY AND CENTRIFUGATION TECHNIQUE	
IV	Principle and law of absorption, construction, operation and uses of	
	UV-Visible spectrophotometer, Principles, methods of centrifug	gation, types of
	centrifuge and applications.	

#### **BIOSTATISTICS:**

V Data collection methods, population, samples, parameters; Representation of Data: Tabular, Graphical— Histogram – frequency curve – Bar diagram—measures of central tendency – Mean, Median and Mode; Standard deviation, Standard error, Chi-square test and goodness of fit –t–test.

lest and goodness of ill -t-test.	
Extended ProfessionalComponent (is a	Questions related to the above topics, from various
part of internal component only, Not to be	competitive examinations UPSC / TRB / NET / UGC -
included in the External Examination	CSIR / GATE / TNPSC /others to be solved (To be
question paper)	discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability,
·	Professional Competency, Professional
	Communication and Transferrable Skill

#### **Recommended Texts**

- Sharma, V.K. 1991. Techniques in microscopy and cell biology, Tata McGraw Hill, New Delhi.
- Sawhney, S.K and Randhir Singh. 2000. Introductory practical biochemistry, Narosa Publishing House.
- 3. Asokan, P. 2001. Basics of analytical biochemistry. Chinna Publications.
- Bajpai, P.K. 2006. Biological instrumentation and methodology. S. Chand & Company, New Delhi.
- 5. Veerakumari, L. 2009. Bioinstrumentation. MJP Publications.
- Palanivelu, P. 2013. Analytical Biochemistry and Separation techniques, 20<sup>th</sup> century publications, Palkalai nagar, Madurai.

#### **Reference Books**

- 1.Rana, S.V.S. 2009. Biotechniques: Theory and Practice. Rastogi Publications.
- 2. Zar, J.H. 2012. Biostatistical Analysis. 4th edition. Pearson Publication. U.S.A.
- Sundar Rao, P.S.S and Richard, J. 2011. Introduction to Biostatistics and research methods, PHI learning Private Ltd., New Delhi.
- 4. Johansen, D.A. 1940. Plant Micro technique, TATA McGraw Hill Book Co., Ins., New Delhi.
- 5. Peter Gray. 1964. Handbook of Basic Micro technique. McGraw hill publication, New York.
- 6. Cooper, T.G. 1991. The Tools of Bio chemistry, John Wiley & sons, London.
- 7. Dey, P.M and Harborne, J.B. 2000. Plant Biochemistry Harcourt Asia Pvt. Ltd.
- Plummer, D.T. 2003. An introduction to practical Biochemistry. 3rd Edn. Tata McGraw Hill Publishing Company Ltd. New Delhi.
- 9. Zar, J.H. 1984. Biostatistics Analysis, Prentice Hall International, England Cliffs, New Jersy.

#### Web Resources

- 1. https://www.kobo.com/in/en/ebook/bioinstrumentation-1
- 2. https://www.worldcat.org/title/bioinstrumentation/oclc/74848857
- 3. https://www.amazon.in/Bioinstrumentation-M-H-Fulekar-Bhawana-Pandey-ebook/dp/B01JP3M9TW
- https://www.amazon.in/Handbook-Biomedical-Instrumentation-R-S-Khandpurebook/dp/B0129ZDO9W?ref=kindlecontentin50-21&tag=kindlecontentin50-21&gclid=CjwKCAiAx\_DwBRAfEiwA3vwZYkqkwRb\_EGf73exaWpY8D9JNpJZsOcXQCQ4pZlRzTrY H2lopaVP1xxoClPgQAvD\_BwE

- https://www.kobo.com/us/en/ebooks/biostatistics
   https://www.amazon.in/Biostatistics-Veer-Bala-Rastogi-ebook/dp/B07LDCPXDG

mapping with a regramme outcomes.										
COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	2	3	2	1	2	2	3	2
CO 2	3	3	2	2	1	3	2	3	3	3
CO 3	2	2	3	2	1	2	1	3	2	2
CO 4	3	2	1	1	3	2	1	3	3	2
CO 5	3	2	1	3	2	2	3	3	3	2

SEMESTER -V	23UBOTE55-3: AQUATIC BOTANY	Credits: 3
PART – III		H/W: 4
ELECTIVE - V		

Pre-requisite	To understand ecological functions and economic uses	of aquatic plants.				
Learning Obje	ectives					
C1	To give an overview of the distribution of lower plants forms and its ecological significance.					
C2	To enable students to understand the ecological functions at of aquatic plants.	nd economic uses				
C3	To equip students to collect, analyze and identify the plankto	ons.				
C4	To give an exposure to various forms seaweeds.					
<b>C</b> 5	To know about the values and uses of aquatic plants.					
Course outco	mes:	Programme				
On completion CO	of this course, the students will be able to:	Outcomes				
1. Recognize a	equatic plants and their ecological importance.	K1				
	out commonly occurring marine and limnetic algae of	K2				
Apply tech addition.	3. Apply techniques for conservation of aquatic plants for value K3					
	4. Analyze and decipher the significance and properties of K4 mangroves, other aquatic angiosperms and microalgae.					
5. Develop r	5. Develop new strategies to conserve mangroves and device K5 & K6					
	innovative methods for cultivation of aquatic plants.					
UNIT						
	MARINE AND LIMNETIC MACRO ALGAE:					
ı	Common seaweeds of Indian subcontinent: <i>Ulva, Caulerpa, Sargassum, Gracilaria</i> , etc. Common terrestrial algae, including cyanobacteria and lichen photobionts of Indian subcontinent and its life cycle, ecology and taxonomy: <i>Anabaena, Chlorella, Scenedesmus</i> .					
	MANGROVES:					
II	Mangrove forests of India, including Sundarbans, Pic	chavaram, Kerala				
	mangroves, Rathnagiri mangroves. Common species of mangroves					
	and mangrove associated plants, including Avicennia, Rhizophora,					
	Acanthus and Aegiceras. Ecological significance of ma	angroves.				
	PHYTOPLANKTONS, CYANOBACTERIA, DINOFLAGELLATES AND					
III	DIATOMS: Common marine microalgae of India, including					
	phytoplanktons and picoplanktons, Common	diatoms and				
	dinoflagellates of Indian Ocean, Common limneti	c and terrestrial				
	cyanobacteria of India.					
	AQUATIC ANGIOSPERMS:					
IV	Common aquatic angiosperms of India, including L Water hyacinth. Ecology, life cycle, taxonomy	•				

	importance of aquati	ic angiosperms.		
V  Extended Profes	Economic important plants, including bio sequestration and se	s of Aquatic Plants: ce of aquatic plants, Ecosystem services of aquatic geochemical cycles, oxygen production and carbon o on, edible seaweed and algal resources of India, piritual importance of aquatic plants.  Questions related to the above topics, from various		
a part of interna to be include Examination question paper)	I component only, Not d in the External	competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved (To be discussed during the Tutorial hour)		
Skills acquired f course		Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill		
Recommended Texts	<ol> <li>Lee, R.E. 2008. Phycology. 4<sup>th</sup> edition. Cambridge University Cambridge.</li> <li>Wile, J.M, Sherwood, L.M and Woolverton, C.J. 2013 Press Microbiology. 9th Edition. Mc Graw Hill International.</li> <li>Kumar, H.D. 1999. Introductory Phycology. Affiliated East-V Press, Delhi.</li> <li>Hoek, C. Van, D. 1999. An Introduction to Phycology. Cambridge University Press.</li> <li>Daubenmire, R.F.1973. Plant and Environment. John Willey</li> <li>Sharma, J.P.2004. Environmental Studies, Laxmi Publication Ltd. New Delhi.</li> <li>Bast, F. 2014. Seaweeds: Ancestors of land plants with rich</li> </ol>			
Reference Books	1.Kathiresan, K and Ecosystems. Hindust 2. Allan, J.D. and Caspringer, Netherlands 3. Barnes, R.S.K. 19 Barnes & K.H. Mann, 4. Bennet, G.W. 197 Reinhold Co.,NY.375 5. Goldman, C.R. Internat.Book.Co.Tok	astillo, M.M. 2009. Stream Ecology (Second Ed.). s. 74. Fundamentals of Aquatic Ecosystems, (R.S.K. eds.), Blackwell Sci. Publ., London, 229 pp. 1 Management of Lakes and Ponds. von Nostrand pp. & A.J. Horne 1983. Limnology. McGraw Hill		
Web Resources	<ol> <li>http://kyry6.gq/734 science.pdf</li> <li>http://fuls7.gq/824 science.pdf</li> <li>https://www.spring</li> </ol>	447c/aquatic-botany-published-by-elsevier- 42e/aquatic-botany-published-by-elsevier- ger.com/gp/book/9788132221777 44a1/aquatic-botany-published-by-elsevier-		

science.pdf
5. https://www.amazon.in/Aquatic-Plants-iFlora-Plant-Guide-
ebook/dp/B07NS9V7LN

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	1	3	2	1	2	2	2	1
CO 2	3	2	1	1	2	3	2	3	2	3
CO 3	2	2	3	1	1	2	1	3	1	2
CO 4	3	3	3	3	3	2	1	2	3	2
CO 5	3	2	1	1	2	3	3	3	2	3

SEMESTER -V		Credits: 3
PART – III	23UBOTE56: ENTREPRENEURIAL BOTANY	
<b>ELECTIVE - VI</b>		H/W: 4

-	To develop innovative ideas to exploit the economically use	eful plant products for				
	commercial purposes.					
Learning Ob						
C1	To enable students to develop innovative ideas to exploit the economically useful plant products for commercial purposes.					
C2	To inculcate entrepreneurial values to start a new business. To enlighten people about					
C3	bioventure.  To comprehend the molecular processes.					
C4	To expose the students a fundamental of the various value adde	nd products				
C5	To introduce the entrepreneurial opportunities.	tu producis.				
		Drogrammo				
Course outc		Programme Outcomes				
CO	on of this course, the students will be able to:	Outcomes				
_	ize the significance of government agencies for	K1				
	rship development.	160				
-	about entrepreneurial values, risk assessment and	K2				
solutions		1/0				
	of entrepreneurial opportunities.	K3				
	4. Analyze and decipher the significance of bioventure and value added K4					
products. 5. Devise in	novative methods for making value added products.	K5 &				
UNIT	CONTENTS	K6				
UNIT	INTRODUCTION:					
I	Need - definition and concept - Types and characterization - entrepreneurial values-motivation and barriers-entrepreneurship as innovation, risk assessment and solutions.					
	BIOVENTURE:					
l II	Industry - overview of Spirulina, Pleurotus, Natural dyes,	Banana fibers, Wine,				
	Hydroponics, Drumstick and coconut - Straight Veget					
	Pure Plant Oil (PPO) -methods and marketing - fresh and dry flowers for					
	aesthetics.					
	VALUE ADDED PRODUCTS:					
III	Canning of fruits - process and equipment, fruit and vege	table based products				
	(squash) - ready to serve (RTS) (syrup, pulp, paste, ketch	hup, soup, vegetable				
	sauces, jam and jellies), Palmyrah Palm produc					
	Rose/Jasmine - Bamboo and cane based products-virging					
	oil production, nutraceuticals, standards and quality mana	igement.				

	ORGANIZATIONS AND AG	ENCIES:					
IV							
IV	TIIC, DIC, NABARD, MICROSTAT, DBT - case study - sarvodaya - SIDCO -						
		m Enterprises – support structure for promoting					
	entrepreneurship – variou	s government schemes.					
	ENTREPRENEURIAL OPPO	ORTUNITIES:					
V	Understanding a market a	nd assessment, selection of an enterprise, business					
	planning, mobilization of resources, Break Even Analysis, project proposal						
	(guidelines, collection of information and preparation of project report), steps						
	in filing patents, trademark	ks and copyright, Intellectual Property Rights, export					
	and import license.						
	essional Component (is a	Questions related to the above topics, from various					
	component only, Not to be	competitive examinations UPSC / TRB / NET / UGC -					
	External Examination	CSIR / GATE / TNPSC / others to be solved (To be					
question paper	ion paper) discussed during the Tutorial hour)						
Skills acquired	from this course	Knowledge, Problem Solving, Analytical ability,					
Oniis acquired	nom una courae						
		1 27					
		Communication and Transferrable Skill					
	Recommended Texts						

#### Recommended Texts

- 1. Taneja, S. and Gupta, S. L. 2015. Entrepreneurship development, New venture creation, Galgeba publication company, New Delhi.ISSN: 2321-8916.
- 2. Desai, V., 2015. Entrepreneurship development, First edition. Himalaya publication house, Mumbai, ISBN:9789350973837.
- 3. Khanna, S.S. 2016. Entrepreneurial development. S. Chand company limited, New Delhi.ISBN:9788121918015.
- 4. Bendre, M. Ashok and Ashok Kumar, A. 2020. Text Book of Practical Botany 1 (10th ed). Rastogi Publications, Meerut.
- 5. Singh, R and U.C. Singh 2020. Modern mushroom cultivation, 3d Edition Agrobios (India), Jodhpur.

#### Reference Books

- 1. Manohar, D.1989. Entrepreneurship of small scale industries, vol. III. Deepanddeep publication, New Delhi. ISSN: 09735925.
- 2. Lal, G., Siddhapa, G.S. and Tandon, G.L., 1988. Preservation of fruits and vegetables. Indian Council of Agricultural Research (ICAR). ISSN:0101-2061.
- 3. Ranganna, S., 2001. Handbook of analysis and quality control of fruits and Vegetable products, Second edition, Tata Mc Graw hill, New Delhi. ISBN: 780074518519.
- 4. Gupta. P.K., 1998. Elements of Biotechnology. Rastogi publications, Meerut.
- Edmond Musser and Andres, Fundamentals of Horticulture, McGraw Hill Book Co.New Delhi.

#### Web resources

- 1. https://store.pothi.com/book/ebook-priya-lokare-botanical-entrepreneurship/
- 2. https://www.taylorfrancis.com/chapters/mono/10.1201/b14920-15/value-added-productsmicroalgae-faizal-bux
- 3. https://www.amazon.in/Microalgae-Biotechnology-Health-Value-Productsebook/dp/B0845QXPY3
- 4. https://www.elsevier.com/books/value-addition-in-food-products-and-processing-through-

- enzyme-technology/kuddus/978-0-323-89929-1
- 5. https://www.oreilly.com/library/view/selling-todaypartnering/9780134477404/xhtml/fileP700101194000000000000000001DEB.xhtm

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	1	3	2	1	2	2	1	2
CO 2	3	1	3	2	1	3	1	3	3	1
CO 3	2	2	3	3	1	1	2	3	1	2
CO 4	3	3	2	2	3	2	3	3	2	3
CO 5	3	3	2	3	1	2	3	3	2	3

SEMESTER -V	23UVALG57: VALUE EDUCATION	Credits: 2
PART – IV		H/W: 2

SEMESTER -V	23UBOTI58: SUMMER INTERNSHIP	CREDITS: 2
PART – IV		HOURS:

(Refer to the Regulations)

## SEMESTER - VI

SEMESTER - VI	23UBOTC61: PLANT ECOLOGY AND	Credits: 4
PART – III	PHYTOGEOGRAPHY	H/W: 6
CORE - XIII		

Understanding the environmental factors impacting biodiversity is crucial					
after taking this course.					
etives					
To relate to the significance of the biotic and abiotic components of the					
ecosystems.					
To understand the energy flow in ecosystem.					
To conceptualize the biodiversity.					
To know implication of pollution on the environment.					
To familiarize with the phytogeography.					
Course outcomes:					
On completion of this course, the students will be able to:					
the significance of the biotic and abiotic components of the	K1				
s and energy flow.					
ne phytogeographical division of India.	K2				
3. Explain the implication of pollution on the environment.					
4. Analyze the implications of functional and behavioral ecology in					
natural and man-made areas, biodiversity and conservation.					
tigations for the effective conservation of biodiversity and	K5				
disaster management.					
	after taking this course.  Itives  To relate to the significance of the biotic and abiotic or ecosystems.  To understand the energy flow in ecosystem.  To conceptualize the biodiversity.  To know implication of pollution on the environment.  To familiarize with the phytogeography.  mes:  of this course, the students will be able to:  the significance of the biotic and abiotic components of the sand energy flow.  the phytogeographical division of India.  mplication of pollution on the environment.  e implications of functional and behavioral ecology in man-made areas, biodiversity and conservation.  tigations for the effective conservation of biodiversity and				

Unit	CONTENTS
I	Biotic and abiotic factors and their influence on vegetation – a brief account of microbes, plants, animals, soil, wind, light, temperature, rainfall, and fire. Autecology and Synecology – Vegetation – Units of Vegetation – Formation, Association, Consociation, Society – development of vegetation. Migration – ecesis, colonization, Methods of study of vegetation (Quadrat and transect). Plant succession –Hydrosere and Xerosere. Ecological classification of plants: Morphological and anatomical features of plants and their correlation to the habitat factors.
	Structure, trophic organization; food chains and food web, energy flow in an
II	ecosystem. Types of ecosystems: pond, forest and grassland. Ecological pyramids and Biogeochemical cycles of carbon and nitrogen and phosphorus.
III	Biodiversity: Ecosystem/community, species and genetic diversity. Endemism and hotspots, Natural resources and its conservation ( <i>In situ</i> and <i>ex situ</i> ).
IV	<b>Pollution:</b> Types of pollution: Primary and secondary and their impacts: Air - Green house effect, global warming, ozone depletion, acid rain, Water, soil-causes and consequences. Remedial measures – Green building. Disaster management.

V	Phytogeography Introduction, continuous and discontinuous distribution, Phytogeography of India, Vegentational regions of India, Plant indicators. Diversification of land plants. Speciation Changing Earth. Island Biogeography. Plant Biodiversity and its importance. Definition, levels of biodiversity-genetic, species and ecosystem. Biodiversity								
	•	spots- Criteria, Biodiversity hotspots of India. Loss of biodiversity –							
		ses and conservation (In situ and ex situ methods). Seed banks -							
			sources and their importance. Consequences of on of targeted species; Forest conservation, Social						
		•	Management of Forest. Concept of degeneration						
		generation of plants.	viality of the order. Contest of degeneration						
Extended		onalComponent (is a	Questions related to the above topics, from various						
		nponent only, Not to	competitive examinations UPSC / TRB / NET / UGC						
		n the External	<ul><li>– CSIR / GATE / TNPSC /others to be solved</li></ul>						
Examination			(To be discussed during the Tutorial hour)						
question p		n this course	Knowledge, Problem Solving, Analytical ability,						
OKIIIS acqu	uneu noi	ii tiiis course	Professional						
			Competency, Professional Communication and						
Pagamma	ndod	1 Singh IS Si	Transferrable Skill						
Recomme Texts	nueu		ngh, S.P., Gupta, S. 2006. Ecology Environment Conservation. Anamaya Publications, New Delhi,						
TOXIS		India.	Conscivation. Atlantaya i dolloations, New Delin,						
			2010. Ecology and Environment. Rastogi						
			leerut, India.8th edition.						
		_	.V.R. 1992. Environmental protection and legal						
			ing Publishers Pvt. Ltd.,						
			and Chandel,PS.1990. Plant Ecology, S.Chand &						
		Co. Pvt. Ltd.,	V KV 2002 An advanced toxt book on						
		Biodiversity - F	y, K.V. 2003. An advanced text book on Principle and Practice. Oxford and IBH Publishing						
		Co. Pvt. Ltd., N							
		6. Sharma, P.I Publications.	D. 2009. Ecology and Environment, Rastogi						
Reference	Books		05. Fundamentals of ecology. Cengage Learning						
Keierence	מאטטעם ,	*	New Delhi. 5th edition.						
		2. Wilkinson, D.M. 2007. Fundamental Processes in Ecology: An							
		Earth Systems Approach. Oxford University Press. U.S.A.							
		3. Kumar,H.D. 1990. Modern concepts of Ecology, Vikas							
		Publishing House Pvt. Ltd.,							
		4. Smith,W.H. 1981. Air pollution and forest : Interactions							
		between air contaminants and forest ecosystems.							
		5. Vickery, M.L. 1984. Ecology of Tropical plants, John Wiley and							
		Sons.							
			, 2001. Biodiversity and Conservation, Science						
		Publishers Inc.	USA.						

	Ţ						
	<ol> <li>Asthana, D.K and Meera Asthana. 2006. A text book of Environmental studies. S.Chand and Company Ltd. New Delhi.</li> <li>Brian Groombridge. 1992. Global Biodiversity, Chapman and Hall, UK.</li> <li>IUCN. 1985. The World Conservation Strategy, IUCN, Switzerland.</li> <li>Ambasht, R.S. 2017. A textbook of plant ecology 15ed (pb 2019). CBS Publishers Distributors.</li> </ol>						
Web Resources	1. https://www.kobo.com/us/en/ebook/plant-ecology-3.						
	2. https://www.worldcat.org/title/plant-ecology/oclc/613206385						
	3. <a href="https://books.google.co.in/books/about/Plant_Ecology.html?">https://books.google.co.in/books/about/Plant_Ecology.html?</a>						
	4. https://www.kopykitab.com/Plant-Ecology-by-Agrawal-AK-And-Deo-						
	PP 5. http://www.freebookcentre.net/Biology/Ecology-Books.html						
	6. <a href="https://www.amazon.in/Plant-Ecology-Ernst-Detlef-">https://www.amazon.in/Plant-Ecology-Ernst-Detlef-</a>						
	Schulze/dp/354020833X						
	7. https://www.tandfonline.com/toc/tped20/current (Plant Ecology and						
	Diversity)						
	8. https://link.springer.com/journal/11258 (Plant Ecology)						

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	1	3	2	1	2	2	2	1
CO 2	3	3	2	2	3	3	1	3	3	3
CO 3	2	2	3	3	1	2	1	3	1	2
CO 4	3	3	3	3	3	1	3	3	3	1
CO 5	3	3	2	3	1	2	3	1	1	2

SEMESTER - VI	23UBOTC62: PLANT BIOTECHNOLOGY AND	Credits: 4
PART – III	MOLECULAR BIOLOGY	H/W: 6
CORE - XIV		

Pre-requisit	To empower students recognize and appreciate t that sustain biotechnology as an interdisciplinary and research.	• • • •						
Learning C								
C1								
C2	To know the concept and techniques of plant tissue cu	ulture.						
C3	To familiarize with the gene transfer techniques.							
C4	To know about DNA replication and repair.							
C5	To familiarize with gene regulation.							
Course ou		Programme						
	mpletion of the course the students will be able to:	Outcomes						
CO:								
1. Recogn	ize the fundamentals concepts of plant biotechnology	K1						
_	c engineering.							
	various steps in transcription, protein synthesis and	K2						
protein mo	·							
3. Elucidat	e gene cloning and evaluate different methods of gene	K3						
transfer.								
4. Analyze technology.	e the major concerns and applications of transgenic	K4						
	their competency on different types of plant tissue	K5						
culture.								
UNIT	CONTENTS							
ı	Biotechnology – definition, history and scope. Application of in various fields. Agriculture - Biofertilizers, Biopesticides. M (Penicillin) Recombinant vaccines, insulin and interferor Bioremediation and Biofuel. Industry – ethanol production production (Aspergillus niger) and Proteases production (Back)	edicine – Antibiotics ns. Environment – n (yeast), citric acid						
II	Plant tissue culture - introduction, scope and import totipotency, aseptic techniques in plant tissue culture media, types of media, sterilization, explant preparation Callus induction and micropropogation. Application of printing in agriculture, horticulture and forestry. Synthetic seed to	tance, concept of e. Composition of and inoculation. plant tissue culture						
III	Vectors; plasmid, bacteriophage, viral vectors, cosenzymes. Recombinant DNA technology, gene transfer <i>Agrobacterium</i> mediated gene transfer. Direct method Development of transgenic plants with reference to inse (Advantages) and cons (Disadvantages) of GM food.  Nature and function of genetic materials, Nucleic acid Chargaff's rule, DNA – structure. Types, denaturation	<ul> <li>indirect method,</li> <li>Biolistic method.</li> <li>ct resistance, Pros</li> <li>d - base paring -</li> </ul>						
IV	Replication of DNA in prokaryotes. RNA structure and							

	mechanism.						
V	Transcription – Enzymology – RNA polymerase – classes of RNA molecules – transcription in prokaryotes. Protein synthesis – Genetic code – characters – codons and anticodons. Gene regulation in Prokaryotes – <i>lac</i> operon and <i>trp</i> operon						
a part of ir	Extended Professional Component (is a part of internal component only, Not to be included in the External Examination    Questions related to the above topics, from various competitive examinations UPSC / TRB NET / UGC – CSIR / GATE / TNPSC /others to be solved						
	red from this	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill					
Recommended Texts							

#### Recommended Texts

- 1. Bhajwani, S and Razdan, 1984. Plant tissue culture. Theory and practice.
- 2. Verma P.S and Agarwal V.K. 2010. Molecular Biology. S Chand Publishers.
- 3. Ignacimuthu, S.J. 2003. Plant Biotechnology. Oxford & IBH Publishing, New Delhi.
- 4. Bhojwani, S.S and Razdan, M.K. 2004. Plant Tissue Culture, Read Elsevier India Pvt. Ltd.
- 5. Purohit, S.S. 2010. Plant tissue culture, Student edition, Jodhpur.
- 6. Bajaj, Y.P.S. 1987. Biotechnology in agriculture and forestry. Springer Verlag

#### **Reference Books**

- 1. Bernard R Glick and Jack J Pasternak. 2001. Molecular biotechnology-principles and applications of recombinant DNA, (2nd Edition), ASM Press, Washington, D.C.
- 2. Jogdand, SN. 1997. Gene biotechnology, Himalaya Publishing House, New Delhi.
- Ernst L. Winnaccker. 2002. From Genes to Clones-introduction to gene technology, VCR Pub., Weintein.
- James, D Watson et al., 1992. Recombinant DNA (2nd Edition), WH Freeman and Co.. New York.
- Maniatis and Sambrook. 2003. Molecular Cloning- A lab manual Vol.I, II & III, Coldspring Harbor Laboratory Press, New York.
- Old, RW and Primrose, SB. 2001. Principles of Gene Manipulation-an introduction to genetic engineering, Black Well Science Ltd., New York.
- 7. Halder, T and Gadgil, V.N.1981. Plant cell culture in crop improvement. Plenum, New York.
- Neuman, K.H., Barz, W and E. Reinhard. 1985. Primary and secondary metabolism of plant cell cultures - Springer - Verlag, Berlin.
- 9. Barz, W., Reinhard, E and Zenk, M.H. 1977. Plant tissue culture and its biotechnology application - Springer - Verlag, Berlin.
- 10. Hu, C.Y and P.J.Wang. 1984. Handbook of plant cell culture Vol.1. Mac million, New York.
- 11. Hammond, J.C. McGarvey and V. Yusibov. 2009. Plant Biotechnology, Springer Verlag. New York.

#### **Web Resources**

- 1. http://www.freebookcentre.net/Biology/BioTechnology-Books.html
- 2. <a href="https://books.google.co.in/books/about/Introduction\_to\_Plant\_Biotechnology.html?id=Rg\_QLISN8zT8C">https://books.google.co.in/books/about/Introduction\_to\_Plant\_Biotechnology.html?id=Rg\_QLISN8zT8C</a>
- 3. <a href="https://www.kobo.com/us/en/ebook/plant-biotechnology-1">https://www.kobo.com/us/en/ebook/plant-biotechnology-1</a>
- 4. https://www.kobo.com/us/en/ebook/plant-biotechnology-1
- 5. https://www.worldcat.org/title/molecular-biology/oclc/1062496183
- 6. http://www.freebookcentre.net/Biology/Molecular-Biology-Books.html
- 7. <a href="https://www.amazon.in/Molecular-Biology-Multicolour-Verma-Agarwal-ebook/dp/B06XKVVWT3">https://www.amazon.in/Molecular-Biology-Multicolour-Verma-Agarwal-ebook/dp/B06XKVVWT3</a>

## **Mapping with Programme Outcomes:**

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	1	3	2	1	2	2	1	3
CO 2	3	3	2	2	3	3	2	3	2	2
CO 3	3	2	3	3	2	1	2	1	3	3
CO 4	3	3	3	3	3	2	3	2	3	3
CO 5	3	3	2	3	2	3	3	3	2	3

SEMESTER - VI	23UBOTC63: PLANT PHYSIOLOGY AND PLANT	Credits: 4
PART – III	BIOCHEMISTRY	H/W: 6
CORE - XV		

CORE- Pre-red	quisite Basic knowledge on physiological proce	esses in plants and					
	primary and secondary plant metabolites a	-					
Learning Obj	ectives	•					
C1	To relate to water relation of plants with respect to	various physiological					
phenomenon.							
C2	To know the pathways of photosynthesis.						
C3	To familiarize with respiration and nitrogen metabolis	m.					
C4	To know about plant growth regulators.						
C5	To familiarize with plant biochemistry.						
Course outo		Programme					
	on of this course, the students will be able to: CO	Outcomes					
	water relation of plants with respect to various	K1					
	the process and significance of photosynthesis and	K2					
respiratio		ΝZ					
	properties of nutrients and their deficiency symptoms in	K3					
plants.		_					
4. Analyze	the biological role of plant growth regulators,	K4					
	rates, proteins, lipids, nucleic acids and enzymes.						
	the phenomenon of seed dormancy and germination in	K5					
	plants.						
UNII	JNIT CONTENTS						
	WATER RELATIONS:						
	Properties of water—imbibition, diffusion, osmosis and pla						
	sap, mechanism of water absorption – active and pa symplast pathway. Transpiration – types and factors a						
•	and significance. Opening and closing of stomata- mech						
	of transpiration.						
	PHOTOSYNTHESIS:						
	Radiant energy, Photosynthetic unit, photosynthetic	nigments and their					
	role, photo systems, path of carbon in photosynthesis - Light reaction,						
,,	alection transport exists in the ablamplant (7 Cabana). Double relation						
"	C3 cycle, C4 cycle, CAM pathway, Photorespiration						
	RESPIRATION						
	Aerobic, Glycolysis, Krebs Cycle, Electron Transpor	t System, oxidative					
III	phosphorylation, respiratory quotient, Anaerobic	•					
	Respiratory quotient.						
	NITROGEN METABOLISM						
	Biological nitrogen fixation, nitrogen cycle.						

	CDOWTH.			
IV	GROWTH:  Growth – plant growth regulators (auxins, gibberellins, cytokinins, ethylene and abscisic acid) - Practical applications - Photo morphogenesis – photoperiodism – vernalization – dormancy-phytochromes. Stress Physiology: Concepts of plant responses to stresses (water, salt, temperature).			
	PLANT BIOCHEMISTRY: Classification, properties and biological role of carbohydrates, proteins, lipids and nucleic acids. Enzyme – properties – classification – nomenclature of enzymes – mode of enzyme action – factors influencing enzyme action.  fessional Component (is a part of onent only, Not to be included in from various competitive examinations			
the External E question paper	xamination	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				
Reference Books	<ol> <li>Buchanan, B.B., Gruissem, W and Jones, R.L. 2000. Biochemistry and Molecular Biology of Plants, American Society of Plant Physiologists, Maryland, USA.</li> <li>Dennis, D.T., Turpin, D.H., Lefebvre, D.D and Layzell, D.B. (Eds) 1997. Plant Metabolism (second edition). Longman Essex, England.</li> <li>Galston, A.W. 1989. Life Processes in Plants. Scientific American Library, Springer-Verlag, New York, USA.</li> </ol>			

- Hooykaas, P.J.J., Hall M.A and Libbenga, K.R. (eds). 1999.
   Biochemistry and Molecular Biology of Plant Hormones, Elsevier, Amsterdam. The Netherlands.
- 5. Hopkins, W.G. 1995. Introduction to Plant Physiology. John Wiley & Sons, Inc., New York, USA.
- 6. Moore, T.C. 1989. Biochemistry and Physiology of Plant Hormones (second edition). Springer-Verlag, NewYork, USA.
- Nobel, P.S. 1999. Physiochemical and Environmental Plant Physiology (second edition), Academic Press, San Diego, USA.
- 8. Salisbury, F.B and Ross, C.W. 1992. Plant Physiology (4th edition). Wadsworth Publishing Co., California, USA.
- Singhal, G.S., Renger, G., Sopory, S.K., Irrgang, K.D and Govindjee.
   1999. Concepts in Photobiology: Photosynthesis and Photomorphogenesis. Narosa Publishing House, New Delhi.
- 10.Taiz, L and Zeiger, E. 1998. Plant Physiology (2nd edition). Sinauer Associates, Inc., Publishers, Massachusetts, USA.
- 11. Thomas, B and Vince-Prue, D. 1997. Photoperiodism in Plants (second edition). Academic Press, San Diego. USA.

## Web Resources

- 1. <a href="https://www.kobo.com/us/en/ebook/biochemistry-and-molecular-biology-of-plants">https://www.kobo.com/us/en/ebook/biochemistry-and-molecular-biology-of-plants</a>
- 2.https://www.amazon.in/Plant-Biochemistry-Hans-Walter-Heldt-ebook/dp/B004FV4RS6
- 3. https://www.kobo.com/us/en/ebook/plant-biochemistry
- 4. <a href="https://www.kobo.com/us/en/ebook/a-textbook-of-plant-physiology-1">https://www.kobo.com/us/en/ebook/a-textbook-of-plant-physiology-1</a>
- 5.<u>https://www.amazon.in/Advances-Plant-Physiology-P-Trivedi-</u>ebook/dp/B01JP5L0YA
- 6.https://www.crcpress.com/Plant-Physiology/Stewart-

Globig/p/book/9781926692692

7. https://www.amazon.com/Introduction-Plant-Physiology-William-

Hopkins-ebook/dp/B006R6I850

## **Mapping with Programme Outcomes:**

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	1	3	2	1	2	2	2	2
CO 2	3	3	2	2	3	3	2	3	2	3
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

SEMESTER - VI	23UBOTE64: PRACTICAL-VII:	Credits: 3
PART – III	COVERING – CORE XIII, XIV AND XV	H/W: 5
<b>ELECTIVE - VII</b>		

	<u></u>					
Pre-requisite	Practicals pertaining to above subjects is important to get knowledge on					
	various physiological functions of plants.					
Learning Obj	Learning Objectives					
C1	To study morphological and anatomical adaptations of plants of various habitats.					
C2	To demonstrate techniques of plant tissue culture.					
C3	To familiarize with the structure of DNA, RNA.					
C4	To carryout experiments related with plant physiology.					
C5	To perform biochemistry experiments.					
Course outcomes: Programme Outcomes						
On completion of this course, the students will be able						
to: CO						
1. Relate	Relate to the distribution and adaptions of plants					
pertaining to their habitat						
Demonstrate skills in green planning and callus culture.  K2						
3. Elucidate the basic principles involved in the plant K3						
physiology and biochemistry experiments.						
4. Appreciate the structure and functions of DNA and RNA. K4						
5. Estimate the biochemical components and determine the K5						
factors	s controlling photosynthesis and transpiration of					
plants						

#### **EXPERIMENTS**

## Plant Ecology and Phytogeography

1. Study of morphological and anatomical adaptations of locally available hydrophytes, xerophytes, mesophytes and halophytes and correlate to their particular habitats.

Hydrophytes: *Nymphaea, Hydrilla*Xerophytes: *Nerium, Casuarina*Mesophytes: *Tridax, Vernonia*Halophytes: *Avicennia, Rhizophora* 

Epiphytes: Vanda

- 2. Map of the phytogeographical regions of India.
- 3. Quadrate study and line transect.
- 4. Plan for a green building.
- **5.** Field trip to any one scrub jungle or wetland (Guindy National park/Nanmangalam Scrub jungle/Pallikaranai Marsh/Siruthavur Scrub/Vedanthangal Bird Sanctuary/Kelampakkam Marsh/Adyar Poonga).

## Plant Biotechnology - Demonstration

- 1. Sterilization techniques in plant tissue culture.
- 2. MS Media preparation.
- 3. Explant sterilization, Callus induction, Plantlet, hardening.

## **Molecular Biology – Photographs**

- 1. DNA Structure
- 2. tRNA
- 3. DNA Replication
- 4. DNA Repair
- 5. Genetic code

## Plant Physiology and Plant Biochemistry

- 1. Determination of water potential by plasmolytic method.
- 2. Effect of chemicals on membrane permeability.
- 3. Effect of environmental factors on rate of transpiration by gravimetric method.
- 4. Separation of plant pigments by paper chromatography.
- 5. Study the rate of photosynthesis under different light intensities by using Willmott's bubble counter.
- 6. Study of rate of photosynthesis under different wavelengths (red & blue) of light.
- 7. Comparison of rate of respiration of different respiratory substrates.
- 8. Measurement of pH of expressed cell sap and different soils using pH meter.
- 9. Enzyme activity catalase.

Biochemical test for carbohydrates, proteins and lipids

# **Demonstration – Experiments**

- 1. Study the rate of transpiration by using Ganong's photometer
- 2. Demonstration of stomatal movement.
- 3. Induction of roots in leaves by auxins.

	Questions related to the above topics, from					
internal component only, Not to be included in	various competitive examinations UPSC / TRB /					
the Cuteman Cummination acception as an	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, P.D. 2017. Ecology and Environment- Rastogi Publication, Meerut.
- Bhojwani, S.S and Razdan, M.K. 1996. Plant Tissue Culture: Theory and Practice. Elsevier Science Amsterdam. The Netherlands.
- Jackson, S.A., Kianian, S.F., Hossain, K.G and Walling, J.G. 2012. Practical laboratory exercises for plant molecular cytogenetics. In Plant Cytogenetics (pp. 323-333). Springer, New York.
- 4 Plummer, D. 1988. An introduction to Practical Biochemistry, Tata McGraw-Hill Publishing Company Ltd., New Delhi.
- 5 Palanivelu, P. 2004. Laboratory Manual for analytical biochemistry and separation techniques, School of Biotechnology, Madurai Kamaraj University, Madurai.
- 6. Jayaraman.J.1981. Laboratory Manual in Biochemistry. Whiley Eastern Limited, New Delhi.
- 7. Bendre, A.M. and Ashok Kumar, 2009. A text book of practical Botany. Vol. I & II. Rastogi Publication. Meerut. 9<sup>th</sup> Edition.

# **Reference Books**

- 1. Mick Crawley. 1996. Plant Ecology, 2nd Edition Wiley-Blackwell.
- Gamborg, O.L and G.C. Phillips (eds). 1995. Plant cell, tissue and organ culture. Springer Lab Manual.
- Glick, B.R and J.E. Thompson. 1993. Methods in Plant Molecular Biology and Biotechnology. CRC Press, Boca Raton, Florida.
- 4. Bala, M., Gupta, S., Gupta, N.K and Sangha, M.K. 2013. Practicals in plant physiology and biochemistry. Scientific Publishers (India).
- 5. Wilson, K and J. Walker (Eds). 1994. Principles and Techniques of Practical Biochemistry (4<sup>th</sup> Edition) Cambridge University Press, Cambridge.
- 6. Bendre, A.M and Ashok Kumar. 2009. A text book of practical Botany. Vol. I & II. Rastogi Publication. Meerut. 9<sup>th</sup> Edition.
- 7. Manju Bala, Sunita Gupta, Gupta, N.K. 2012. Practicals in Plant Physiology and Biochemistry. Scientific Publisher.

# Web resources

- https://www.amazon.com/Practical-plant-ecology-beginnerscommunities/dp/B00088FDQK
- 2. https://www.amazon.in/Practical-Biotechnology-Plant-Tissue-Culture/dp/8121932009
- 3. <a href="https://www.elsevier.com/books/molecular-biology-techniques/carson/978-0-12-815774-9">https://www.elsevier.com/books/molecular-biology-techniques/carson/978-0-12-815774-9</a>
- 4. <a href="https://www.amazon.in/Practical-Physiology-Biochemistry-Sunita-Sangha/dp/9386102633">https://www.amazon.in/Practical-Physiology-Biochemistry-Sunita-Sangha/dp/9386102633</a>
- 5. <a href="https://www.amazon.in/Practical-Biochemistry-Muriel-Wheldale-Onslow/dp/1107634318">https://www.amazon.in/Practical-Biochemistry-Muriel-Wheldale-Onslow/dp/1107634318</a>

**Mapping with Programme Outcomes:** 

	<u> </u>		g. a							
COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	1	3	2	1	2	2	3	1
CO 2	3	3	2	2	3	3	2	3	3	2
CO 3	2	2	3	3	1	2	1	2	2	3
CO 4	3	3	3	3	3	2	3	3	3	3
CO 5	3	3	2	3	2	3	3	3	3	2

SEMESTER - VI	23UBOTE65-1 : HORTICULTURE	Credits: 3
PART – III		H/W: 5
<b>ELECTIVE - VIII</b>		

Pre-requisite	Students shouldknow fundamental knowledge of applications.	on horticulture					
Learning Obj	ectives						
C1	To gain an understanding of the fundamentals of horticulture and techniques needed to grow and maintain plants.						
C2	To develop skills in students to work as gardeners, therapists, designers, growers and technical advisors in the food and non-food sectors of horticulture.						
C3	To know about hydroponic culture.						
C4	To develop the various horticultural crop protection.						
C5	To impart the knowledge on market preparation.						
On completion	omes: n of this course, the students will be able to:	Programme Outcomes					
1. Enumerate	e the concepts in horticulture and nursery management.	K1					
2. Demonstr making, des	2. Demonstrate a working knowledge on biology of soil, compost making, designing and planning of garden, pest, diseases and nutrient management practices.						
3. Appraise							
4. Analyze di	fferent methods of weed control in horticultural crops.	K4					
	5. Develop their competency on pre and post-harvest technology in K5 horticultural crops. K5						
UNIT	CONTENTS						
I	Importance and scope of horticulture. Classification of horticultural crops –fruits and vegetables. Essentials of nursery Management - Soil management: Garden soil, Physical and chemical properties of soil, Organic matter, Compost, Cultural practices; Water management: Water quality, Irrigation, Mulching. Nursery structures: Protected cultivation (greenhouses), environment controls.						
	Hydroponic culture-types of container. Use of manures						
II	Horticultural crop production. Principles of organic farming. Environmental factors influencing vegetable and fruit production.						
III	Horticultural crop protection; physical control - pruning. Chemical control- pesticides, fungicides. Plant propagation - cutting, layering, budding, grafting. Types of gardens: formal, informal, kitchen and Terrace. Indoor gardening-bottle garden. Floriculture, ornamental gardening.						
IV	A brief account of annual, biennials and perennials with reference to ornamental gardens. Green house, terrarium, water garden, rockery plants, bonsai techniques. Landscaping, principles and basic components.						

	V	Technology of horticultural crops - market preparation: harvesting and handling, packaging and transport, storage; chemical treatment. Economics of cultivation Crops: Cardamom, pepper, clove. Food processing - freezing, bottling and canning, drying and chemical preservation.					
o ir	f internal co	essionalComponent (is a part omponent only, Not to be External Examination	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved				
S	Skills acquired	I from this Course	(To be discussed during the Tutorial hour)  Knowledge, Problem Solving, Analytical				
			ability, Professional Competency, Professional Communication and Transferrable Skill				
	Recommended Texts						

## Recommended Texts

- 1. Hartmann, H.T and D.E. Kester. 1989. Plant propagation principles and practices. Half of India. New Delhi.
- 2. Bose, T.K and Mitra and Sadhu. 1991. Propagation of tropical and subtropical horticultural crops. Nava Prakash.
- 3. Singh, S.P. 1989. Mist propagation Metropolitan book Co., New Delhi.
- 4. Chadha, K.L. 1986. Ornamental horticulture in India ICAR, Krishi Bhavan, New Delhi.
- 5. Bose, T.K and Mukharjee, D. 1977. Gardening in India. Oxford & IBH Pub., Co., Calcutta.
- Gopalswamy Iyyangar. 1970. Complete gardening in India, Kalyan Printers, Bangalore.
- Rangaswami, G and Mahadevan, A. 1999. Diseases of Crop Plants in India (4th edition). Prentice Hall of India Pvt. Ltd., New Delhi

#### **Reference Books**

- 1. Arditti, A. 1977. Orchid biology, Gornell Univ., Press. Ithaca.
- 2. Bailey, S. 1971. Perpectual flowering carnation, Fabner and Fabner, London.
- 3. Laurie, A., Kiplingr, D.D and Nelson, K.S. 1968. Commercial flower forcing. Mc Graw-Hill Book, London.
- 4. Cumming, R.W. 1964. The chrysanthemum Book. D.Van., Nostrand Inc.
- Biswas, T.D. 1984. Rose growing Principles and Practices Assoc., Pub., Co., New Delhi.
- 6. Hartman, H.T and Kester, D.E. 1989. Plant propagation. Printice Hall Ltd., New Delhi.
- 7. Abraham, A and Vatsala, P. 1981. Introduction to Orchids. Trop. Bot. Garden, Trivandrum.
- 8. Bose, T.K and Yadav, L.P. 1989. Commercial flowers. Naya Prakash, Calcutta.
- 9. Mc Daniel, G.L. 1982. Ornamental horticulture. Reston Publ., London.
- 10. Helleyer, A. 1976. The Collingridge Encyclopedia of gardening Chartwell Book, Inc., New Jercy.

# **Web Resources**

- 1.https://www.kopykitab.com/Precision-Horticulture-by-Archarya-SK
- 2. https://www.ebooks.com/en-us/subjects/science-horticulture-ebooks/423/
- 3. http://www.agrimoon.com/horticulture-icar-ecourse-pdf-books/
- 4. https://www.worldcat.org/title/handbook-of-horticulture/oclc/688653648
- 5. https://cbseportal.com/ebook/vocational-books-horticulture
- 6. http://www.digitalbookindex.org/\_search/search010agriculhortigardena.asp

# **Mapping with Programme Outcomes:**

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	1	1	2	1	2	2	2	1
CO 2	3	3	2	1	1	3	1	3	1	3
CO 3	2	2	3	3	1	2	2	3	1	2
CO 4	3	3	2	2	3	2	3	1	3	2
CO 5	3	3	2	3	1	3	2	3	1	3

SEMESTER - VI	23UBOTE65-2 : COMPUTER APPLICATIONS IN	Credits: 3
PART – III	BOTANY	H/W: 5
<b>ELECTIVE - VIII</b>		

C1 To familiarize the student with the fundamentals concepts of bioinformatics.  C2 To equip students with computational skills for drug design.  C3 To learn about the bioinformatics database, data format and data retrieval from online sources.  C4 To develop interdisciplinary skills in using computers in botany learn about the biological database.  C5 Student is aware with the most recent technologies for sequence	ing				
concepts of bioinformatics.  C2 To equip students with computational skills for drug design.  C3 To learn about the bioinformatics database, data format and data retrieval from online sources.  C4 To develop interdisciplinary skills in using computers in botany learn about the biological database.	ing				
C2 To equip students with computational skills for drug design.  C3 To learn about the bioinformatics database, data format and data retrieval from online sources.  C4 To develop interdisciplinary skills in using computers in botany learn about the biological database.	ing				
design.  C3 To learn about the bioinformatics database, data format and data retrieval from online sources.  C4 To develop interdisciplinary skills in using computers in botany learn about the biological database.	ing				
C3 To learn about the bioinformatics database, data format and data retrieval from online sources.  C4 To develop interdisciplinary skills in using computers in botany learn about the biological database.	ing				
data retrieval from online sources.  C4 To develop interdisciplinary skills in using computers in botany learn about the biological database.	ing				
learn about the biological database.	ing				
and bioinformatics analysis and is able to apply them to structural and functional genomics of plants.	ırıe				
Course outcomes:					
On completion of this course, the students will be able to: CO  Programme Outcomes					
Recognize advanced resources for accessing scholarly  K1					
literature from the internet.					
2. Explain the concept of databases and use of different K2					
public domain for DNA and proteins sequence retrieval.					
3. Apply various software resources with advanced K3					
functions to carry out analysis of data procured through					
research.					
4. Decipher the effective utilization of bibliography management K4					
software while typing and downloading citations.  5. Determine how the knowledge gained can be used for K5 & K6					
5 5					
designing experiments and data interpretation.  UNIT  CONTENTS					
	+0				
Introduction to computers and Bioinformatics. Introduction to Computers – classification, computer generation, low, medium and high level languages, software and hardware, operating systems personal, mini, main frame and super computers, characteristics and application, computer memory and its types, data representation and storage. Microsoft excel, data entry, graphs, aggregate functions, formulas and functions, number systems, conversion devices, secondary storage media					
Biological Research on the web: Using search engines, find scientific articles. Fundamentals of networking, interintranet, search engines- yahoo, Google, etc. telnet, ftp.					
Computer fundamentals - programming languages	in				

III	higinformation role	of auparaamautara in hialagu Historiaal					
""		of supercomputers in biology. Historical pe of bioinformatics - Genomics,					
		Proteomics, Metabolomics, Molecular					
	•	er aided Drug Design (structure based and					
	ligand based approaches), Systems Biology and Functional Biology. Applications and Limitations of bioinformatics.						
		bases. Biological databases- NCBI, EMBL					
		eneration and Data Retrieval Generation of					
		quencing, Protein sequencing, Mass					
	spectrometry, Microarray), Sequence submission tools (Banklt,						
	Sequin, Webin); Sequence file format (flat file, FASTA, GCG,						
IV	EMBL, Clustal, Phylip, Swiss-Prot); Sequence annotation; Data						
14	retrieval systems (SRS, Entrez) DNA sequencing methods.						
	protein sequencing Phylogenetic analysis Similarity, identity and						
	homology, Alignment – local and global alignment, pairwise and						
	multiple sequence alignments, alignment algorithms. Methods						
	of Alignment (Dot matrix, Dynamic Programming, BLAST and						
	FASTA); Phylogenetic analysis: Construction of phylogenetic						
	tree, dendrograms, methods of construction of phylogenetic						
	trees.						
	Applications:						
V	Application of Ta	axonomic Software for preparation of					
	Dichotomous Key. P	Phylogenetic analysis.					
	Make line drawing	of Plants for description. Usage of plant					
	identification apps of	on android phones. Computer application in					
		xcel and SPSS.Computer Aided Designing					
	(CAD) for outdoor and indoor Land scaping. Exposure to CAD						
	(Computer Aided Designing).						
	onal Component (is a	Questions related to the above topics, from					
	ponent only, Not to be	various competitive examinations UPSC /					
included in the External Examination question paper)		TRB / NET / UGC - CSIR / GATE / TNPSC /					
- <del>γασσαστι μαμοι /</del>		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. P.K. Gupta. Biotechnology and Henomics. 2016-2017. Rastogi Publications, 7th Reprint (1st Edition.
- 2. Ghosh, Z., Mallick, B. 2008. Bioinformatics Principles and Applications, 1st edition. New Delhi, Delhi: Oxford University Press.
- 3. Baxevanis, A.D. and Ouellette, B.F., John.2005. Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins, 3rd edition. New Jersey, U.S.: Wiley & Sons, Inc.

- 4. Roy, D. 2009. Bioinformatics, 1st edition. New Delhi, Delhi: Narosa Publishing House.
- Andreas, D., Baxevanis, B.F., Francis, Ouellette. 2004. Bioinformatics: A practical guide to the analysis of genes and proteins, 3rd edition. New Jersey, U.S.: John Wiley and Sons.
- Pevsner J. 2009. Bioinformatics and Functional Genomics, 2nd edition. New Jersey, U.S.: Wiley Blackwell.
- 7. Xiong J. 2006. Essential Bioinformatics, 1st edition. Cambridge, U.K.: Cambridge University Press.

# **Reference Books**

- Gibas, C and Jambeck, P. 1999. Developing Bioinformatics Skills. O'Reilly Shroff Publishers and Distributors Pvt, Ltd., New York, US.
- 2. David W. Mount. 2004. Bioinformatics Sequence and Genome Analysis. 2nd Edition, Cold Spring Harbor Laboratory Press, New York, US.
- 3. Harshitha, D. 2006. Techniques of Teaching Computer Science, International Book Distributor, Dehradun.
- 4. Chwan-Hwa (John) Wu, J. David Irwin. 2016. Computer networks and cyber security. CRC Press.
- Rui Jiang, Xuegong Zhang and Michael Q. Zhang. 2013. Basics of Bioinformatics. Springer-Verlag Berlin Heidelberg.
- 6. Ron Wehrens and Reza Salek. 2019. Metabolomics: Practical Guide to Design and Analysis. Chapman and Hall/CRC; 1st edition.
- 7. Simon, R. Miller and S.A. Garry. 1998. Internet for the Molecular Biologists. Volume III 2nd Edn. Horizontal Scientific Press, Norwich, UK.

# **Web Resources**

- 1. http://www.agrimoon.com/introduction-to-computer-applications-pdf-book/
- 2. <a href="https://www.ebooks.com/en-us/subjects/computers/">https://www.ebooks.com/en-us/subjects/computers/</a>
- https://it.careers360.com/download/ebooks
- 4. <a href="http://www.aun.edu.eg/molecular\_biology/Procedure%20Bioinformatics22.23-4-2015/Xiong%20-%20Essential%20Bioinformatics%20send%20by%20Amira.pdf">http://www.aun.edu.eg/molecular\_biology/Procedure%20Bioinformatics22.23-4-2015/Xiong%20-%20Essential%20Bioinformatics%20send%20by%20Amira.pdf</a>
- 5. <a href="http://www.freebookcentre.net/Biology/BioInformatics-Books.html">http://www.freebookcentre.net/Biology/BioInformatics-Books.html</a>
- 6. <a href="https://courses.cs.ut.ee/MTAT.03.242/2017\_fall/uploads/Main/Basics\_of\_Bioinformatics.pdf">https://courses.cs.ut.ee/MTAT.03.242/2017\_fall/uploads/Main/Basics\_of\_Bioinformatics.pdf</a>

**Mapping with Programme Outcomes:** 

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3	1	3	3		
CO 2	3	3	3	2	1	3	3	2		
CO 3	3	3	3	1	2	1	3	2		
CO 4	3	3	3	1	2	1	3	2		
CO 5	3	3	3	1	2	1	3	2		

SEMESTER - VI PART - III ELECTIVE - VIII	23UBOTE65-2 : CULTIVATION OF ALGAE	CREDITS: 3 H/W: 5
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Pre-requisite Students should know fundamental knowledge on algae and its biotechnological applications.								
Learning Objectives								
C1 C1	o impart sufficient information about the culture and cultivation of algae							
	der laboratory andoutdoor conditions							
C2	To study the media composition for algae cultivation	study the media composition for algae cultivation and high value products						
	and its applications.							
C3	To know about the important seaweeds and its cu	Itivation practices.						
C4	To study the SLF production and applications	in agriculture crops.						
C5	To understand about the Environment Imp	pact Assessment of algal						
	cultivation.							
Course outco		Programme Outcomes						
•	of this course, the students will be able to:							
CO								
	in-depth knowledge on culture and mass	K1						
	algae and its differentmethods.	160						
	n and recommendation of the commercial	K2						
potential of al	<u> </u>	V2						
	d the applied facet of algology and acquire a	K3						
•	complete knowledge about the cultivation methods in							
algae.  4. Describe the preparation of seaweed liquid fertilizers and their  K4								
	agricultureand horticulture.	K.I						
	the information about algal applications in	K5 & K6						
	stries and agriculture fields in the current							
scenario.	· ·							
UNIT	CONTENTS							
	Morphology, life history and mass culture	•						
I	-	Spirulina, Chlorella, Dunaliella and Botryococcus.						
	High value products: Single Cell Protein (SCP), phycocyanin, β-							
II	carotene, astaxanthin -biofuel, media composition - scale up - lab to							
	land - raceway ponds and photobioreactor.							
	Marine macroalgae: Morphology, life history and mass cultivation of							
III	Gracilaria, Kappaphycus, Sargassum and Ulva							
157	Polysaccharides: agar, carrageen, alginate							
IV	seaweed as food, feedand Seaweed Liquid Fer							
v	Role of seaweeds in aquaculture: Environmen	t impact Assessment of algal						
	cultivation. ssionalComponent (is a Questions related to the	a above tonics from various						
		e above topics, from various						
part of internal component only, Not to competitive examinations UPSC / TRB / NET / UGC								

be included	in the	External	- CSIR / GATE / TNPSC /others to be solved (To be				
Examination	ation		discussed during the Tutorial hour)				
question paper)			,				
Skills acquired fro	m this cour	se	Knowledge, Problem Solving, Analytical ability, Professional				
			Competency, Professional Communication and Transferrable Skill				
Recommended	1. Kumar	H.D. and Si	ngh, H.N. 1976. A Text Book of Algae Affiliated East				
Texts	West F	ress Pvt. Ltd	d., New Delhi, Madras.				
			D. Introductory Phycology, Affiliated East West ew Delhi, Madras, Hyderabad, Bangalore.				
		y, B.P. 1993	. A Text book of Botany-Algae S. Chand & Co., (P) Ltd.,				
	4. Sharm	a, O.P. 1990	). Text Book of Algae Tata McGraw Hill Publishing Co.,				
	5. Vashis	<ul><li>Ltd., New Delhi.</li><li>5. Vashista, B.R. 1988. Botany for degree students-Algae. S. Chand &amp; Co., (P) Ltd., New Delhi</li></ul>					
Reference Books	Bilgrami, K.S., and L.C. Saha. 1996. A Text Book of Algae, CBS     Publishers & Distributors (P)Ltd., New Delhi.						
		lan, 498 pp.	d Chapman, D.J., 1973. The Algae. 2 <sup>nd</sup> Ed. ELBS &				
	3. Fritsch	F.E. 1935.	The Structure and Reproduction of Algae 1945.				
		idge Univers	sity Press, Cambridge, U.K. Vol. I-791 pp., Vol. II-939				
	pp., 4. Round, F.E. 1973. Biology of the Algae. 2 <sup>nd</sup> Ed. Edward Arnold, London. 278 pp.,						
	5. Sharma, O.P. 1990. Text Book of Algae. Tata McGraw Hill Publishing Co., Ltd., New Delhi, 396						
Web			org/academy/videos/conference-				
Resources			y-culture-strategies-microalgae-continuous-				
			stem-biofuel-production				
	•	. •	c.com/article/10.1007/s10811-013-9983-9				
		•	ov/docs/legosti/old/2360.pdf ovo/AppData/Local/Temp/alba2018.pdf				
			ovo/AppData/Local/Temp/albazoTo.pdi ovo/AppData/Local/Temp/Seaweed_aquaculture_Culti				
		technologie:	• • • • • • • • • • • • • • • • • • • •				
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**Mapping with Programme Outcomes:** 

mapping with regianine catesines.										
COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	1	3	2	1	2	2	2	1
CO 2	3	2	1	2	1	3	2	3	1	3
CO 3	2	1	1	3	2	1	2	3	2	1
CO 4	3	3	3	3	1	2	1	3	1	2
CO 5	3	3	2	2	1	1	3	3	1	1

SEMESTER - VI	23UBOTF66: PROFESSIONAL COMPETENCY	Credits: 2
PART – IV	SKILL: BOTANY FOR COMPETITIVE	H/W: 2
	EXAMINATIONS	

Pre-requisite	To develop the students for preparing various c	ompetitive examination.					
Learning Objecti	ves						
C1	To develop the student for competitive examination	ation.					
C2	To select the important topics as far as possib examination point of view. It gives a combotany.						
C3	To understand not only the basics of bota broader perspective to prepare for the competi	tive examinations.					
C4	The essays give a detailed account of each a students preparing for IAS, IFS and state civil states.	services.					
C5	General understanding of plants around us, t and biochemical processes that occur w importance to human life.						
Course outcom	es:	Programme Outcomes					
On completion of	f this course, the students will be able to: CO						
taxonomic position	ifferent groups of plants and evaluate their	K1, K2 & K5					
2.List down Pteridophytes an Classify the type Tamil Nadu	the general characters of Bryophytes, ad Gymnosperms es of fossils and recognize the fossil beds of ce the origin of different plant groups using	K1,K3 & K5					
3.Appreciates the modifications of particular the majimportance.	e morphology of plant and analyse different plant organs. or Herbaria of the world and recognize the	K3 & K5					
Evaluate the sigr Justify the cause	rokaryotic and Eukaryotic cell.  ificance of cell division.  for the sex linked inheritance.  erent cell organelles with their functions.	K2, K3 & K5					
Identify the cause Design eco frien	5. Define and appreciates biodiversity.  Identify the cause and solve environmental related issues .  Design eco friendly approaches to protect earth and generate new conservation strategies.  K1, K5  & K6						

	GENERAL STU	DIES FOR COMPETITIVE EXAMINATIONS (2 hours)					
	Di circi Occasi	,					
	Physical Geograph Indian and World G						
	Indian and World H	<b>.</b>					
	International Organ						
	Everyday Science	izations					
	Awards and Honors						
	Indian Economy						
	Indian Polity						
UNIT		CONTENTS					
	PLANT WORLD:						
I		es . Five kingdom classification. Outline of Kingdom					
	Lichens.	and Economic importance of Algae, Fungi and					
	GENERAL CHARACTER	S OF PLANT GROUPS:					
II		nd Economic importance of Bryophytes,					
		nosperms. Palaeobotany- Types of fossils,					
	Geological time scale ,Fos						
		vstem. Modifications (Pneumatophore, Stilt root,					
III	1	Phylloclade, Pitcher and Phyllode) Parts of a					
		ne) Parthenocarpy- Pollination - types, Seed					
		Germination types. Taxonomy –definition. Types					
		nic hierarchy, ICN, Binomial nomenclature and					
	BSI. Herbarium and Major  CYTOLOGY AND GENET						
IV		caryotic – Cell organelles with functions . DNA					
		) -Cell division and its significance -Mitosis and					
	Meiosis (outline) Mentalis	m – Monohybrid and Dihybrid cross, Sex linked					
	inheritance						
V	ECOLOGY AND BIODIVE						
		nd biotic components. Energy flow in an					
	ecosystem, Afforestation, Deforestation- Chipko movement —Fores Conservation Act- Pollution types and effects- Eutrophication, Globa						
		warming, Ozone depletion, Climate change.					
	Biodiversity and types- Hot spots, Mega diversity countries, Conservation						
		ethods. Endangered plants and Red data Book.					
		versity Management Policies - IUCN, UNEP,					
Extended Pro	WWF, ICSU, WCMC. ofessional Component (is a	Questions related to the above topics, from					
	al component only, Not to be	various competitive examinations UPSC / TRB /					
included in the	e External Examination	NET / UGC – CSIR / GATE / TNPSC / others to					
question pape	er)	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	for Competitive Service, Civil Se	D, Varalakshmi Narayana, P, Suresh. 2021. Botany Examinations: (Useful for UPSC-Indian Forest ervices, PCS, ASRB CSIR - NET, ICAR-NET and Exams.) Astral Cracker.
	2. Mitra, S. 201 Publishers.	6. Botany for competitive examinations, Academi
	3. Mohd Akil S House.	hahezad. 2018. M.C.Qs. in Botany, Library Book
	Publishing Hous 5. Sharma, O.P.	. 2017. Plant Taxonomy. (Il Edition).The McGraw
	Hill Companies	Taxonomy: Nair Datta
	6. Thieman. 2014 Education India.	4. Introduction to Biotechnology 3rd Edition. Pearson
Reference Books	Biology, Sau 2. Gardner, E Principles of York. 3. Salisbury, Wassworth F	s and De Robertis. 1990. Cell and Molecular Inders College, Philadelphia, USA.  J., Simmons, M.J and Snustad, D. 1991.  Genetics, John Wiley Sons Inc., 8 <sup>th</sup> Edn., New  F. B.C.W. Ross.1991. Plant Physiology.  Pub. Co. Belmont.
	Publication,	D. 2017. Ecology and Environment- Rastogi Meerut. R. 2009. Economic Botany. 1st ed. Sarup Book
	Publishers P 6. Power, C.B : <u>Himalaya P</u>	vt Ltd. New Delhi. and Daginawa, H.F. 2010. General Microbiology Publishing House Pvt Ltd,
	edition). Tata 8. Singh, V., F	G. 2006. Disease of crop plants in India (4th a Mc Graw Hill New Delhi. Pande, P.C and Jain, D.K. 2021. A Text Book
	<ol><li>Bhojwani, S Embryology</li></ol>	Rastogi Publications, MeerutS. Bhatnagar, S.P and Dantu, P.K. 2015. The of Angiosperms (6th revised and enlarged as Publishing House, New Delhi.
Web resources	1. https://www.a	amazon.in/BOTANY-COMPETITIVE- ONS-SUNIT-MITRA/dp/9383420898 amazon.in/Botany-Competitive-Examinations-

<u>UPS(</u>	C-Indian-0	Com	petive/d	p/B08\v	<b>WB</b>	64BC	<u>)</u>
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- 3. <a href="https://www.ssclatestnews.com/botany-book-pdf-free-download-for-competitive-exams/">https://www.ssclatestnews.com/botany-book-pdf-free-download-for-competitive-exams/</a>
- 4. https://sscstudy.com/botany-for-competitive-exams-pdf/
- 5. https://www.amazon.in/Botany-Entrance-Examination-Anupam-Rajak-ebook/dp/B089S1GLMP

# **Mapping with Programme Outcomes:**

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	1	3	2	1	1	2	3	1
CO 2	3	2	1	2	3	3	2	3	2	1
CO 3	2	2	3	3	1	2	1	3	2	3
CO 4	3	3	3	3	3	2	3	3	3	3
CO 5	3	3	2	3	2	1	3	3	3	2

SEMESTER -VI PART - V	23UBOTX67: EXTENSION ACTIVITY	CREDITS: 1 HOURS:

# (Refer to the Regulations)

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