MOTHER TERESA WOMEN'S UNIVERSITY
KODAIKANAL-624 101

DEPARTMENT OF BIOTECHNOLOGY

M.Sc BOTANY
Curriculum Framework, Syllabus, and Regulations
(Based onTANSCHE Syllabus under choice Based Credit System–CBCS)

(For the candidates to be admitted from the Academic Year 2023-2024)

M.Sc. BOTANY

1. About the Programme:

M.Sc. Botany is a 2 year post graduate programme divided into 4 semesters that deals with all aspects of plant biology, their origin and their impact on the environment. The programme incorporates core courses, electives and practicals. The programme syllabus includes all the subjects associated with plants, microbes,plant cells, genetics and other related topics. Students can get both practical, outdoor tours and theoretical hands on the subject. There are a number of jobs and career options available after this programme in both the public and private sectors, the opportunities await in areas like academics, Botanical garden, national park, agriculture and forest department, tissue culture labs, food industries, oil industries, seed companies, agricultural and biotechnology firms etc.

2.Programme Educational Objectives(PEOs)

1. Build up the ability for the application of acquired knowledge in different field soflife there by make our country self-sufficient
2. Make the students skilled in practical experiments, laboratory equipments and to interpret the data correctly
3. Widen the ability for the application of obtained knowledge in various field soflife to make our country self-contained
4. Apply moral principles to biological science research, studies, and adopt recent pedagogical trends in education, including e-learning
5. Mold responsible citizen for nation-building and transforming the country towards future

3. Eligibility:

- A candidate who has passed Graduate in Botany and other Relevant Subject
- Candidate should have secured atleast 55% in the above subject from any recognized university.

4. GeneralGuidelinesforPGProgramme

i. **Duration:** The programme shall extend through a period of 4 consecutive semesters and the duration of a semester shall normally be 90 days or 450 hours. Examinations shall be conducted at the end of each semester for the respective subjects.

ii. **Mediumof Instruction:** English

iii. **Evaluation:** Evaluation of the candidates shall be through Internal Assessment and External Examination.

- **ProjectReport**

A student should select a topic for the Project Work at the end of the third semester

itself and submit the Project Report at the end of the fourth semester. TheProject Report shall not exceed 75 typed pagesin Times New Roman font with 1.5linespace.

- **ProjectEvaluation**

There is a VivaVoce Examination for ProjectWork.The Guide and an External Examiner shall evaluate and conduct the Viva Voce Examination.The Project Work carries 100 marks(Internal:25 Marks; External(Viva):75 Marks).

Methods of Evaluation Theory		
Internal Evaluation	Continuous Internal Assessment Test	25 Marks
	Assignments	
	Seminars	
	Attendance and Class Participation	
External Evaluation	End Semester Examination	75 Marks
	Total	**100 Marks**
	Methods of Evaluation Practicals	
	Continuous Internal Assessment Test	40 Marks
	Attendance and Class Participation	
External Evaluation	End Semester Examination	60 Marks
	Record	
	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 offbeat situations, Discussion, Debating or Presentations	

- **Question paper pattern for External examination for Core and Elective papers:**

WRITTEN EXAMINATION QUESTION PAPER PATTERN

Theory Paper (Bloom's Taxonomy based)

Intended Learning Skills	**Maximum 75 Marks** **Passing Minimum: 50%** **Duration: Three Hours**
Memory Recall/Example/ Counter Example / Knowledge about the Concepts/Understanding	**Part–A (10x2=20Marks)** Answer ALL questions **Each Question carries 2 marks**
	Two questions from each Unit
	Question 1 toQuestion10
Descriptions/Application (problems)	**Part–B (5x5=25Marks) Answer ALL questions** **Each question carries 5 Marks**
	Either - or Type Both parts of each question from the same Unit
	Question 11 (a) or 11(b) to **Question 15(a) or 15(b)**
Analysis/Synthesis / Evaluation	**Part-C (3x 10 = 30 Marks)** **Answer any THREE questions** **Each question carries 10 Marks**
	There shall be FIVE questions covering all the five units
	Question 16 to Question 20

***Minimum credits required to pass:91**

5.Conversion of Marks to Grade Points and Letter Grade(Performanceina Course/Paper)

Rangeof Marks	Grade Points	Letter Grade	Description
90 – 100	9.0 – 10.0	O	Outstanding

80-89	8.0 – 8.9	D+	Excellent
75-79	7.5 – 7.9	D	Distinction
70-74	7.0 – 7.4	A+	VeryGood
60-69	6.0 – 6.9	A	Good
50-59	5.0 – 5.9	B	Average
00-49	0.0	U	Re-appear
ABSENT	0.0	AAA	ABSENT

6.Attendance

Students must have earned 75% of attendance in each course for appearing for theexamination. Students with 71% to 74% of attendance must apply for condonation in thePrescribedFormwithprescribedfee.Studentswith65%to70%ofattendancemustapply for condonation in the Prescribed Form with the prescribed fee along with theMedical Certificate. Students with attendance less than 65% are not eligible to appear forthe examination and they shall re-do the course with the prior permission of the Head oftheDepartment, Principal and theRegistrar oftheUniversity.

7. MaternityLeave

Thestudentwhoavailsmaternityleavemaybeconsideredtoappearfortheexaminationwiththe approvalofStaffi/c,HeadoftheDepartment,ControllerofExaminationandtheRegistrar.

8. AnyOtherInformation

Inadditiontotheabovementionedregulations,anyothercommonregulationspertainingto thePGProgrammes arealso applicableforthis Programme.

9.PROGRAMMEOUTCOMES(POs)

Oncompletionof M.Sc.,BotanyProgramme,thestudentswillbeableto

PO1	equip themselves with subject domain knowledge and technical skillspertainingto plants in aholisticmanner
PO2	applythe knowledgeofbiologyto makescientificqueriesand enhance the intellectual capacity
PO3	renderbeneficialcontribution tothesocietythroughtheir knowledgeacquired
PO4	buildupthescientificanalysis,interpretationofdataandproblemsolvingsk ills duringexperimentations and researchprojects.
PO5	inculcatethescientifictemperamentandexecute it

PO6	applycontextualknowledge andmoderntoolsof researchfor solvingproblems
PO7	enhancetheircapacitytoobtain employmentandhigherstudies inscience
PO8	generateprofessional&ethicalattitude,environmentalconsciousness, leadershipquality,teamworkmanship withenormousresponsibilityi norder to servethe societyefficiently.

10.PROGRAMMESPECIFICOUTCOMES(PSOs)

Oncompletionof M.Sc.,BotanyProgramme,thestudentswillbeableto

PSO1	acquireknowledgeaboutvariousplantgroupsfrom primitive tohighlyevolve
PSO2	implementtheconceptofscienceand technology withtraditionalandmoderntechniques for solvingthe complexproblemsin plant biology
PSO3	developskillsin laboratorypractices aswellasfieldbasedstudies
PSO4	makeexpertsincultivation,conservationandsustainable utilizationof biodiversity
PSO5	know about the advanced techniques in plant sciences like tissue culture,Phytoremediation, plant disease management, formulation ofnew herbaldrugs,nurserymaintainance,mushroomcultivation,biofertilizerprodu ction,fruit preservationandhorticultural practices

MOTHER TERESA WOMEN'S UNIVERSITY,KODAIKANAL
B.Sc.BOTANY SYLLABUS
2023-2024

SEMESTER-I								
Course Code	**Course Title**	**Hours**			**Credits**	**CIA**	**ESE**	**Total**
		L	**T**	**P**				
P23BOT11	Plant Diversity – I: Algae, Fungi, Lichens and Bryophytes	4	3		5	25	75	100
P23BOT12	Plant Diversity –II: Pteridophytes, Gymnosperms and Paleobotany	4	3		5	25	75	100
P23BOP11	Laboratory Course-I Covering Theory Papers, I and II			6	4	25	75	100
P23BOE1A/ P23BOE1B/ P23BOE1C/ P23BOE1D	Elective-I: A. Microbiology, Immunology and Plant Pathology/ B. Conservation of Natural Resources and Policies/ C. Mushroom Cultivation/ D. Phytopharmacognosy	3	2		3	25	75	100
P23WSG11	Generic Course – I: Women Empowerment	3	2		3	25	75	100
	Total	**30**			**20**	**-**	**-**	**500**
SEMESTER-II								
P23BOT23	Plant Taxonomy of Angiosperms and Economic Botany	3	3		5	25	75	100
P23BOT24	Plant Anatomy and Embryology of Angiosperms	3	3		5	25	75	100
P23BOP22	Laboratory Course-II Covering Papers, IV, V And VI			6	4	25	75	100
P23BOE2A/ P23BOE2B/ P23BOE2C/ P23BOE2D	A. Medicinal Botany/ B.Phytochemistry/ C.Research Methodology, Computer Applications & Bioinformatics/ D.Biopesticide Technology	2	2		3	25	75	100
P23CSG22	Generic Course-2: Cyber Security	2	2		2	25	75	100

P23BOS21	Skill Enhancement Course-1: NME - Nursery and Gardening	2	2		3	25	75	100
	Total	**30**			**22**	**-**	**-**	**600**

P23BOT11		**PLANT DIVERSITY – I: ALGAE, FUNGI, LICHENS AND BRYOPHYTES**					
PaperNumber		**COREI**					
Category	Core	**Year**	I	**Credits**	5	**Course Code**	P23BOCT11
		Semester	I				
InstructionalHours perweek		**Lecture**	**Tutorial**	**LabPractice**	**Total**		
		4	3	--	7		
Pre-requisite		Students should be familiar with the basics of algae,fungi,lichens and Bryophytes.					
Learning Objectives		1. To learn about the classification, distinguishing traits, geographic distribution, and reproductive cycle of algae, fungi, lichens, and bryophytes. 2. To gain knowledge about the ecological and economic importance of algae, fungi, lichens and bryophytes. 3. To spark interest in the evolutionary roots of plant development. 4. To study the biodiversity by describing and explaining the morphology and reproductive processes of algae, fungi, bryophytes and microorganisms. 5. Toexposethebeneficialandharmfulviewpoint.					

UNIT	CONTENTS
I	**ALGAE:** General account of algology, Contributions of Indian Phycologist (T.V.Desikachary, V.Krishnamurthy and V.S. Sundaralingam), Classification of algae by F.E. Fritsch (1935-45) & Silva (1982). Salient features of major classes: Cyanophyceae, Chlorophyceae, Xanthophyceae, Chrysophyceae, Cryptophyceae, Dinophyceae, Chloromonadineae, Euglenophyceae, Charophyceae, Bacillariophyceae, Phaeophyceae and Rhodophyceae. Range of thallus organization, algae of diverse habitats, reproduction (vegetative, asexual and sexual) and life cycles. Phylogeny and inter-relationships of algae, origin and evolution of sex in algae. Structure, reproduction and life histories of the following genera: *Oscillatoria*, *Scytonema*, *Ulva*, *Codium*, *Diatoms*, *Dictyota* and *Gelidium.*
II	**FUNGI:** General Characteristics, occurrence and distribution. Mode of nutrition in fungi. Contributions of Indian Mycologists (C.V.Subramanian), Classification of Fungi by Alexopoulos and Mims (1979) & Recent trends in the classification of fungi - Phylogeny and inter-relationships of major groups of fungi. General characters of major classes: Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina and Deuteromycotina. Heterothallism in fungi, sexuality in fungi, Para sexuality, sex hormones in fungi. Structure, reproduction and life histories of the following genera: *Plasmodiophora*,

	Phytophthora, Rhizopus, Taphrina, Polyporus and *Colletotrichum.*
III	**LICHENS:** Introduction and Classification (Hale, 1969). Occurrence and inter-relationship of phycobionts and mycobionts, structure and reproduction in Ascolichens, Basiodiolichens and Deuterolichens.
IV	**BRYOPHYTES:** General characters and Classification of Bryophytes by Watson (1971). Distribution, Structural variations and evolution of gametophytes and sporophytes in Bryopsida, Anthoceropsida and Mosses. General characters of major groups - Marchantiales, Jungermaniales, Anthocerotales, Sphagnales, Funariales and Polytrichales. Reproduction - Vegetative and sexual, spore dispersal mechanisms in bryophytes, spore germination patterns in bryophytes. Structure, reproduction and life histories of the following genera: *Targionia, Lunularia, Porella* and *Polytrichum.*
V	**ECONOMIC IMPORTANCE:** Algae - Economic importance in Food and feed - Single cell protein, Industrial products (Agar-Agar, Carrageenan, Alginic acid, Iodine, biofertilizers, Vitamins and biofuel), Medicinal value and Diatomaceous earth. Fungi – Economic importance in food, industries and medicine. Culturing and cultivation of mushrooms *Pleurotus.* Lichen –economic importance and as indicator pollution. Bryophytes – Ecological and economic importance – industry, horticulture and medicine.

Extended Professional Component (is a part of internal component only, Not to be included in the External Examinationquestion 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 thiscourse	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill

Recommended texts:

1. Kumar, H.D.1999. Introductory Phycology. Affiliated East-WestPress,Delhi.
2. Barsanti, L. and Guadtieri, P. 2014. Algae: Anatomy, Biochemistry and Biotechnology, 2nd Edition, CRC Press, ISBN: 1439867321.
3. Sharma, O.P. 2011. Fungi and Allied Microorganisms, Mc Graw Hill, ISBN:9780070700383, 0070700389
4. Kevin K. 2018. Fungi biology and Application, 3rd Edition, Wiley Blackwell.
5. Pandey, P.B. 2014. College Botany-1: Including Algae, Fungi, Lichens, Bacteria, Viruses, Plant Pathology, Industrial Microbiology and Bryophyta. Chand Publishing, New Delhi.
6. Singh, Pandey and Jain. 2020. A text book of Botany, 5th Edition, Rastogi Publication, Meerut.
7. Sharma, O.P. 2014. Bryophyta, Mcgraw Hill, ISBN: 9781259062872, 1259062872

Reference Books:

1. Sundaralingam, V. 1991. Marine algae. Bishen Singh and Mahendra Pal Singh Publishers, Dehradun.

2. Edwardlee,R. 2018. Phycology, 5th Ed., CambridgeUniversityPress, London.
3. Nash, T.H. 2008. Lichen Biology, Cambridge University press.
4. Johri, R.M., Lata, S. and Tyagi, K. 2012. A Textbook of Bryophyta. Dominant Publishers & Distributors Pvt., Ltd., New Delhi. ISBN: 9789384207335.
5. Alexopoulos, C.J. and Mims, M. 2007. Introductory Mycology. 4th Edition, Wiley Publishers,ISBN: 9780471522294

Web resources:

1. https://www.britannica.com/science/algae
2. https://en.wikipedia.org/wiki/Bryophyte
3. https://www.britannica.com/plant/bryophyte/Ecology-and-habits
4. https://www.livescience.com/53618-fungus.html.
5. http://www.uobabylon.edu.iq/eprints/paper_11_20160_754.pdf
6. https://www.youtube.com/watch?v=vcYPI6y-Udo
7. https://www.youtube.com/watch?v=XQ_ZY57MY64
8. http://www-plb.ucdavis.edu/courses/bis/1c/text/Chapter22nf.pdf

MappingwithProgrammeOutcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	3	2	3	2	1	2	2	2	2
CO2	3	3	2	2	3	3	2	3	2	3
CO3	2	2	3	3	1	2	1	3	1	3
CO4	3	3	3	3	3	2	3	3	3	3
CO5	3	3	2	3	2	3	3	3	3	3

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

P23BOT12		**PLANT DIVERSITY – II: PTERIDOPHYTES, GYMNOSPERMS AND PALEOBOTANY**					
PaperNumber		**COREII**					
Category	Core	**Year**	I	**Credits**	5	**Course Code**	P23BOCT12
		Semester	I				
InstructionalHours perweek		**Lecture**	**Tutorial**	**LabPractice**	**Total**		
		4	3	--	7		
Pre-requisite		Studentsshouldknowaboutthefundamentsof Pteridophytes,Gymnospermsand fossil records.					
Learning Objectives		1. Toinvestigatetheclassification,distinctive traits,distributionandreproductionandlifehistoryofthevariousclassesand majortypes ofPteridophytesand Gymnosperms. 2. To identify and characterize diversity of lower vascular plants in order to comprehend the dynamics of diversity to realize the importance of diversity. 3. To research the classification, phylogeny and economic importance of Pteridophytes and Gymnosperms. 4. Tostudyandunderstandthephylogenyand PaleontologyofPteridophytesand Gymnosperms. 5. To learn about the conceptoffossilsandprocessoffossilization;distinctive characteristics offossilrecords of Pteridophytes and Gymnosperms.					

UNIT	CONTENTS
I	**PTERIDOPHYTES:** General characteristics and classification (Reimer, 1954). Range of structure, reproduction and evolution of the gametophytes, Gametophyte types – sex organs. Apogamy and Apospory. Life cycles. Stellar evolution. Heterospory and seed habit, Telome theory, morphogenesis, Economic importance of Pteridophytes.
II	**PTERIDOPHYTES:** Structure, anatomy, reproduction and life histories of the following genera: *Isoetes, Equisetum Angiopteris, Osmunda, Pteris* and *Azolla.*
III	**GYMNOSPERMS:** General characters - A general account of distribution of Gymnosperms. Morphology, anatomy, reproduction, phylogeny and classification (K.R.Sporne, 1965). Economic importance of Gymnosperms.
IV	**GYMNOSPERMS:** Structure (Exomorphic and endomorphic), anatomy, reproduction and life histories of the following genera: *Thuja,Cupressus, Araucaria, Podocarpus, Gnetum*and *Ephedra*.
	PALEOBOTANY: Geological Scale; Radiocarbon dating; Contribution of Birbal Sahni to

V	Paleobotany.Gondwana flora of India. Study of fossils in understanding evolution. Fossilization and fossil types. Economic importance of fossils – fossil fuels and industrial raw materials and uses.Study of organ genera: *Rhynia, Lepidocarpon, Calamites,Cordaites*and *Lyginopteris.*

Course Outcomes:On completion of this course the student will be able to	**Programme Outcomes**
CO1: Recallonclassification,recenttrendsinphylogeneticrelationship, generalcharacters ofPteridophytesand Gymnosperms.	K1 &K3
CO2: Learnthemorphological/anatomicalorganization,lifehistory of majortypes ofPteridophytesand Gymnosperms.	K3 & K4
CO3: ComprehendtheeconomicimportanceofPteridophytes, Gymnosperms, and fossils.	K3 & K5
CO4: UnderstandingtheevolutionaryrelationshipofPteridophytesand Gymnosperms.	K2
CO5: Awarenessonfossiltypes,fossilizationandfossilrecordsofPteridophytesand Gymnosperms.	K1 & K3

K1-Remember; **K2**-Understand; **K3**-Apply;**K4**-Analyze;**K5** -Evaluate; **K6** –Create.

ExtendedProfessionalComponent (is a part ofinternal component only,Not to be included in theExternalExamination questionpaper)	Questionsrelatedtotheabovetopics,fromvariouscompetitiveexaminationsUPSC/TRB/NET/UGC–CSIR/GATE/TNPSC/otherstobesolved (TobediscussedduringtheTutorialhour)
Skillsacquiredfromthis Course	Knowledge,ProblemSolving,Analyticalability,Professional Competency,ProfessionalCommunicationandTransferrableSkill

RecommendedText:

1. Vashishta, P.C. Sinha, A.K and Anil Kumar. 2016. Botany for Degree students. Gymnosperms. S. Chand and Company Ltd., New Delhi.
2. Singh,V.,Pande,P.C andJain,D.K. 2021. ATextBookofBotany.RastogiPublications,Meerut.
3. Bhatnagar, S.P and Alok Moitra. 2020. Gymnosperms, New Age International (P) Ltd., Publishers, Bengaluru.
4. Sharma, O.P. 2017. Pteridophyta, McGraw Hill Education, New York.
5. Vashishta.P.C.,A.K.SinhaandAnilKumar.2018.BotanyforDegreestudents-Gymnosperms.S. Chand and Company Ltd., NewDelhi.
6. Johri, R.M, Lata, S, Tyagi, K. 2005. A text book of Gymnosperms, Dominate pub and Distributer, New Delhi.

Reference books:

1. Parihar, N.S. 2019. An Introduction to Embryophyta Pteridophytes. 5th Edition, Surjeet Publication, Delhi.
2. Pandey, S.N and Trivedi, P.S. 2015. A Text Book of Botany Vol. II- 12 th edition (Paperback), Vikas Publishing.

3. Rashid, A. 2013. An introduction to Pteridophyta – Diversity, Development and differentiation (2nd edition), Vikas Publications.
4. ArnoldA.C.2005.An IntroductiontoPaleobotany.Agrobios(India).Jodhpur.
5. Sporne, K.R. 2017. The morphology of Pteridophytes (The structure of Ferns and Allied Plants) (Paper back), Andesite Press.
6. Sporne, K.R. 1967. The Morphology of Gymnosperms. Hutchinson & Co., London.
7. Taylor, E, Taylor, T, Krings, M. 2008. Paleobotany: The Biology and Evolution of FossilPlants,2nd Edition, AcademicPress.

Web resources:

1. https://www.toppr.com/guides/biology/plant-kingdom/pteridophytes/
2. http://www.bsienvis.nic.in/Database/Pteridophytes-in-India_23432.aspx
3. https://books.google.co.in/books?hl=en&lr=&id=Pn7CAAAQBAJ&oi=fnd&pg=PA1&dq=Introduction+to+Gymnosperms&ots=sfYSzCL02&sig=ysX1KRvetV0bAza4Sq6RWau4XU8&redir_esc=y#v=onepage&q=Introduction%20to%20Gymnosperms&f=false
4. https://books.google.co.in/books/about/Botany_for_Degree_Gymnosperm_Multicolor.html?id=HTdFYFNxnWQC&redir_esc=y
5. https://books.google.co.in/books/about/Gymnosperms.html?id=4dvyNckni8wC
6. https://arboretum.harvard.edu/wp-content/uploads/2013-70-4-beyond-pine-cones-an-introduction-to-gymnosperms.pdf
7. https://www.palaeontologyonline.com/
8. https://books.google.co.in/books/about/Paleobotany.html?id=HzYUAQAAIAAJ
   https://trove.nla.gov.au/work/11471742?q&versionId=46695996

MappingwithProgrammeOutcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3
CO3	2	3	3	3	3	1	3	3	3	3
CO4	3	3	2	3	3	3	3	2	3	2
CO5	3	2	2	2	2	2	2	1	2	1

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

<table>
<tr><td>P23BOP11</td><td colspan="7">CORE-III LABORATORY COURSE-I
1. Algae, Fungi, Lichens and Bryophytes &
2. Pteridophytes, Gymnosperms and Paleobotany</td></tr>
<tr><td></td><td colspan="7">CORE III</td></tr>
<tr><td>Category</td><td>Core</td><td>Year</td><td>I</td><td>Credits</td><td>4</td><td>CourseCode</td><td>P23BOCP11</td></tr>
<tr><td></td><td></td><td>Semester</td><td>I</td><td></td><td></td><td></td><td></td></tr>
<tr><td>InstructionalHours perweek</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">LabPractice</td><td colspan="2">Total</td></tr>
<tr><td></td><td></td><td colspan="2">--</td><td colspan="2">6</td><td colspan="2">6</td></tr>
<tr><td>Pre-requisite</td><td colspan="7">Studentsshould be familiar withthefundamentalsofalgae,fungi,lichens, Bryophytes, Pteridophytes, Gymnospersms, Paleobotany andmicrobes in addition to essential laboratory techniques.</td></tr>
<tr><td>Learning Objectives</td><td colspan="7">1.To learn how to employ the use of instruments, technologies and methodologies related tothallophytes and non-flowering plant groups.</td></tr>
<tr><td></td><td colspan="7">2.To enhance information on the identification of each taxonomical group by developing the skill-based detection of the morphology and microstructure of algae, and fungi.</td></tr>
<tr><td></td><td colspan="7">3.To comprehend the fundamental concepts and methods used to identify Bryophytes, Pteridophytes and Gymnosperms through morphological changes and evolution, anatomy and reproduction.</td></tr>
<tr><td></td><td colspan="7">4.To develop the technical abilities in staining, sectioning, sterilizing, and characterizing. thallophytes, and other varieties of non-flowering plants.</td></tr>
<tr><td></td><td colspan="7">5.To compare the structural diversity of fossil and extant plant species.</td></tr>
<tr><td>UNIT</td><td colspan="7">EXPERIMENTS</td></tr>
<tr><td>I</td><td colspan="7">ALGAE
Study of algae in the field and laboratory of the genera included in theory.
External morphology and internal anatomy of the vegetative and reproductive structures of thefollowinglivingforms: Oscillatoria, Scytonema, Ulva, Codium, Diatoms, Dictyotaand Gelidium(depending onavailability of thespecimen).

Torecordthelocalalgalflora–Studyoftheirmorphology and structure.
Identification of algae to species level (at least One).
Preparation of culture media and culture of green algae</td></tr>
</table>

	and blue green algae in the laboratory (Demonstration).
II	**FUNGI** Study of morphological and reproductive structures ofthefollowinglivingforms: *Plasmodiophora, Phytophthora, Rhizopus, Taphrina, Polyporus* and *Colletotrichum* (depending onavailability of thespecimen). Isolation and identification of fungi from soil, air, and Baiting method. Preparation of culture media. Cultivationofmushroomin the laboratory (Demonstration). **LICHENS** Study of morphological and reproductive structures of the genera *Parmelia.*
III	**BRYOPHYTES** External morphology and internal anatomy of the vegetative and reproductive organs of thefollowinglivingforms: *Targionia, Lunularia, Porella* and *Polytrichum* (depending onavailability of thespecimen).
IV	**PTERIDOPHYTES** External morphology and internal anatomy of the vegetative and reproductive organs of thefollowinglivingforms: *Isoetes, Equisetum Angiopteris, Osmunda, Pteris* and *Azolla* (depending onavailability of thespecimen). *Fossilslidesobservation:Rhynia, Lepidocarpon, Calamites.*
V	**GYMNOSPERMS** External morphology and internal anatomy of the vegetative and reproductive organs of thefollowinglivingforms:*Thuja,Cupressus, Araucaria, Podocarpus, Gnetum* and *Ephedra* (depending onavailability of thespecimen). Fossilslidesobservation*: Cordaites* and *Lyginopteris.*

Course outcomes: **COOn completion of this course the student will be able to**
CO1: Recallandapplyingthebasickeystodistinguishatspecieslevelidentificationofimportantalg itsstructuralorganizations.
CO2: Demonstrate practical skills in thallophytes, Pteridophytes and Gymnosperms.
CO3: Describe the structure of algae, fungi, lichens, Bryophytes,Pteridophytes and Gymnosperms.

CO4: Determine the importance of structural diversity in the evolution of plant forms.	
CO5: Formulate techniques to isolate and culture of alga and fungi as well as to understand the diversity of plant	
ExtendedProfessionalComponent (is a part ofinternal component only,Not to be included in theExternalExamination questionpaper)	Questionsrelatedtotheabovetopics,fromvariouscompe CSIR/GATE/TNPSC/otherstobesolved (Tobediscusse
Skillsacquiredfromthis Course	Knowledge,ProblemSolving,Analyticalability,Profe Competency,ProfessionalCommunicationandTransfe
ExtendedProfessionalComponent (is a part ofinternal component only,Not to be included in theExternalExamination questionpaper)	Questionsrelatedtotheabovetopics,fromvariouscomp CSIR/GATE/TNPSC/otherstobesolved (TobediscussedduringtheTutorialhour)
Skillsacquiredfromthis Course	Knowledge,ProblemSolving,Analyticalability,Profe Competency,ProfessionalCommunicationandTransf

RecommendedText:

1. Kumar,H.D.1999. IntroductoryPhycology.Affiliated East-WestPress,Delhi.
2. Das,SandSaha,R.2020.MicrobiologyPracticalManual.CBSPublishersandDistributors(P) Ltd., New Delhi,India.
3. Sharma,O.P.2012. Pteridophyta,Tata McGraw-Hills Ltd,NewDelhi.
4. SharmaO.P and S, Dixit.2002.Gymnosperms.PragatiPrakashan.
5. Johri, R.M, Lata, S, Tyagi, K. 2005. A text book of Gymnosperms, Dominate pub and Distributer, New Delhi.

Reference Books:

1. Chmielewski, J.G andKrayesky,D. 2013.GeneralBotany laboratory Manual.AuthorHouse,Bloomington, USA.
2. Webster,J andWeber,R.2007.IntroductiontoFungi,3rdEd.CambridgeUniversityPress,Cambridge.
3. Sharma,O.P.2017. Bryophyta,MacMillanIndia Ltd,NewDelhi.
4. 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.
5. Gangulee, H.C and A.K. Kar. 2013. College Botany. Vth Edition. S. Chand.

Web resources:

1. https://www.frontiersin.org/articles/10.3389/fmicb.2017.00923/full
2. https://microbiologyonline.org/file/7926d7789d8a2f7b2075109f68c3175e.pdf
3. http://www.cuteri.eu/microbiologia/manuale_microbiologia_pratica.pdf
4. https://www.amazon.in/Manual-Practical-Bryophyta-Suresh-Kumar/dp/B0072GNFX4
5. https://www.amazon.in/Practical-Manual-Pteridophyta-Rajan-Sundara/dp/8126106883
6. https://www.google.co.in/books/edition/Gymnosperms/3YrT5E3Erm8C?hl=en&gbpv=1&dq=gymnosperms&printsec=frontcover

7. https://www.amazon.in/Paleobotany-Biology-Evolution-Fossil-Plants/dp/0123739721

MappingwithProgrammeOutcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	3	3	3	3	3	3	3	3	3
CO2	3	3	2	3	3	3	1	3	1	3
CO3	3	3	3	3	3	3	2	3	2	3
CO4	3	3	2	1	2	2	1	2	1	3
CO5	3	3	3	3	3	3	3	2	3	2

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

Title of the Course	**P23BOE1A - MICROBIOLOGY, IMMUNOLOGY AND PLANT PATHOLOGY**						
Paper Number	ELECTIVE I						
Category	ELECTIVE	**Year**	I	**Credits**	3	**Course Code**	
		Semester	I				
InstructionalHours perweek		**Lecture**	**Tutorial**	**LabPractice**	**Total**		
		3	2	--	5		
Pre-requisite	1.The goal of the course is to provide students with basic understanding of microbiology, immunology, plant pathology and the etiology of specific plant diseases.						
Learning Objectives	2.To provide comprehensive knowledge about microbes and its effect on man and environment.						

	3.To provide comparative analysis of major groups of microbes.
	4.To study the principles of immune system, immunizing agents like antibodies and vaccines and gene therapy methods.
	5.To enhance the knowledge and skills needed for self-employment using the microbial derived products.
	6.To appreciate the role of immune system in conferring disease resistance.

UNIT	CONTENTS
I	**BACTERIA:** Types of microorganisms. General characteristic of bacteria – Outline classification of Bergey's manual of 9th edition. Classification of bacteria based on Morphological, cultural, physiological and molecular characteristics. Bacterial growth – batch culture and continuous culture. Growth Curve. Factors affecting growth. Determination of bacterial growth – Direct method: Haemocytometer, Viable plate count; Indirect method: Turbidity. Nutritional types. Reproduction - Fission and sporulation. Genetic recombination- Transformation, Transduction and Conjugation. Isolation and cultivation of bacteria. Maintenance of bacterial culture.
II	**VIRUSES:** General characters, Classification, Structure, Multiplication. Overview of Phycoviruses and Mycoviruses. Viruses of Eukaryotes – Animal & Plant viruses. Cultivation of viruses – in embryonated egg and in plants. Control of viral infections. Bacteriophages- classification, replication of DNA and RNA phages - Lytic and Lysogenic cycle. Viroids and prions. Mycoplasma: Structure and classification.
III	**FOOD MICROBIOLOGY:** Beneficial role of microbes – yoghurt, Olives, Cheese, Bread, Wine, Tempeh, Miso & Fermented green tea. Spoilage of fruits, vegetables, meats, poultry, eggs, bakery products, dairy products and canned foods. Microbial toxins - Exotoxin, Endotoxin & Mycotoxin. Action of Enterotoxin, Cytotoxin& Neurotoxin. Food Preservation – temperature, drying, radiation and chemicals. Soil Microbiology: Importance of Microbial flora of soil and factors affecting the microbial community in soil. Interaction among soil microbes (positive and negative interactions) & with higher plants (rhizosphere &phyllosphere). Microorganisms in organic matter decomposition. Environmental Microbiology: Microbiology of water and air. Water borne diseases - diphtheria, chicken pox. Air borne diseases - Swine flu and **Measles**. Microbial degradation of chemical pesticides and hydrocarbon.

IV	**IMMUNOLOGY:** Introduction; Immune System; Types of Immunity - Innate and Acquired.Immune Cells - Hematopoiesis, B and T lymphocytes - Maturation, NK cells. Introduction to inflammation, Adaptive immune system, Innate Immune system. Antigen: Definition, Properties and types. Antibody – Structure, types and function. Generation of antibody diversity.Antigen - Antibody interactions: definition, types- Precipitation, Agglutination, Complement fixation. Immune Response – Humoral and Cell Mediated. Vaccines – history, types and recombinant vaccines. Immunodiagnosis –Blood Grouping, Widal test, Enzyme-Linked Immunosorbent Assay (ELISA), Immunoelectrophoresis and Immunodiffusion.
V	**PLANT PATHOLOGY:** **History and significance of plant pathology. Classification of plant diseases, Symptomology (important symptoms of**plant pathogens). Principles of plant infection –Inoculum, inoculum potential, Pathogenicity. Disease triangle. Host parasite interrelationship and interaction. Causal agents of plant diseases - biotic causes (fungi, bacteria virus, mycoplasma, nematodes, parasitic algae, angiospermic parasites - Abiotic causes (Physiological, deficiency of nutrients & minerals and pollution).Mechanism of penetration- Disease development of pathogen (colonization) and dissemination of pathogens. Role of enzymes and toxins in disease development. Defence mechanism of host – structural and biochemical defences. Important diseases of crop plants in India - Sheath blight of rice, Late blight of potato, Little leaf of Brinjal and Red rust of tea. Principles of disease management – Cultural practices, physical, chemical and biological methods, disease controlled by immunization. Biocontrol - merits and demerits; Plant quarantine and legislation. Integrated Pest Management system. Diagnostic technique to detect pest/pathogen infection - Immunofluorescence (IF).

Course outcomes: **On completion of this course the student will be able to** **CO**		**Programme outcomes**
CO1	Recognize the general characteristics of microbes, plant defense and immune cells.	K1
CO2	Explain about the stages in disease development and various defense mechanisms in plants and humans.	K2
CO3	Elucidate concepts of microbial interactions with plant and humans.	K3
CO4	Analyze the importance of harmful and beneficial microbes and immune system	K4
CO5	Determine and interpret the detection of pathogens and appreciate their adaptive strategies.	K5 & K6

ExtendedProfessionalComponent (is a part ofinternal component only,Not to be included in theExternalExamination questionpaper)	Questionsrelatedtotheabovetopics,fromvariouscompetitiveexaminationsUPSC/TRB/NET/UGC–CSIR/GATE/TNPSC/otherstobesolved (TobediscussedduringtheTutorialhour)
Skillsacquiredfromthis Course	Knowledge,ProblemSolving,Analyticalability,Professional Competency,ProfessionalCommunicationandTransferrableSkill

RecommendedText:

1. Singh, R.S. 2018. Introduction to Principles of Plant Pathology, 4th Edition.
2. Bilgrami, K.S and H.C. Dube. 2010 A text book of Modern Plant Pathology – Vikas Publishing House (P) Ltd., New Delhi
3. Mehrotra, R.S. and Aggarwal, A. 2017. Plant Pathology. McGraw Hill Publisher.
4. Dube, H.C. 2010. A text Book of Fungi, Bacteria and Viruses, 3rd Edition, Agrobios India, ISBN: 8188826383.
5. Vaman Rao, C. 2006. Immunology. 2nd Edition. Narosa Publisher.
6. Kenneth, M. 2017. Janeway's Immunobiology. 9th Edition. Garland Publisher.

Reference Books:

1. Agrios, A.G. 2007. Plant Pathology, Elsevier. ISBN: 9780120445653.
2. Jeffery, C., Pommerville. 2014. Alcamos Fundalmedals of Microbiology. 10th Edition. Johnsand Bartlett Learning.
3. Pelczar, M. J. 2007. Microbiology. 35th Edition, Tata-McGraw Hill Publications, New York,ISBN: 0074623260.
4. Ravi Chandra, N.G. 2013. Fundamentals of Plant Pathology, Phi Learning, ISBN:812034703X.
5. Willie, J. and Sherwood, L. 2016. Prescott's Microbiology McGraw-Hill Education; 10th Edition, ISBN: 978-1259281594
6. Chaube, H.S. and Singh, R. 2015. Introductory Plant Pathology CBS Publishers, ISBN: 978-8123926704.
7. Rangasamy, G. 2006. Disease of crop plants in India (4th edition). Tata Mc Graw Hill New Delhi.
8. Mishra, A., A. Bohra and A, Mishra. 2011. Plant Pathology-Disease and Management. Agro Bios, Jodhpur.

Web resources:

1. https://www.wileyindia.com/a-textbook-of-plant-pathology.html
2. https://www.britannica.com/science/plant-disease.
3. https://www.planetatural.com/pest-problem-solver/plant-disease/
4. https://www.elsevier.com/books/plant-pathology/agrios/978-0-08-047378-9
5. https://www.elsevier.com/life-sciences/immunology-and-microbiology/books
6. https://www.amazon.in/INTRODUCTION-IMMUNOLOGY-RAFIA-IMRAN-ebook/dp/B09B66SD3J

MappingwithProgrammeOutcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3	3	3	2	3	2
CO2	3	3	2	2	3	3	2	1	2	1
CO3	3	3	3	3	3	3	1	3	1	3
CO4	3	3	2	2	3	3	2	1	2	1
CO5	3	3	3	3	3	3	3	2	3	2

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

ELECTIVE-I CONSERVATION OF NATURAL RESOURCES AND POLICIES

Title of the Course	**P23BOE1B - CONSERVATION OF NATURAL RESOURCES AND POLIC**						
Paper Number	**ELECTIVE I**						
Category	ELECTIVE	**Year**	I	**Credits**	3	**CourseCode**	
		Semester	I				
InstructionalHours		**Lecture**		**Tutorial**		**LabPractice**	**Total**

perweek	3	2	--	5
Pre-requisite	To create awareness of environmental problems and their consequences.			
Learning Objectives	1.Explain the term natural resources.			
	2.Describe the reasons for degradation of natural resources and suggest mea these.			
	3.List the various endangered species of animals and plants.			
	4.State the various environmental laws passed to conserve the natural resource			
	5.Explain sustainable development and justify its need; and describe the vari as well as non-conventional sources of energy.			

UNIT	CONTENTS
I	**NATURAL RESOURCES:** Definition – Importance – Classification – Human physiological socio-economic and cultural Human Population Explosion – Natural Resource Degradation – Concept of conservation – Equitable resource use for sustainable life system.
II	**FOREST RESOURCES:** Forest cover in India and the World – Importance – Desertification – Forest Wealth – Vanasamrakshna Samithi– Agroforestry – Social Forestry – Joint Forest Management Stra Conservation. **Wild Life:** Resources – Importance – Benefits – Wild life Extinction – Causes List of Endanger species in India and in the World – Ecological approach in wild life man Tourism – Wild Life projects in India – Sanctuaries and National Parks In India – Man Programme.
III	**LAND AND SOIL RESOURCES:** Soil, Complexity of soil nature, regional deposits, Land use and capability classification sys Planning models and their limitations. Impacts of natural and man-made activities on land cha land use planning– Soil Erosion – Loss of Soil Nutrients – Restoration of Soil Fertility – So Methods and Strategies in India. Wet Land Conservation and Management – Ecological Imp lands in India – Conservation Strategy and ecological Importance. Water Resources: Rivers and – Water Conservation and ground water level increase - WatershedProgramme.
IV	**MINERAL RESOURCES:** Use and exploitation – Environmental effects of extracting and using mineral resources – mining lands – Expansion of supplies by substitution and conservation. Food Resources Problems – Changes caused by agriculture – overgrazing effects of modern agriculture – Fer problems – Water Logging – Salinity – Sustainable agriculture, life stock breeding and farming
V	**ENVIRONMENTAL POLICY IN INDIA:** Need for policies- Public Policy – Economic policies – Relationship between economic de environment – Implementing Environmental Public Policy Strategies in pollution control – provisions in India regarding environment – Public Awareness and Participation in Management – National Land Use Policy 1988 – Industrial Policy 1991.

Course	

outcomes:On completion of this course the student will be able to CO	
CO1 Understand the concept of different natural resources and their utilization.	
CO2 Critically analyze the sustainable utilization land, water, forest and energy resources	
CO3 Evaluate the management strategies of different natural Resources	
CO4 Reflect upon the different national and international efforts in resource management and their conservation.	
CO5 State the various environmental policy passed to conserve the natural resources.	
ExtendedProfessionalComponent (is a part ofinternal component only,Not to be included in theExternalExamination questionpaper)	QuestionsrelatedtotheabovetopicsfromvariouscompetitiveexaminationsUPSC CSIR/GATE/TNPSC/otherstobesolved (TobediscussedduringtheTutorialhour)
Skillsacquiredfromthis course	Knowledge,ProblemSolving,Analyticalability,Professional Competency,ProfessionalCommunicationandTransferrableSkill

RecommendedText:

1. Trivedi R.K.1994. Environment and Natural Resources Conservation.
2. Murthy J.V.S.1994. Watershed Management in India.
3. Raymond, F Dasmann. 1984. Environmental Conservation, John Wiley.
4. Nalini, K.S. 1993. Environmental Resources and Management, Anmol Publishers, New Delhi.
5. Shyam Divan and Armin Rosencranz. 2001. Environmental Law and Policy in India, Oxford Uni.Press.

Reference Books:

1. Haue, R and Freed V.H. 1975. Environmental Dynamics of Pesticides, Menum Press, London
2. Singh, B. 1992. Social Forestry for Rural Development, Anmol Publishers, New Delhi.
3. Shafi. R. 1992. Forest Ecosystem of the World.
4. Stacy Keach. 2016. Natural Resources Management. Syrawood Publishing House.
5. Rathor B.S. 2013. Management of Natural Resource for Sustainable Development. Daya Publishing House, New Delhi.

Web resources:

1. https://www.amazon.in/conservation-natural-resources-Gifford-Pinchot-ebook/dp/B07HX76TVN
2. https://books.google.co.in/books/about/Natural_Resource_Conservation_and_Enviro.html?id=T2SRuhxpUW8C&redir_esc=y
3. https://www.kobo.com/ww/en/ebook/natural-resources-conservation-law
4. https://www.scribd.com/book/552185119/Natural-Resources-Conservation-and-Advances-for-Sustainability
5. https://www.scribd.com/document/354699536/Conservation-of-Natural-Resources

MappingwithProgrammeOutcomes:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	M	S	M	S	M	S
CO2	S	S	S	S	M	M	L	S	L	S
CO3	S	S	S	M	M	M	L	S	L	S
CO4	S	S	S	M	M	M	L	S	L	S
CO5	S	S	S	M	M	M	L	S	L	S

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

ELECTIVE-I MUSHROOMCULTIVATION

Title of the Course	**P23BOE1C -MUSHROOMCULTIVATION**						
Paper Number	**ELECTIVE I**						
Category	ELECTIVE	**Year**	I	**Credits**	3	**CourseCode**	
		Semester	I				
InstructionalHours perweek		**Lecture**	**Tutorial**	**LabPractice**	**Total**		
		3	2	--	5		
Pre-requisite	Basicknowledgeonstructureandfunction ofvarious groupsof mushrooms.						
Learning Objectives	1.Toteachtheidentificationofmushrooms.						
	2.Todifferentiatetheediblemushrooms withtoxicand hallucinatingfungi.						
	3.Tostudythecultivation techniqueofmushrooms						
	4.Tolearntheeconomicimportanceofmushroominvariousfields.						
	5.Tostudy howto establishmushroom cultivation asbusiness enterprise.						
	6.Toteachtheidentificationofmushrooms.						

UNIT	CONTENTS
I	**INTRODUCTION:** Mushroom,EdibleMushroom,commercialproduction,medicinalvalueofmushrooms,nutraceuticals and dietary supplements
II	**MORPHOLOGICAL AND MICROSCOPICAL IDENTIFICATION OF EDIBLE AND POISONOUS MUSHROOMS**: Keysforidentificationofediblemushrooms:*Agaricusbisporus*,*Pleurotussajorcaju*,*Volvariellavolvcea*and*Calocybeindica.*Keyforidentifyinghallucinogenicmushroom(*Psilocybe*sp.)MedicinalMushroom –*Cordyceps*,*Ganoderma lucidum*and*Lentinusedodes.*

III	**CULTIVATION:** Substratesterilization,bedpreparation,croppingroomandmaintenance,raising of pure culture and spawn preparation, factors effecting button mushroom production(Temp,pH, airandwatermanagement, competitor mouldsand otherdisease).
IV	**POST-HARVESTMANAGEMENT:** Harvest,storage,qualityassuranceofmushrooms.Pestmanagement.
V	Worldproductionediblemushroom,Legalandregulatoryissuesofintroducingthemedicinalmushrooms in different countries. Developing small scale industry and Government schemes.MushroomResearch Centres–Internationaland National levels.

Course Outcomes:On completion of this course the student will be able to **CO**		**Programme outcomes**
CO1	Knowledgeonidentificationofedibleandtoxicmushrooms belongingtoAscomycotaand Basidiomycota.	K1,K3
CO2	Outlinethenutraceutical propertiesof ediblemushrooms.	K2,K4
CO3	Knowledgeon cultivationtechniques ofedible and medicinal mushrooms.	K3,K6
CO4	Understandtheharvestand post-harvesttechniquesofmushroom crops.	K4
CO5	Knowledgeonthe productionand marketingstrategies for mushrooms.	K5

ExtendedProfessional Component (is a part ofinternal component only,Not to be included in theExternalExamination questionpaper)	QuestionsrelatedtotheabovetopicsfromvariouscompetitiveexaminationsUPSC/TRB/NET/UGC–CSIR/GATE/TNPSC/otherstobesolved (TobediscussedduringtheTutorialhour)
Skillsacquiredfromthis course	Knowledge,ProblemSolving,Analyticalability,Professional Competency,ProfessionalCommunicationandTransferrableSkill

RecommendedText:

1. Cheung,P.C.K.2008. Mushroomsasfunctionalfood.AJohnWiley&Sons, Inc.,Publication.
2. Dijksterhuis, J. and Samson, R.A. 2007. Food Mycology: A multifaceted approach in fungiandfood. CRC press, Newyork.
3. Hall.,R.I.,Stepheson,S.L.,Buchanan,P.K.,Yun,W.andCole,A.L.J.2003.Edibleandpoisonous

mushrooms of theworld. TimberPress,Portland, Cambridge.
4. Ting,S.andMiles,P.G.2004.Mushrooms:Cultivation,nutritionalvalue,medicinaleffectandnutritional environmental impact. CRC press, Newyork.
5. Verma, 2013. Mushroom: edible and medicinal: cultivation conservation, strainimprovement with their marketing.DayaPublishingHouse.

Referencebooks:

1. Tiwari.,SC.,PandeyK. 2018.Mushroomcultivation.Mittalpublisher,NewDelhi.
2. Philips,G.,Miles,Chang,S-T. 2004.Mushrooms:Cultivation, nutritionalvalue, medicinaleffectand environmentaleffect. 2nd ed. CRCPress.
3. Diego,C.Z.,Pando-Gimenez,A.2017.EdibleandmedicinalmushroomsTechnologyandApplication.Wiley-Blackwell publishers.
4. Nita Bahl. 2002. Handbook on Mushroom 4th edition Vijayprimlani for oxford & IBH publishing co., Pvt., Ltd., New Delhi. Dr.C. Sebastian Rajesekaran Reader in Botany Bishop Heber College, Trichy – 17.
5. Suman. 2005. Mushroom Cultivation Processing and Uses, M/s. IBD Publishers and Distributors, New Delhi.

Web resources:

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

MappingwithProgrammeOutcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	1	3	2	1	2	2	2	2
CO2	3	3	2	2	3	3	2	3	2	3
CO3	3	3	2	2	1	3	1	3	1	2
CO4	3	3	3	3	3	2	3	3	3	3
CO5	3	3	2	3	2	3	3	3	3	3

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

ELECTIVE I- PHYTOPHARMACOGNOSY

Title of the Course	**P23BOE1D - PHYTOPHARMACOGNOSY**						
Paper Number	**ELECTIVE I**						
Category	ELECTIVE	**Year**	I	**Credits**	3	**CourseCode**	
		Semester	I				

InstructionalHours perweek	**Lecture**	**Tutorial**	**LabPractice**	**Total**
	3	2	--	5

Pre-requisite	Studentsshouldawareoftraditionaluseofplantderiveddrugsinworld.
Learning Objectives	1.Tolearnthetraditionalknowledgeonplantderiveddrugsandtheirconventional classification.
	2.Toelucidatethebiosyntheticpathwayof majorclassesofsecondarymetabolites.
	3.Tostudythegeneralpharmacologicalmodeofactionofcrudedrugsoffewmedicinalplants.
	4.Toelucidatetheisolationandcharacterizationofplantderiveddrugsusingmodern biotechniques.
	5.Knowledgeonpharmacologicalactionofdrugs.
	6.Tolearnthetraditionalknowledgeonplantderiveddrugsandtheirconventional classification.

UNIT	**CONTENTS**
I	Generalintroduction – HistoryandscopeofPharmacognosyincludingindigenoussystemofmedicine. Various systems of classification of drugs. Pharmacological action of plant drugs.Significanceof Pharmacopoeial standards.
II	MORPHOLOGICAL AND MICROSCOPICALBiosynthetic pathway of secondary metabolites: Acetate pathway (fatty acids andpolyketides),mevalonateanddeoxyxylulosephosphatepathway(terpenoidsandsteroids),shikimatepathway (phenols, amino acids etc.).
	Characterization of Therapeutic drugs: Extraction, separation, isolation (Chromatographictechniques) and characterization of secondary metabolites (Spectroscopic techniques). Qualitycontrolof plant drugs: Classical and

III	modernapproaches of drugs.Significanceof Pharmacopoeial standards.
IV	Pharmacological action of Plant Drugs: Anti-cancer, Bitter tonic, Carminatives and G.I.regulators, Cardiotonics, CNS-Stimulatant, Expectorant, Laxatives, Puragatives. Outline ofpharmacogenomicsfunctions.
V	Hallucinogenic, allergenic and other toxic plants, poisonous plants - biopesticides - biocides– biofungicides.

Course outcomes: **On completion of this course the student will be able to** **CO**		**Programme outcomes**
CO1	Reviewonthe traditionalknowledgeandclassification ofplantderived drugs.	K1
CO2	Knowledgeon biosyntheticpathwayof different classesof plant metabolites.	K2
CO3 metabolites.	Knowledgeon moderninstrumentation oncharacterization ofplant	K3,K6
CO4	DiscussvariousaspectsofPharmacologicalactionofherbaldrugs.	K4 K5
CO5 variioussectors.	Understandingmedicalandnon-medicalpotential ofplantderivedin	K6

RecommendedText:

1. DewickP.M.,2002.MedicinalNaturalProducts:Abiosyntheticapproach,JohnWiley&Sons Ltd.
2. EvansW.C.,2002,TreaseandEvan'sPharmacognosy,W.B.Saunders.
3. Harborne,J.B.,1998.PhytochemicalMethods,ChapmanandHall.
4. Harborne,J.B.,1998.PhytochemicalMethods,ChapmanandHall.
5. VickeryM.L.andB.Vickery,1981.SecondaryPlantMetabolism,TheMacMillanPressLtd.

Referencebooks:

1. Bruneton,J.1999.Pharmacognosy,Phytochemistry,MedicinalPlants,InterceptLtd.,Paris.
2. EvansW.C.2002,TreaseandEvan'sPharmacognosy,W.B.Saunders.
3. Harborne,J.B.1998.PhytochemicalMethods,ChapmanandHall.
4. VickeryM.LandB.Vickery,1981.SecondaryPlantMetabolism,TheMacMillanPressLtd.
5. WagnerH.,S.BladtandE.M.Zgainski(TranslatedbyA.Scott)1984,PlantDrugAnalysis,Springer-Verlag.

Web resources:

1. https://pharmabookbank.files.wordpress.com/2019/03/14.2.pharmacognosy-by-biren-shahavinash-seth-1.pdf

2. https://www.pdfdrive.com/pharmacognosy-books.html
3. https://www.amazon.in/Textbook-Pharmacognosy-Phytochemistry-Kumar-Jayaveera-ebook/dp/B06XKSY76H
4. https://www.amazon.in/Pharmacognosy-Dr-C-K-Kokate-ebook/dp/B07JHNNMWB
5. https://www.amazon.in/EXPERIMENTAL-PHYTOPHARMACOGNOSY-Comprehensive-Guide-Khadabadi-ebook/dp/B07ZFMYQK8

MappingwithProgrammeOutcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3	3	2	1	2	1
CO2	3	2	3	3	3	2	2	1	2	1
CO3	3	2	3	3	3	3	2	2	3	2
CO4	3	2	2	3	3	3	3	2	3	2
CO5	3	2	2	3	3	3	3	2	3	2

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

CORE-IV TAXONOMY OF ANGIOSPERMS AND ECONOMIC BOTANY

Title of the Course	**P23BOT23** **PLANT TAXONOMY OF ANGIOSPERMS AND ECONOMIC BOTA**						
Paper Number	**CORE IV**						
Category	Core	**Year**	I	**Credits**	5	**CourseCode**	
		Semester	II				
InstructionalHours perweek		**Lecture**		**Tutorial**	**LabPractice**		**Total**
		3		3	--		6
Pre-requisite	Prior knowledge on morphological, anatomical characteristics and uses of pl						
Learning Objectives	1.To be familiar with the basic concepts and principles of plant systematics.						
	2.To develop a suitable method for correct characterization and identificatio						
	3.To understand the importance of taxonomic relationships in research of pl						
	4.To provide information on various classification systems						
	5.To know about the economic importance of plants.						

UNIT	CONTENTS
I	**TAXONOMY AND SYSTEMATICS** Botanical exploration and contribution with special reference to India by William Roxb Robert Wright, Nathanial Wallich and Gamble, J.S. Principles of classification as prop Linnaeus, Natural – Bentham and Hooker, Phylogenetic system - Hutchinson, Modern – T gardens and herbaria of world, preparation and maintenance of Herbarium, Botanical su organization and role.
II	**MODERN TRENDS IN TAXONOMY** Modern trends in taxonomy, chemotaxonomy, numerical taxonomy, biosystemics. ICBN u genesis binomial nomenclature, importance and principle. Important articles, typification, p effective and valid publication, author citation, recommendations and amendents of co dictionaries, Taxonomic literature (Index Kewensis)
III	**YSTEMATIC ANALYSIS OF PLANTS-I** Polypetalae – Nympheaceae, Sterculiaceae, Portulaceae, Rhamnaceae, Vitaceae, Sapindac Turneraceae.
	YSTEMATIC ANALYSIS OF PLANTS-II Gamopetalae – Sapotaceae, Oleaceae, Boraginaceae, Scrophulariaceae, Bignoniacea Acanthaceae, Verbenaceae.

IV	Monochlamydeae – Nyctaginaceae, Aristolochiaceae, Casuarinaceae. Monocots – Orchidac Lilliaceae, Commelinaceae, Cyperaceae.
V	**ECONOMIC BOTANY** General account on utilization of selected crop plants: (i) Cereals (rice and wheat) – (ii) P black gram), (iii) Drug yielding plants (*Withaniasomnifera*and *Coleus aromaticus)* (iv) (Groundnut, sunflower).* (v) Sugar yielding plants (sugarcane and sugar beet), (vi) Spices and condiments (cardamo Commercial crops - fibre (jute), (viii) Timber (Teak and red (ix) Resins and gums (Asafoetida and gum arabic) – (x) Essential oils (lemon grass Beverages (tea, coffee), (xii) Plants used as avenue trees for shade, pollution control and aes plantation - uses of *Casuarina.*

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

CO	
CO1	Recollect the basic concepts of morphology of leaves, flowers. Identify the types of compound leaves , inflorescence and fruits Describe their characteristic features
CO2	Explain the principles of taxonomy. Summarize the taxonomic hierarchy. Define Binomial nomenclature. Group Activity – Construct key preparation
CO3	Explain the various types of classification.Distinguish its advantages and disadvantages Construction of floral formula anf floral diagram.
CO4	Illustrate and explain the characteristic features and list out the economic importance of the families Field trip to local botanical garden and regional botanical garden.
CO5	Illustrate and explain the characteristic featuresand list out the economic importance of the families.
ExtendedProfessionalComponent (is a part ofinternal component only,Not to be included in theExternalExamination questionpaper)	Questionsrelatedtotheabovetopics,fromvariouscompetitiveexaminationsUPS CSIR/GATE/TNPSC/otherstobesolved (TobediscussedduringtheTutorialhour)
Skillsacquiredfromthis Course	Knowledge,ProblemSolving,Analyticalability,Professional Competency,ProfessionalCommunicationandTransferrableSkill

RecommendedText:

1. Pandey, B.P. 2013. Taxonomy of Angiosperms, S. Chand Publishing, New Delhi.
2. Sharma, O.P. 2017. Plant Taxonomy. (II Edition).The McGraw Hill Companies.
3. Singh, G. 2007. Plant systematics theory and practices. Oxford and IBH Publishing Co.
4. Jain, S.K and Rao R.R. 1993. A handbook of field and herbarium methods. Today and Tomorrow Publ.

5. Pandurangan, A.G., Vrinda, K.B and Mathew Dan. 2013. Frontiers in plant taxonomy. JNTBGRI, Thiruvananthapuram, Kerala.
6. Vardhana, R. 2009. Economic Botany. 1st ed. Sarup Book Publishers Pvt Ltd. New Delhi.
7. Subramaniam, N.S. 1997. Modern plant taxonomy. Vikas Publishing House, New Delhi.

Reference Books:

1. Wallis, T.E. 1999. Text book of Pharmacognosy. CBS Publishers and Distributors, New Delhi.
2. Kumaresan, V and Annie Regland. 2004. Taxonomy of Angiosperms systematic Botany, Economic Botany, Botany &Ethnobotany.
3. Anonymous, 2004. Cultivation of Selected Medicinal Plants. National MedicinalPlants Board, Govt. of India, New Delhi.
4. Vallabh. 2000. Practical Pharmacognosy, Kolkata. New Delhi.
5. Acharya Vipul Rao. 2000. Herbal cure for common diseases. Diamond books, Pvt. Ltd.
6. Dey, A.C. 1998. Indian medicinal plants used in Ayurvedic preparations, Bishen Singh Mahendra Pal Singh.
7. Sathya, S., Jaiganesh, K.P and Sudha, T. 2019. Current Trends in Herbal Drug Technology. Pharmacy Council of India New Delhi.
8. Mohamad Ali. 2009. Pharmacognosy and Phytochemistry. CBS Publications& Distribution, New Delhi, Volume.1.
9. Lewis, W.H and M.P.F. Elwin Lewis. 1976. Medical Botany. Plants affecting Man's Health. A Wiley Inter Science Publication. John Wiley and Sons, New York.

Web resources:

1.https://www.ipni.org/
2.http://www.theplantlist.org/
3.https://www.amazon.in/PLANT-TAXONOMY-Sharma/dp/0070141592
4.https://www.tropicos.org/home
5.http://apps.kew.org/herbcat/gotoHerbariumGrowthPage.do
7.https://www.absbooksindia.com/shop/science/botany/textbook-of-economic-botany

MappingwithProgrammeOutcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3	3	3	3	3	3
CO2	3	3	2	3	3	2	2	1	2	2
CO3	3	3	2	3	1	3	2	3	3	1
CO4	3	2	3	3	2	3	3	1	3	3
CO5	3	3	2	2	1	2	1	3	2	1

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

CORE-V PLANT ANATOMY AND EMBRYOLOGY OF ANGIOSPERMS

Title of the Course	**P23BOT24 -PLANT ANATOMY AND EMBRYOLOGY OF ANGIOSPE**

Paper Number	**CORE V**						
Category	Core	**Year**	I	**Credits**	5	**CourseCode**	
		Semester	II				
InstructionalHours perweek		**Lecture**		**Tutorial**	**LabPractice**		**Total**
		3		3	--		6
Pre-requisite		To acquire knowledge on the anatomical structure and reproductive phase o					
Learning Objectives		1.Learn the importance of plant anatomy in plant production systems.					
		2.Classify meristems and identify their structures, functions and roles in plants growth and secondary growth of woody plants.					
		3.Understand the mechanism underling the shift from vegetative to reproduc					
		4.Trace the development of male and female gametophyte.					
		5.Understand the recent advances in palynology.					

UNIT	**CONTENTS**
I	**CELL WALL:** Morphological and physico-chemical changes; Plasmodesmata- types of pits – growth of cell intercellular spaces; Meristems: Classifications: Theories of shoot and root apices, Cytologic apex. Vascular Cambium: Composition and organization – multiplicative and additive divisio and secondary xylem – tracheary elements and vessels – vesselless dicots – xylem rays and a angiosperm wood; Dendrochronology – grain, texture and figure in wood; reaction wood; ring porous wood. Phloem: Ultra structure and ontogeny of sieve tube elements and companio tracheary elements.
II	**PERIDERM:** Structure, organization and activity of phellogen. Polyderm and Rhytiderm – wound periderm thickening in Dicots; Anomalous secondary growth in Dicots (Amaranthaceae, Aristolochia Piperaceae, Nyctaginaceae) and arborescent Monocots. Primary thickening in palms; Ontoge and types of Stomata; Leaf abscission; Major nodal types; Kranz anatomy and its significan Principle of killing and fixation, dehydration and rehydration of botanical specimens. Stains: staining (fast-green and light green) of free hand sections; Protocol for serial sectionin impregnated specimens; Mounting and mounting media.
III	**MICROSPORANGIUM AND MALE GAMETOPHYTE:** Structure and development of Anther; Ultrastructure and physiology of anther tapetum; Palynology: Morphology and ultrastructure of pollen wall, pollen kitt, pollen analysis, po sterility and pollen physiology.

IV	**MEGASPORANGIUM AND FEMALE GAMETOPHYTE:** Structure and development of Megasporangium; Types of ovules, Endothelium, obtu Megasporogenesis: Female gametophyte: Structure, types, haustorialbehavior and Nutriti Fertilization: Double fertilization and triple fusion; Endosperm: Development of endosperm, efficiency of endosperm haustoria and functions; Ruminate endosperm. Embryogeny: Devel (Grass) and dicot (Crucifer) embryos.
V	**POLYEMBRYONY:** Causes of Polyembryony, classification, induction and practical application. Apomixis and it and Fruit development and role of growth substances. Parthenocarpy and its importance.

Course outcomes: CO	**On completion of this course, the students will be able to:**
CO1	Learn the structures, functions and roles of apical *vs* lateral meristems in monocot and dicot plant growth.
CO2	Study the function and organization of woody stems derived from secondary growth in dicot and monocot plants.
CO3	Apply their idea on sectioning and dissection of plants to demonstrate various stages of plant development.
CO4	Understand the various concepts of plant development and reproduction.
CO5	Profitably manipulate the process of reproduction in plants with a professional and entrepreneurial mindset.

ExtendedProfessionalComponent (is a part ofinternal component only,Not to be included in theExternalExamination questionpaper)	QuestionsrelatedtotheabovetopicsfromvariouscompetitiveexaminationsUPS CSIR/GATE/TNPSC/otherstobesolved (TobediscussedduringtheTutorialhour)
Skillsacquiredfromthis course	Knowledge,ProblemSolving,Analyticalability,Professional Competency,ProfessionalCommunicationandTransferrableSkill

RecommendedText:

1. Bhojwani, S.S. Bhatnagar, S.P and Dantu, P.K. 2015. The Embryology of Angiosperms (6th revised and enlarged edition). Vikas Publishing House, New Delhi.
2. Maheshwari, P. 1963. Recent Advances in Embryology of Angiosperms. Intl. Soc. Plant Morphologists, New Delhi.
3. Sharma, P.C. 2017. Text Book of Plant Anatomy. Arjun Publishing House, New Delhi.
4. Pandey.S.N and Ajanta Chandha. 2006. Plant Anatomy and Embryology. Vikas Publishinf House Pvt. Ltd, New Delhi.
5. Narayanaswamy, S. 1994. Plant Cell and Tissue Culture. Tata McGraw Hill Ltd. New Delhi.

Reference Books:

1. Krishnamurthy, K.V. 1988. Methods in Plant Histochemistry. S. Viswanathan & Co., Madras.
2. Swamy, B.G.L and Krishnamurthy. K.V 1990. From flower to fruits, Tata – McGraw Hill publishing Co Ltd, New Delhi.
3. Pullaiah, T., Lakshiminarayana, K and Hanumantha Rao, B. 2006. Text book of Embryology of Angiosperms. Regency Publications, New Delhi.
4. Bierhorst, D.W. 1971. Morphology of Vascular Plants. Macmillan publishers, New York.
6. Crang, R., Lyons-Sobaski, S and Wise, R. 2018. Plant Anatomy: A Concept-Based Approach to the Structure of Seed Plants. Springer International Publishing.
7. Cutler, D. F., Botha, T and Stevenson, D.W. 2008. Plant Anatomy: An Applied Approach. Blackwell Publishing, Malden, USA.
8. Eames, A.J and Mac Daniels, L.H. 2013. Introduction to Plant Anatomy, 3rd Edition. McGraw-Hill Inc., US.

Web resources:

1. https://www.ipni.org/
2. http://www.theplantlist.org/
3. https://faculty.etsu.edu/liuc/plant_anatomy_sites.htm
4. http://aryacollegeludhiana.in/E_BOOK/Botany/plant_anatomy.pdf
5. https://www.uou.ac.in/sites/default/files/slm/BSCBO-202.pdf
6. http://greenlab.cirad.fr/GLUVED/html/P1_Prelim/Bota/Bota_typo_014.html
7. https://www.askiitians.com/

MappingwithProgrammeOutcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	3	3	3	3	3	3	3	3	3
CO2	3	1	3	3	3	3	3	3	3	3
CO3	3	1	3	3	3	3	3	2	3	1
CO4	3	3	3	1	1	2	3	2	2	1
CO5	3	3	3	3	3	3	2	3	3	2

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

ELECTIVE-II MEDICINAL BOTANY

Title of the Course	**P23BOE2A** **MEDICINAL BOTANY**						
Paper Number	**ELECTIVE II**						
Category	ELECTIVE	**Year**	I	**Credits**	3	**CourseCode**	
		Semester	II				
InstructionalHours perweek		**Lecture**		**Tutorial**		**LabPractice**	**Total**
		2		2		--	4

Pre-requisite	Understanding the uses of medicinal plants and its conservation.
Learning Objectives	1.To understand the uses and effects of medicinal plants and herbal supplemer
	2.Togain knowledge about the historical and modern uses of plants in medicin
	3.To gain insights into the perspectives of ethnobotanical research.
	4.To know the various methods of harvesting, drying and storage of medicinal
	5.To create new strategies to enhance growth and quality check of medicinal h

UNIT	CONTENTS
I	**HISTORY AND TRADITIONAL SYSTEMS OF MEDICINE:** Historical Perspectives – European, African, American, Southeast Asian Practices. Scope a Medicinal Plants; Traditional systems of medicine - Definition and Scope. Classical h Naturopathy, Siddha, Ayurveda, Homeopathy, Unani and MateriaMedica. Ayurveda: panchamahabhutas, saptadhatu and tridosha concepts, Rasayana, plants used in Ayurvedic tr Origin of Siddha medicinal systems, Basis of Siddha system, plants used in Siddha medicine concept: Umoor-e-tabiya, tumors treatments/ therapy, polyherbal formulations.
II	**PHYTOCHEMISTRY AND PHARMACOGNOSY:** Phytochemistry, important phytoconstituents, their plant sources, medicinal properties. definition, principles, staining methods. Biological stains – bright field dyes and flurochrom localization of phytochemicals. Raw drugs, authenticity, study through physical, microscop methods. Different types of formulations. Adulteration and Admixtures.
III	**ACTIVE PRINCIPLE &DRUG DISCOVERY:** Brief description of selected plants, Active principles, biochemical properties and medicinal (*Commiphora*) for hypercholesterolemia, *Boswellia*for inflammatory disorders, Arjuna (*Term* cardio protection, turmeric (*Curcuma longa*) for wound healing, antioxidant and anticancer (*Picrorhizakurroa*) for hepatoprotection, Opium Poppy for analgesic and antitussive, *Sa Cinchona* and *Artemisia* for Malaria, *Rauwolfia*as tranquilizer, *Belladona* as anticholine cardiotonic, *Podophyllum* as antitumor, *Stevia rebaudiana*for antidiabetic, *Catharanthusrose* Bioprospecting, drug discovery from plants with reference to diabetes and cancer.Product quality control.
IV	**CONSERVATION AND AUGMENTATION:** Significance of Cultivation, management, policies for conservation and sustainable use of Conservation of endemic and endangered medicinal plants, Red list criteria; *In situ* conser reserves, sacred groves, National Parks; *Ex situ* conservation: Botanic Gardens, Ethno medici Propagation of Medicinal Plants: seeds, cuttings, layering, grafting and budding.

V	**ETHNO BOTANY AND FOLK MEDICINE:** Concepts and definition of Ethno botany and folk medicines. A brief history of ethnobotanical & locally. Methods to study ethno botany; Applications of Ethno botany: Folk medicines of et medicine, ethno ecology, ethnic communities of India. Understanding the traditions of tribes Irulas and Kanis. Repository of Ethnobotanical data – Archeology, inventories, folklo Traditional Knowledge Sharing - Prior information consent, interviews, questionnaires partners.Plants associated with culture, social, religious and medicinal purposes.Commercial knowledge – ethics, IPR, biopiracy, equitable benefit sharing models.

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

CO	
CO1	Recognize plants and relate to their medicinal uses
CO2	Explain about the phytochemistry, pharmacognosy and bioprospecting of medicinal plant extracts.
CO3	Apply techniques for conservation and propagation of medicinal plants.
CO4	Analyze and decipher the significance of various methods of harvesting, drying and storage of medicinal herbs.
CO5	Develop new strategies to enhance growth and quality check of medicinal herbs considering the practical issues pertinent to India.

ExtendedProfessionalComponent (is a part of internal component only,Not to be included in theExternalExamination questionpaper)	Questionsrelatedtotheabovetopics,fromvariouscompetitiveexaminationsUPSC CSIR/GATE/TNPSC/otherstobesolved (TobediscussedduringtheTutorialhour)
Skillsacquiredfromthis course	Knowledge,ProblemSolving,Analyticalability,Professional Competency,ProfessionalCommunicationandTransferrableSkill

RecommendedText:

1. AYUSH (www.indianmedicine.nic.in). 2014. *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.
2. Bhat, S.V., Nagasampagi, B.A., & Meenakshi, S. 2009. Natural Products – Chemistry and Applications. Narosa Publishing House, India Ltd.
3. CSIR- Central Institute of Medicinal and Aromatic Plants, Lucknow. 2016. *AushGyanya*: Handbook of Medicinal and Aromatic Plant Cultivation.
4. Kapoor, L. D. 2001. Handbook of Ayurvedic medicinal plants. Boca Raton, FL: CRC Press.
5. Saroya, A.S. 2017. Ethno botany. ICAR publication.

6. Sharma, R. 2003. Medicinal Plants of India-An Encyclopedia. Delhi: Daya Publishing House.
7. Sharma, R. 2013. Agro Techniques of Medicinal Plants. Daya Publishing House, Delhi.
8. Thakur, R. S., H. S. Puri, and Husain, A. 1989. *Major medicinal plants of India*. Central Institute of Medicinal and Aromatic Plants, Lucknow, India.

Reference Books:

1. Akerele, O., Heywood, V and Synge, H. 1991. The Conservation of Medicinal Plants. Cambridge University Press.
2. Evans, W.C. 2009. Trease and Evans Pharmacognosy, 16th edn. Philadelphia, PA: Elsevier Saunders Ltd.
3. Jain, S.K. and Jain, Vartika. (eds.). 2017. Methods and Approaches in Ethnobotany: Concepts, Practices and Prospects. Deep Publications, Delhi
4. Amruth. 1996. The Medicinal plants Magazine (All volumes) Medicinal plant Conservatory Society, Bangalore.
5. Bhattacharjee, S.K. 2004. Hand Book of Medicinal plants. Pointer Publishers, Jaipur.
6. Handa, S.S and V.K. Kapoor. 1993. Pharmacognosy. VallabhPrakashan, New Delhi.

Web resources:

1. https://www.amazon.in/Medical-Botany-Plants-Affecting-Health/dp/0471628824
2. https://www.amazon.in/Current-Trends-Medicinal-Botany-Muhammad/dp/9382332502
3. https://link.springer.com/book/10.1007/978-3-030-74779-4
4. https://www.elsevier.com/books/medicinal-plants/da/978-0-08-100085-4
5. https://www.pdfdrive.com/medicinal-plants-books.html

MappingwithProgrammeOutcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3	3	2	1	3	3
CO2	3	2	3	3	3	2	2	1	3	2
CO3	3	2	3	3	3	3	3	2	3	3
CO4	3	2	2	3	3	3	3	2	3	3
CO5	3	2	2	3	3	3	3	2	3	3

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

Title of the Course			
Paper Number			
Category	ELECTIVE	**Year**	I
		Semester	II
InstructionalHours perweek		**Lecture**	**Tutorial**
		2	2
Pre-requisite		Basic understanding of plantmetabolites.	
Learning Objectives		1.To comprehend the various classesofphytochemicals pres	
		2.Tounderstandthebiosyntheticprocessesthroughwhichdiver	
		3.Tolearnabouttheisolationofdifferentphytochemicalsusingt	
		4.Tolearnabouttheapplicationofdifferentphytochemicalstocu	
		5.To understand the information of the traditional system of	

UNIT	
I	***SECONDARYMETABOLITESANDCLASSIFICATION*** Phytochemistry: Definition, history, principles. Secondary metabolites: definition,classification,occu
II	**ISOLATIONANDQUANTIFICATIONOFPHYTOCHEMICALS** Techniquesforisolationofmedicinallyimportantbiomolecules:solventextraction,chemical separations,
III	**BIOSYNTHETIC PATHWAYS AND APPLICATION OF PHYTOCHEMICALS** Biosynthetic pathways of secondary compounds: Shikimic pathway;MevalonicAcidPathway;Pathwa
IV	**HERBALISMANDETHNOBOTANY** Herbsandhealing:Historicalperspectives:local,nationalandgloballevel;Herbalcultures: origin and dev

V	**TRADITIONALSYSTEMOFMEDICINE** Classicalhealthtraditions:Systemsofmedicine:originanddevelopmentofbiomedicine;IndianSystemsofM ndamentalprinciplesofAyurveda:Panchabhoothatheory,Thridoshatheory,Saptadhatu theory and *Mala*

Course outcomes:	**On completion of this course, the students will be able to:**
CO	
CO1	Understandtheroleofplantsinthesurvivalofhumanbeingsandother Organisms.
CO2	Recognitionofthecontributionmadebyprimitivepeoplein explorationofplantknowledgetoalleviatecommondiseases and development ofsystems ofmedicine.
CO3	Gainingknowledgeondifferentclassesofphytochemicalspresent inhigherandlowerplants species.
CO4	Demonstrate the various aspects of extraction, isolation and characterization of secondary metabolites.
CO5	Know the methods of screening of secondary metabolites for various biological properties.

ExtendedProfessionalComponent (is a part ofinternal component only,Not to be included in theExternalExamination questionpaper)	Questionsrelatedtotheabovetopics,fromvariouscompetitivee (TobediscussedduringtheTutorialhour)
Skillsacquiredfromthis course	Knowledge,ProblemSolving,Analyticalability,Professiona Competency,ProfessionalCommunicationandTransferrableS

RecommendedText:

1. Kokate, C.K., Purohit, A.P and Gokhale, S.B. 2010. Pharmacognosy. Vol. I & II. NiraliPrakashan, Pune.
2. Mohamed Ali. 2012. Textbook of Pharmacognosy. CBS Publishers & Distributors Pvt. Ltd., New Delhi.
3. Gokhale, S.B., Kokate, C.K. and Gokhale, A. 2016. Pharmacognosy of Traditional Drugs. NiraliPrakashan, 1st Edition. ISBN: 9351642062. 2.
4. Joshi, S.G. 2018. Medicinal Plants. Oxford & IBH Publishing C., Pvt., Ltd., New Delhi.
5. Kumar, N. 2018. A Textbook of Pharmacognosy. Aitbs Publishers, India.

Reference Books:

1. Shah, B.N. 2005. Textbook of Pharmacognosy and phytochemistry. Cbs Publishers & Distributors, New Delhi.
2. Harshal A andPawar. 2018.Practicalbookof pharmacognosyandphytochemistry-EverestPublishinghouse.

3. Varsha TiwariandShamim Ahmad. 2018.Apracticalbookofpharmacognosyand phytochemistry.Niraliprakashanadvancementofknowledge.
4. Braithwaite,AandF.J.Smith.1996.*ChromatographicMethods*(5th Edition)BlackieAcademic &ProfessionalLondon.
5. Wilson,KandJ.Walker(Eds).1994.PrinciplesandTechniquesofPracticalBiochemistry(4th Edition)CambridgeUniversityPress,Cambridge.
6. Harborne. J.B. 1998. Phytochemical methods. A guide to modern techniques of Plant Analysis,Chapman and Hall publication, London.

Web resources:

1. https://www.kobo.com/gr/en/ebook/phytochemistry-2
2. https://www.amazon.in/Textbook-Pharmacognosy-Phytochemistry-Kumar-Jayaveera-ebook/dp/B06XKSY76H
3. https://www.amazon.in/Computational-Phytochemistry-Satyajit-Dey-Sarker-ebook/dp/B07CV96NZJ
4. https://studyfrnd.com/pharmacognosy-and-phytochemistry-book/
5. https://www.worldcat.org/title/textbook-of-pharmacognosy-and-phytochemistry/oclc/802053616
6. https://www.worldcat.org/title/phytochemistry/oclc/621430002

MappingwithProgrammeOutcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	2	1	3	3	3	3
CO2	3	3	3	2	2	1	2	3	2	3
CO3	3	3	3	3	3	2	1	2	1	3
CO4	2	3	3	3	3	2	2	3	2	3
CO5	2	3	3	3	3	2	2	2	3	2

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

ELECTIVE-II RESEARCH METHODOLOGY, COMPUTER APPLICATIONS & BIOINFORMATICS

Title of the Course	**P23BOE2C** **RESEARCH METHODOLOGY, COMPUTER APPLICATIONS &BIOINFORI**						
Paper Number	**ELECTIVE II**						
Category	ELECTIVE	**Year**	I	**Credits**	3	**CourseCode**	
		Semester	II				
InstructionalHours perweek		**Lecture**	**Tutorial**	**LabPractice**	**Total**		
		2	2	--	4		
Pre-requisite	To impart expertise about analysis and research.						
Learning Objectives	1.To equip students to collect, analyze and evaluate data generated by their scientific manner.						
	2.To provide an overview on modern equipments that they would help studer to instantly commence research careers and/or start entrepreneurial ventures.						
	3.To develop interdisciplinary skills in using computers in botany to learn a database.						
	4.Studentsawarewith the most recent technologies for sequencing and bioir and is able to apply them to the structural and functional genomics of plants.						
	5.Operate various software resources with advanced functions and its open off						
UNIT	**CONTENTS**						
I	Literature collection and citation: bibliography —bibliometrics (scientometrics): definition-la bibliography - *biblioscape – plagiarism - project proposal writing - dissertation writing – p (oral/poster) - E-learning tools- monograph - introduction and writing-Standard operating p introduction and preparation — Research Institutions - National and International.						
II	Basic principles and applications of pH meter, UV-visible spectrophotometer, centri chromatography- TLC, Gas chromatography with mass spectrum (GC/MS), and HPLC-S microscopy-Agarose gel Electrophoresis — Polyacrylamide GelElectrophoresis –Polymerase c						
III	Introduction to computers and Bioinformatics. Types of hardware and software op Fundamentals of networking, operation of networks, telnet, ftp, www, Internet. Biological Res Using search engines, finding scientific articles.						
IV	Public biological databases, searching biological databases. Use of nucleic acid and protein dat						

V	NCBI, EMBL, DDBJ, SWISSPORT, Protein prediction and Gene finding tools. Techniques i BLAST, FASTA, Multiple Sequence Analysis.

Course outcomes:	**On completion of this course, the students will be able to:**
CO	
CO1	Realize the need of centrifuges and chromatography and their uses in Research
CO2	Learn the principles and applications of electrophoresis.
CO3	Construct the phylogenetic trees for similar characteristic feature of plant genomes and study *de novo* drug design through synthetic biology.
CO4	Understand the concept of pairwise alignment of DNA sequences using algorithms.
CO5	Interpret the features of local and multiple alignments.

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 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 Text:

1. Veerakumari, L. 2017. Bioinstrumentation. MJP Publisher, India. p578.
2. SreeRamulu, V.S.1988. Thesis Writing, Oxford& IBH Pub. New Delhi.
3. Kothekar, V and T.Nandi. 2009. An introduction to Bioinformatics. Panima publishing crop, New Delhi.
4. Mani, K and N. Vijayaraj. 2004. Bioinformatics – A Practical Approach.1st Edn. Aparna publication, Coimbatore.
5. Gurumani, N. 2019. Research Methodology: For Biological Sciences, MP. Publishers.

Reference Books:

1. Jayaraman, J. 2000. Laboratory manual of Biochemistry, Wiley Eastern Limited, New Delhi 110 002.
2. Pevsner,J.2015.Bioinformaticsandfunctionalgenomics.Hoboken,NJ:Wiley-Blackwell.
3. Arthur Conklin W.M and Greg White, 2016. Principles of computer security. TMH. McGraw-Hill Education; 4 edition.
4. Irfan Ali Khan and Attiya Khanum (eds.). 2004. Introductory Bioinformatics. Ukaaz Publications, Hyderabad.
5. Arthur Conklin W.M., and Greg White. 2016. Principles of computer security. TMH., McGraw-Hill Education; 4th edition

6. Mishra Shanthi Bhusan. 2015. Handbook of Research Methodology - A Compendium for Scholars & Researchers, Ebooks2go Inc.
7. Narayana, P.S.D. Varalakshmi, T. Pullaiah. 2016. Research Methodology in Plant Science, Scientific Publishers, Jaipur, Rajasthan.

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
4. https://en.wikipdia.org/wiki/bioinstrumentation
5. https://www.britannica.com/science/chromatography
6. https://en.wikipedia.org/wiki/electrophoresis

MappingwithProgrammeOutcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	2	2	3	3	3	1	3	3
CO2	3	2	2	3	3	3	3	2	3	3
CO3	3	1	2	3	3	3	3	1	3	3
CO4	3	2	1	3	3	3	2	1	3	2
CO5	3	1	2	2	3	3	3	2	3	3

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

Title of the Course	**P23BOE2D** **BIOPESTICIDE TECHNOLOGY**						
Paper Number	**ELECTIVE II**						
Category	ELECTIVE	**Year**	I	**Credits**	3	**CourseCode**	
		Semester	II				

InstructionalHours perweek	**Lecture**	**Tutorial**	**LabPractice**	**Total**
	2	2	--	4

Pre-requisite	Priorknowledgeonimpactofchemicalpesticidesonenvironmentandbiopesticides
Learning Objectives	1.To understand the value and applications of biopesticides.
	2.To comprehend the various issues related to the use of chemical pesticid forestry, and agriculture.
	3.To gain knowledge about several biopesticides (bio-insecticides, bi bactericides, bio-nematicides and bio-herbicides).
	4.To gain knowledge of the techniques for mass production of selected biopes
	5.To be aware of the application strategies and weeds, nematodes, and disease

UNIT	**CONTENTS**
I	**NTRODUCTION** Introduction of biopesticides. Biological control, History and concept of biopesticides. Impo potential of biopesticide. Advantages for the use of biopesticides.
II	**TYPES OF BIOPESTICIDES** Classification of biopesticides, botanical pesticides and biorationales. Mass production te pesticides. Major classes-Properties and uses of Bioinsecticides, biofungicides, biobactericide and bioherbicides. Importance of neem in organic agriculture.
III	**IMPORTANT BIOINSECTICIDES** *Bacillus thuringiensis*, NPV, entomopathogenic fungi (*Beauveria, Metarhizium, Verticillium* Biofungicides: *Trichoderma, Gliocladium,* non-pathogenic *Fusarium, Pseudomonas* spp Biobactericides: *Agro bacterium radiobacter*. Bionematicides: *Paecilomyces, Trichoderm Phytophthora, Colletotrichum*.
IV	**TANDARDIZATION OF BIOPESTICIDES** Target pests and crops of important biopesticides and their mechanisms of action. Testing of c and standardization of biopesticides.
V	**ORMULATION** Mass multiplication and formulation technology of biopesticides. Prospects and problems in c and efficiacy of biopesticides. Commercial products of biopesticides.

Course outcomes: CO	**On completion of this course, the students will be able to:**
CO1	Understandthe issuesinuse of chemicalpesticidesandtheir harmful effects onlife.
CO2	Awarethesignificanceofbiopesticidesandtheirbeneficialrolein controlling insectpests,diseases,nematodesandweeds.
CO3	Knowledge on identification of promising biopesticides and their mechanisms of action against insect pests, diseases, nematodes and weeds.
CO4	Learnthemass productionandformulation technologyofselected biopesticides.
CO5	Knowledge on product development for commercialization of biopesticides.

ExtendedProfessionalComponent (is a part ofinternal component only,Not to be included in theExternalExamination questionpaper)	Questionsrelatedtotheabovetopics,fromvariouscompetitiveexaminationsUPSC CSIR/GATE/TNPSC/otherstobesolved (TobediscussedduringtheTutorialhour)
Skillsacquiredfromthis course	Knowledge,ProblemSolving,Analyticalability,Professional Competency,ProfessionalCommunicationandTransferrableSkill

RecommendedText:

1. Johri,J.2020.RecentAdvancesinBiopesticides:BiotechnologicalApplications.NewIndiaPublishingAgency (NIPA), NewDelhi.
2. Kaushik,N.2004.Biopesticidesforsustainableagriculture:prospectsandconstraints.TERIPress,New Delhi.
3. Sahayaraj,K.2014.BasicandAppliedAspectsofBiopesticides.SpringerIndia,NewDelhi.
4. Tebeest,D.O.2020.MicrobialControlofWeeds.CBSPublishersandDistributors,New Delhi.
5. Joshi, S.R. 2020. Biopesticides: A Biotechnological Approach. New Age International (P) ltd. New Delhi.

Reference Books:

1. Ainsworth, G.C. 1971. A Dictionary of the Fungi. Commonwealth Mycological Institute, Kew, Surrey, England.
2. Carlile, M.J., Watkinson, S.C and Gooday, G.W. 2001. The Fungi. 2nd Edition. Academic Press, San Diego
3. Manoj Parihar, Anand Kumar. 2021. Biopesticides. Volume 2: Advances in Bio-inoculants. Elsevier.
4. Bailey, A., Chandler, D., Grant, W. P., Greaves, J., Prince, G., Tatchell, M. 2010. Biopesticides: pest management and regulation.Plumx.
5. Manoharachary, C., Singh, H.B., Varma, A. 2020. Trichoderma: Agricultural Applications and Beyond. Springer International Publishing, New York, USA.
6. Nollet, L.M.L and Rathore, H.S. 2019. Biopesticides Handbook. CRC Press, Florida, USA.
7. Anwer, M.A. 2021. Biopesticides and Bioagents: Novel Tools for Pest Management.

Apple Academic Press, Florida, USA.
8. Awasthi, L.P. 2021. Biopesticides in Organic Farming: Recent Advances. CRC Press, Florida, USA.
9. Bailey, A., Chandler, D., Grant, W., Greaves, J., Prince, G., Tatchell, M., 2012. Biopesticides: Pest Management and Regulation. CABI, Surrey, UK.
10. Glare, T.R and Moran-Diez, M.E. 2016. Microbial-Based Biopesticides: Methods and Protocols. Humana Press, New Jersey, USA.
11. Gnanamanickam,S.S.2019.BiologicalControlofCropDiseases.CRCPress,Florida,USA.

Web resources:

1. https://www.kobo.com/gr/en/ebook/phytochemistry-2
2. https://www.amazon.in/Textbook-Pharmacognosy-Phytochemistry-Kumar-Jayaveera-ebook/dp/B06XKSY76H
3. https://www.amazon.in/Computational-Phytochemistry-Satyajit-Dey-Sarker-ebook/dp/B07CV96NZJ
4. https://studyfrnd.com/pharmacognosy-and-phytochemistry-book/
5. https://www.worldcat.org/title/textbook-of-pharmacognosy-and-phytochemistry/oclc/802053616
6. https://www.worldcat.org/title/phytochemistry/oclc/621430002

MappingwithProgrammeOutcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3	3	3	3	3	3
CO2	3	2	2	2	3	2	3	1	3	3
CO3	3	3	3	3	1	2	S	2	3	2
CO4	3	2	2	2	3	3	2	1	2	1
CO5	3	3	3	3	2	2	2	3	2	3

S-Strong (3) M-Medium (2) L – Low(1)

SKILL ENHANCEMENT (SE1)

Title of the Course	**P23BOS21** **(NME)** **NURSERY AND GARDENING**

Paper Number	**SKILL ENHANCEMENT**						
Category	Skill Enhancement	**Year**	I	**Credits**	2	**CourseCode**	
		Semester	II				
InstructionalHours perweek		**Lecture**		**Tutorial**		**LabPractice**	**Total**
		2		2		--	4
Pre-requisite	Students should know nursery and gardening practices.						
Learning Objectives	1.To recognize the importance of nursery and gardening						
	2.To gain an understanding of nursery management.						
	3.To develop skills necessary to manage a wholesale nursery.						
	4.To acquire knowledge regarding theory and practice of rising plants.						
	5.To develop an interest to become an entrepreneur.						

UNIT	CONTENTS
I	**NURSERY:** Definition, objectives and scope and building up of infrastructure for nursery, planning and se Planting - direct seeding and transplants.
II	**SEED:** Structure and types - Seed dormancy; causes and methods of breaking dormancy - Seed sto factors affecting seed viability, genetic erosion - Seed production technology - seed testing and
III	**VEGETATIVE PROPAGATION:** Air-layering, cutting, selection of cutting, collecting season, treatment of cutting, rooting mediu cuttings - Hardening of plants - green house - mist chamber, shed root, shade house and glassho
IV	**GARDENING:** definition, objectives and scope - different types of gardening - landscape and home gardeni components - plant materials and design - computer applications in landscaping.
V	**GARDENING OPERATIONS:** Soil laying, manuring, watering, management of pests and diseases and harvesting. Sowing/ra seedlings: Transplanting of seedlings - Study of cultivation of different vegetables: cabba finger, onion, garlic, tomatoes, and carrots - Storage and marketing procedures.

Course outcomes: CO	**On completion of this course, the students will be able to:**

CO1 Recognize the basic process required for growing and maintaining plants in nurseries.	
CO2 Explain the different methods of plant propagation and various gardening styles.	
CO3 Apply techniques for effective hardening of plants and computer applications for creative gardening.	
CO4 Compare and contrast cultivation of different vegetables and growth of plants in nursery and gardening.	
CO5 Develop new strategies to enhance growth and quality of nursery plants.	
ExtendedProfessionalComponent (is a part ofinternal component only,Not to be included in theExternalExamination questionpaper)	QuestionsrelatedtotheabovetopicsfromvariouscompetitiveexaminationsUPSC CSIR/GATE/TNPSC/otherstobesolved (TobediscussedduringtheTutorialhour)
Skillsacquiredfromthis course	Knowledge,ProblemSolving,Analyticalability,Professional Competency,ProfessionalCommunicationandTransferrableSkill

RecommendedText:

1. Bose T.K and Mukherjee, D. 1972. Gardening in India, Oxford & IBH Publishing Co., New Delhi.
2. Sandhu, M.K. 1989. Plant Propagation, Wile Eastern Ltd., Bengaluru.
3. Kumar, N. 1997. Introduction to Horticulture, Rajalakshmi Publications, Nagercoil.
4. Edmond Musser and Andres. 1957. Fundamentals of Horticulture, McGraw Hill Book Co., New Delhi.
5. Agrawal, P.K. 1993. Hand Book of Seed Technology, Dept. of Agriculture and Cooperation, National Seed Corporation Ltd., New Delhi.

Reference Books:

1. N.L. Patel, S.L. Chawla, T.R. Ahlawat:Commercial Horticulture‖, 2016, ASPEE College of Horticulture, Navsari Agricultural University, Navsari 396 450, Gujarat,
2. Prasad S & Kumar U. 2005. Greenhouse Management for Horticultural Crops. 2nd Ed. Agrobios.
3. George Acquaah, 2002, Horticulture-principles and practices. Prentice-Half of India pvt. Ltd., New Delhi.
4. Abraham, A and Vatsala, P. 1981. Introduction to Orchids. Trop. Bot. Garden, Trivandrum.
5. Hartman, H.T and Kester, D.E. 1989. Plant propagation. Printice Hall Ltd., New Delhi.

Web resources:

1. https://www.kopykitab.com/Nursery-And-Gardening-SEC-by-Prof-C-D-Patil-Dr-G-M-Rane-Dr-S-A-Patil
2. https://www.wonderslate.com/nursery-and-gardening-management/ebook-details?siteName=books&bookId=38078&preview=true
3. https://books.google.co.in/books/about/Nursery_Hindi_Book_Bonsai_Plants_Nursery.html?id=-nfDDwAAQBAJ&redir_esc=y
4. https://www.amazon.in/Gardening-Books/b?ie=UTF8&node=1318122031

5 .https://www.worldcat.org/title/handbook-of-horticulture/oclc/688653648

MappingwithProgrammeOutcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	1	3	2	1	2	2	3	2
CO2	3	3	2	2	3	3	2	3	2	3
CO3	2	2	3	3	1	2	1	3	3	1
CO4	3	3	3	3	3	2	3	3	3	1
CO5	3	3	2	3	2	3	1	2	3	2

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

CORE-VII LABORATORY COURSE-II COVERING PAPERS, IV, V AND VI

Title of the Course	**P23BOP22: LABORATORY COURSE-II**						
Paper Number	**CORE VII**						
Category	Core	**Year**	I	**Credits**	4	**CourseCode**	
		Semester	II				
InstructionalHours perweek		**Lecture**		**Tutorial**	**LabPractice**		**Total**
		2		-	4		6
Pre-requisite	Theoretical understanding of plant taxonomy, ecology and phytogeography, embryology as well as basic laboratory skills for the relevant core course.						
Learning Objectives	1.Understand and develop skill sets in plant morphological, floral characteri key preparation.						
	2.Expedite skilled workers to carry out research in frontier areas of plant scien						
	3.Classify meristems and identify their structures, functions and roles in r plants growth and secondary growth of woody plants						
	4.Learn the importance of plant anatomy in plant production systems.						
	5Know about different vegetation sampling methods.						

UNIT	EXPERIMENTS
I	**TAXONOMY AND ECONOMIC BOTANY OF ANGIOSPERMS** Preparation of artificial keys. Description of a species, based on virtual herbarium and live specimens of the families theory. Study the products of plants mentioned in the syllabus of economic botany with special refere morphology, botanical name and family. Solving nomenclature problems. **Field trip:** A field trip at least 3-4 days to a floristically rich area to study plants in nature and field rep not less than 20 herbarium sheets representing the families studied.

II	**ANATOMY** 1. Study of shoot apex of *Hydrilla* 2. Observation of cambial types. 3. Sectioning and observation of nodal types. 4. Study of anomalous secondary growth of the following: STEM- *Nyctanthus, Bouerhhavia, Aristolochia, Bignonia, Piper* petal and *Mirabilis*. ROOT: *Acyranthus* 5. Observation of stomatal types by epidermal peeling. 6. Maceration of wood and observation of the components of xylem. 7. Double staining technique to study the stem anomali.
III	**EMBRYOLOGY** 1. Observation of T.S. of anther. 2. Observation of ovule types. 3. Observation of mature embryo sacs. 4. Dissection and observation of embryos (globular and cordate embryos). 5. Study of pollen morphology 6. Study of in vitro pollen germination. 7. Observation of endosperm types.
IV	**ECOLOGY,** 1. Determination of the quantitative characters of a plant community by random (abundance, density, dominance, species diversity, frequency) in grazing land, forests. 2. Estimation of above ground and below ground biomass in a grazing land employing quadrat. 3. To determine soil moisture, porosity and water holding capacity of soil collected from different locations. 4. Determination of pH of soil and water by universal indicator (or) pH meter. 5. Determinationofdissolvedoxygen. 6. Estimationofcarbonate. 7. Estimationofbicarbonate.
V	**PHYTOGEOGRAPHY, CONSERVATION BIOLOGY &INTELLECTUAL PROPERT** 1. Mapping of world vegetation 2. Mapping of Indian vegetation. 3. Remote sensing – Analyzing and interpretation of Satellite photographs- Vegetation/ v 4. Visit to remote sensing laboratory (at Anna University, Regional Meteorological Centre at Numgambakkam).

Course outcomes: On completion of this course, the students will be able to:	
CO	
CO1	To gain recent advances in plant morphological and floral characteristics.

CO2 Understand about different floral characteristics and artificial key preparation which employed for plant identification and conservation.	
CO3 Recall or remember the information including basic and advanced in relation with plant anatomy and embryology.	
CO4 Apply their idea on sectioning and dissection of plants to demonstrate various stages of plant development.	
CO5 Know about different vegetation sampling methods.	

ExtendedProfessionalComponent (is a part ofinternal component only,Not to be included in theExternalExamination questionpaper)	Questionsrelatedtotheabovetopics,fromvariouscompetitiveexaminationsUPSC CSIR/GATE/TNPSC/otherstobesolved (TobediscussedduringtheTutorialhour)
Skillsacquiredfromthis course	Knowledge,ProblemSolving,Analyticalability,Professional Competency,ProfessionalCommunicationandTransferrableSkill

RecommendedText:

1. Subramaniam, N.S. 1996. Laboratory Manual of Plant Taxonomy. Vikas Publishing House Pvt. Ltd., New Delhi.
2. Gokhale, S.B., Kokate, C.K. and Gokhale, A. 2016. Pharmacognosy of Traditional Drugs. NiraliPrakashan, 1st Edition. ISBN: 9351642062.
3. Joshi, S.G. 2018. Medicinal Plants. Oxford & IBH Publishing C., Pvt., Ltd., New Delhi. ISBN: 9788120414143.
4. Cutler, D.F., Botha, C.E.J., Stevenson, D.W., and William, D. 2008. Plant anatomy: an applied approach (No. QK641 C87). Oxford: Blackwell, UK.
5. Sundara, R. S. 2000. Practical manual of plant anatomy and embryology. Anmol Publ. PVT LTD, New Delhi.
6. Panshin, A.J and C. de Zeeuw.1980.Textbook of wood technology. Structure, identification and uses of the commercial woods of the United States and Canada. Fourth Edition. New York: McGraw-Hill Book Company.
7. Sharma, H.P. 2009. Plant Embryology: Classical and Experimental, Bombay Popular Prakashan, ISBN-8173199698, 9788173199691.

Reference books:

1. Aler Gingauz.2001. MedicinalChemistry.OxfordUniversityPress&WileyPublications.
2. MannJ.Davidson,R.SandJ.B.Hobbs,D.V.Banthorpe,J.B.Harborne.1994.*NaturalProducts*. Longman Scientificand TechnicalEssex.
3. Gopalan,C., B.V.RamasastriandS.C.Balasubramanian.1985.NutritiveValueofIndianFoods. NationalInstituteofNutrition,Hyderabad.
4. Harborne. J.B. 1998. Phytochemical methods. A guide to modern techniques of Plant Analysis, Chapman and Hall publication, London.
5. Traditionalplantmedicinesassourcesofnewdrugs.P.JHoughtoninPharmacognosy.Treaseand Evan's.16Ed.2009.
6. Sundara Rajan, S, 2003. Practical Manual of Plant Anatomy and Embryology 1st ed, Anmol Publications, ISBN-812610668.
7. Katherine Esau. 2006. Anatomy of Seed Plants. 2nd edition, John Wiley and Sons.

Web resources:

1. https://www.kobo.com/gr/en/ebook/phytochemistry-2
2. https://www.amazon.in/Textbook-Pharmacognosy-Phytochemistry-Kumar-Jayaveera-ebook/dp/B06XKSY76H
3. https://www.amazon.in/Computational-Phytochemistry-Satyajit-Dey-Sarker-ebook/dp/B07CV96NZJ
4. https://studyfrnd.com/pharmacognosy-and-phytochemistry-book/
5. https://www.worldcat.org/title/textbook-of-pharmacognosy-and-phytochemistry/oclc/802053616
6. https://www.worldcat.org/title/phytochemistry/oclc/621430002

MappingwithProgrammeOutcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3	3	3	S	3	3
CO2	3	3	2	3	3	2	1	2	3	2
CO3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	1	2	3
CO5	3	2	2	3	3	3	3	2	3	3

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