M.Sc. BOTANY

LOCF SYLLABUS 2023

Department of Botany
School of Biological Sciences
St. Joseph's College (Autonomous)
Tiruchirappalli - 620 002, Tamil Nadu, India

Vision

Forming globally competent, committed, compassionate and holistic persons, to be men and women for others, promoting a just society.

Mission

- Fostering learning environment to students of diverse background, developing their inherent skills and competencies through reflection, creation of knowledge and service.
- Nurturing comprehensive learning and best practices through innovative and value-driven pedagogy.
- Contributing significantly to Higher Education through Teaching, Learning, Research and Extension.

Programme Educational Objectives (PEOs)

- Graduates will be able to accomplish professional standards in the global environment.
- Graduates will be able to uphold integrity and human values.
- Graduates will be able to appreciate and promote pluralism and multiculturalism in working environment.

Programme Outcomes (POs)

1. Graduates will be able to apply assimilated knowledge to evolve tangible solution to emerging problems.
2. Graduates will be able to analyze and interpret data to create and design new knowledge.
3. Graduates will be able to engage in innovative and socially relevant research and effectively communicate the findings.
4. Graduates will become ethically committed professional and entrepreneurs upholding human values.
5. Graduates imbibed with ethical values and social concern will be able to understand and appreciate cultural diversity, social harmony and ensure sustainable environment.

Programme Specific Objectives (PSOs)

1. Graduates are prepared to be creators of new knowledge in the field of life sciences, causing innovation and entrepreneurship, employable in various sectors such as private, government, and clinical /biomedical research organizations.
2. Graduates are trained to study and evolve the biomolecular mechanisms for the life processes in health and diseases.
3. Graduates are groomed to carry on research in biology on chemical basis, by exploring their knowledge independently.
4. Graduates are encouraged to design and conduct experiments, to analyze and interpret biological problems behind the research.
5. Graduates ought to have the ability of effectively communicating the findings of Biological sciences with existing knowledge ethically.

CONTINUOUS INTERNAL ASSESSMENT
Categorizing Outcome Assessment Levels Using Bloom's Taxonomy

Level	Cognitive Domain	Description
K1	Remember	It is the ability to remember the previously learned concepts or ideas.
K2	Understand	The learner explains concepts or ideas.
K3	Apply	The learner uses existing knowledge in new contexts.
K4	Analyse	The learner is expected to draw relations among ideas and to compare and contrast.
K5	Evaluate	The learner makes judgements based on sound analysis.
K6	Create	The learner creates something unique or original.

Question Paper Blueprint for Mid and End Semester Tests

<table>
<tr><td colspan="3">Duration: 2 Hours</td><td colspan="6">Maximum Marks: 60</td></tr>
<tr><td colspan="2" rowspan="2">Section</td><td colspan="6">K level*</td><td rowspan="2">Marks</td></tr>
<tr><td>K1</td><td>K2</td><td>K3</td><td>K4</td><td>K5</td><td>K6</td></tr>
<tr><td colspan="2">A (no choice)</td><td>7</td><td></td><td></td><td></td><td></td><td></td><td>7 × 1 = 7</td></tr>
<tr><td colspan="2">B (no choice)</td><td></td><td>5</td><td></td><td></td><td></td><td></td><td>5 × 3 = 15</td></tr>
<tr><td colspan="2">C (either… or type)</td><td></td><td></td><td>3</td><td></td><td></td><td></td><td>3 × 6 = 18</td></tr>
<tr><td rowspan="4">D (2 out of 3)</td><td>Courses with K4 as the highest cognitive level</td><td></td><td></td><td></td><td>2</td><td></td><td></td><td rowspan="4">2 × 10 = 20</td></tr>
<tr><td>Courses with K5 as the highest cognitive level wherein one question each on K4 and K5 is compulsory.
(Note:K4 has two questions whereas, K5 has no choice.)</td><td></td><td></td><td></td><td>1</td><td>1</td><td></td></tr>
<tr><td rowspan="2">Courses with K6 as the highest cognitive level wherein one question each on K5 and K6 is compulsory.
(Note: Mid Sem: K4 has two questions whereas, K5 has no choice; End sem: K5 has two questions whereas, K6 has no choice)</td><td></td><td></td><td></td><td colspan="2">Mid Sem</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td colspan="2">End Sem</td></tr>
<tr><td colspan="6">Total</td><td>60</td></tr>
</table>

** K4 and K5 levels will be assessed in the Mid semester test whereas K5 and K6 levels will be assessed in the End semester test.*

Question Paper Blueprint for Mid and End Semester Tests *(For quantitative courses only)*

Duration: 2 Hours							**Maximum Marks: 60**
Section	**K level**						**Marks**
	K1	**K2**	**K3**	**K4**	**K5**	**K6**	
A *(no choice)*	5	4					9 × 1 = 9
B *(either… or type)*			2	1			3 × 5 = 15
C *(2 out of 3)*					1	1*	2 × 18 = 36
						Total	**60**

NOTE: *K4 and K5 will be assessed in the Mid semester test whereas K5 and K6 will be assessed in the End semester test.*
** K6 compulsory*

SEMESTER EXAMINATION
Question Paper Blueprint for Semester Examination

Duration: 3 Hours								**Maximum Marks: 100**
Section		**K level**						**Marks**
		K1	**K2**	**K3**	**K4**	**K5**	**K6**	
A *(no choice, two questions from each unit)*		10						10 × 1 = 10
B *(no choice, two questions from each unit)*			10					10 × 3 = 30
C *(either… or type, one question from each unit)*				5				5 × 6 = 30
D *(3 out of 5, one question from each unit)*	*Courses with K4 as the highest cognitive level*				3			3 × 10 = 30
	Courses with K5 as the highest cognitive level wherein two K4 questions and one K5 question are compulsory. (Note: Three questions on K4 and two questions on K5)				2	1		
	Courses with K6 as the highest cognitive level wherein one question each on K4, K5, and K6 is compulsory. (Note: Two questions each on K4 and K5 and one question on K6)				1	1	1	
							Total	**100**

Question Paper Blueprint for Semester Examination *(For quantitative courses only)*

Section	Marks	K level
A	10 × 1 = 10	K1
B	5 × 6 = 30 *(either…or)*	K2 *(Q. No. 11 & 12)* K3 *(Q. No. 13, 14 & 15)*
C	4 × 15 = 60 *(4 out of 5)*	K4 *(Q. No. 16 & 17)* K5 *(Q. No. 18 & 19)* K6 *(Q. No. 20 compulsory)*
Total Marks: 100		

Evaluation Pattern for Part IV One/Two Credit Courses

Title of the Course	CIA	Semester Examination	Total Marks
Internship	100		**100**
UG Skill Enhancement Course (Non Major Elective) Foundation Course **PG** Ability Enhancement Course	20 + 10 + 20 = 50	50 *(External member from the Department)*	**100**
Value Education	50	50 *(CoE)*	**100**

M.Sc. BOTANY							
PROGRAMMAE PATTERN							
Course Details					Scheme of Exams		
Sem	**Course Code**	**Title of the Course**	**Hours**	**Credits**	**CIA**	**SE**	**Final**
1	23PBO1CC01	**Core Course - 1:** Plant Diversity - 1 (Algae, Fungi, Lichens and Bryophytes)	6	6	100	100	100
	23PBO1CC02	**Core Course - 2:** Plant Diversity - 2 (Pteridophytes, Gymnosperms and Paleobotany)	6	6	100	100	100
	23PBO1CP01	**Core Practical - 1:** Plant Diversity - 1 and 2	6	4	100	100	100
	23PBO1ES01	**Elective - 1:** Microbiology, Immunology and Plant Pathology	5	3	100	100	100
	23PBO1ES02	**Elective - 2:** Herbal Technology	5	3	100	100	100
	23PBO1AE01	**Ability Enhancement Course:** Nursery and Gardening	2	1	100	-	100
		Total	**30**	**23**			
2	23PBO2CC03	**Core Course - 3:** Plant Physiology	6	6	100	100	100
	23PBO2CC04	**Core Course - 4:** Plant Anatomy, Embryology and Morphogenesis	5	5	100	100	100
	23PBO2CP02	**Core Practical - 2:** Plant Physiology	3	2	100	100	100
	23PBO2CP03	**Core Practical - 3:** Plant Anatomy, Embryology and Morphogenesis	3	2	100	100	100
	23PBO2SP01	**Self-paced Learning:** Plant Breeding and Evolution*	-	2	50	50	50
	23PBO2ES03A	**Elective - 3:** Biophysics and Instrumentation	5	4	100	100	100
	23PBO2ES03B	**Elective - 3:** Plant Pathology					
	23PSS2SE01	**Skill Enhancement Course:** Soft Skills	4	3	100	-	100
	23PBO2EG01	**Generic Elective - 1 (WS):** Medicinal Botany	4	3	100	100	100
	-	Extra Credit Courses (MOOC/Certificate Courses) - 1	-	(3)			
		Total	**30**	**27(3)**			
3	23PBO3CC05	**Core Course - 5:** Plant Systematics	5	5	100	100	100
	23PBO3CP04	**Core Practical - 4**: Plant Systematics	4	4	100	100	100
	23PBO3CC06	**Core Course - 6:** Biochemistry	5	5	100	100	100
	23PBO3CP05	**Core Practical - 5:** Biochemistry	4	4	100	100	100
	23PBO3CC07	**Core Course - 7:** Pharmacognosy	3	3	100	100	100
	23SBS3CC01	**Common Core:** Intellectual Property Rights	5	4	100	100	100
	23PBO3EG02	**Generic Elective - 2 (BS):** Horticulture and Landscaping	4	3	100	100	100
	-	Extra Credit Courses (MOOC/Certificate Courses) - 2		(3)			
		Total	**30**	**28(3)**			
4	23PBO4CC08	**Core Course - 8:** Research Methodology	5	5	100	100	100
	23PBO4CC09	**Core Course - 9:** Genetic Engineering and Biotechnology	5	5	100	100	100
	23PBO4CC10	**Core Course - 10:** Cell and Molecular Biology	5	4	100	100	100
	23PBO4CP06	**Core Practical - 6:** Research Methodology, Genetic Engineering and Biotechnology	4	3	100	100	100
	23PBO4ES04A	**Elective - 4:** Organic Farming	5	4	100	100	100
	23PBO4ES04B	**Elective - 4:** Genetics					
	23PBO4PW01	Project Work and Viva Voce	6	5	100	100	100
	23PBO4CE01	Comprehensive Examination*	-	2	50	50	50
	-	Extra Credit Courses (MOOC/Certificate Courses) - 3		(3)			
		Total	**30**	**28(3)**			
2 - 4	23PCW4OR01	Outreach Programme (SHEPHERD)		4			
1 - 4		**Total (2 years)**	**120**	**110**			

*- for grade calculation 50 marks are converted into 100 in the mark statements

Semester	Course Code	Title of the Course	Hours/Week	Credits
1	**23PBO1CC01**	**Core Course - 1**: Plant Diversity - 1 (Algae, Fungi, Lichens & Bryophytes)	**6**	**5**

Course Objectives
To learn about the classification, distinguishing traits, geographic distribution, and reproductive cycle of algae, fungi, lichens, and bryophytes.
To gain knowledge about the ecological and economic importance of algae, fungi, lichens and bryophytes.
To spark interest in the evolutionary roots of plant development.
To study the biodiversity by describing and explaining the morphology and reproductive processes of algae, fungi, bryophytes and microorganisms.
To expose the beneficial and harmful viewpoint.

UNIT I: Algae **(18 Hours)**

General account of algology, Contributions of Indian Phycologist (M.O.P. Iyanger, T.V.Desikachary andV.Krishnamurthy), 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*.

UNIT II: Fungi **(18 Hours)**

General Characteristics, occurrence and distribution. Mode of nutrition in fungi. Contributions of Indian Mycologists (C.V.Subramanian), Classification of Fungi by G.C. Ainsworth (1973) and Alexopoulos and Mims (1983) Phylogeny and inter-relationships of major groups of fungi. General characters of major classes: Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina and Deuteromycotina.Heterothallism in fungi, Para sexuality, sex hormones in fungi. Structure and reproduction of the following: Mastigomycotina -*Albugo*; Zygomycotina- *Rhizopus*; Ascomycotina -*Saccharomyces;* Basidiomycotina-*Puccinia*;Deutromycotina-*Cercospora*.

UNIT III: Lichens **(18 Hours)**

Introduction and Classification (Hale, 1969). Occurrence and inter-relationship of phycobionts and mycobionts, structure and reproduction in Ascolichens, Basiodiolichens and Deuterolichens.

UNIT IV: Bryophytes **(18 Hours)**

General characters and Classification of Bryophytes by Watson (1971). Distribution, structural variations and evolution of gametophytes and sporophytes in Hepaticopsida, Anthocerotopsida and Bryopsida. General characters of major groups - Marchantiales, Jungermaniales, Anthocerotales, Sphagnales, Funariales and Polytrichales. Reproduction – Vegetative, asexual and sexual, spore dispersal mechanisms in bryophytes, spore germination patterns in bryophytes.Structure, reproduction and life histories of the following genera: *Marchantia, Porella,nbbAnthoceros,*and *Polytrichum.*

UNIT V: Economic Importance **(18 Hours)**

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 –Ecological and economic importance. Bryophytes – Ecological and economic importance – industry, horticulture and medicine.

Teaching Methodology	Chalk and talk, PPT, charts, Video

Books for Study

1. Kumar, H. D. (1999). *Introductory phycology*. Affiliated East-West Press.
2. Barsanti, L., & Guadtieri, P. (2014). *Algae: anatomy, biochemistry and biotechnology* (2nd ed.). CRC Press.
3. Sharma, O. P. (2011). *Fungi and allied microorganisms*. McGraw-Hill.
4. Kavanagh, K. (2018). *Fungi biology and applications* (3rd ed). Wiley Blackwell.
5. Pandey, P. B. (2014). *College Botany 1: Including algae, fungi, lichens, bacteria, viruses, plant pathology, industrial microbiology and bryophyta*. Chand Publishing.
6. Singh, V., Pande, P. C., & Jain, D. K. (2020). *A textbook of botany* (5th ed.). Rastogi Publications.
7. Sharma, O. P. (2014). *Bryophyta*. McGraw-Hill.

Books for Reference

1. Sundaralingam, V. (1991). *Marine algae*. Bishen Singh and Mahendra Pal Singh Publishers.
2. Lee, R. E. (2018). *Phycology* (5th ed.). Cambridge University Press.
3. Nash, T. H. (2008). *Lichen biology*. Cambridge University press.
4. Johri, R. M., Lata, S., & Tyagi, K. (2012). *A textbook of bryophyta*. Dominant Publishers & Distributors Pvt., Ltd.
5. Alexopoulos, C. J., & Mims, M. (2007). *Introductory mycology* (4th ed.). Wiley Publishers.

Websites and eLearning Sources

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

Course Outcomes		
CO No.	**CO-Statements**	**Cognitive Levels (K - Level)**
	On successful completion of this course, students will be able to	
CO1	relate to the structural organizations of algae, fungi, lichens and Bryophytes.	**K1**
CO2	demonstrate both the theoretical and practical knowledge understanding the diversity of basic life forms and their importance.	**K2**
CO3	explain life cycle patterns in algae, fungi, lichens and Bryophytes.	**K3**
CO4	compare and contrast the mode of reproduction in diverse groups basic plant forms.	**K4**
CO5	discuss and develop skills for effective conservation and utilization of lower plant forms.	**K5**
CO6	develop entrepreneurship skill through industrially important organisms	**K6**

Relationship Matrix

Semester	**Course code**	**Title of the Course**					**Hours**	**Credits**	
1	**23PBO1CC01**	**Core Course - 1**: Plant Diversity - 1 (Algae, Fungi, Lichens & Bryophytes)					**6**	**5**	
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	**3**	**2**	**3**	**2**	**2**	**3**	**2**	**2**	**3**	**2**	**2.4**
CO2	**2**	**3**	**2**	**3**	**2**	**3**	**2**	**3**	**2**	**1**	**2.3**
CO3	**2**	**2**	**3**	**2**	**1**	**3**	**3**	**2**	**3**	**1**	**2.2**
CO4	**3**	**3**	**2**	**3**	**2**	**3**	**3**	**2**	**3**	**2**	**2.6**
CO5	**2**	**2**	**3**	**2**	**1**	**3**	**2**	**3**	**2**	**1**	**2.1**
CO6	**2**	**1**	**2**	**2**	**1**	**2**	**3**	**2**	**3**	**2**	**2.0**
Mean overall Score											**2.3 (High)**

Semester	Course Code	Title of the Course	Hours/ Week	Credits
1	23PBO1CC02	**Core Course - 2:** Plant Diversity - 2 (Pteridophytes, Gymnosperms and Paleobotany)	6	5

Course Objectives
To investigate the classification, distinctive traits, distribution and reproduction and life history of the various classes and major types of Pteridophytes and Gymnosperms.
To identify and characterize diversity of lower vascular plants in order to comprehend the dynamics of diversity to realize the importance of diversity.
To research the classification, phylogeny and economic importance of Pteridophytes and Gymnosperms.
To study and understand the phylogeny and Palaeontology of Pteridophytes and Gymnosperms.
To learn about the concept of fossils and process of fossilization; distinctive characteristics of fossil records of Pteridophytes and Gymnosperms.

UNIT I: Pteridophytes **(18 Hours)**

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.

UNIT II: Pteridophytes **(18 Hours)**

Structure, anatomy, reproduction and life histories of the following genera: *Isoetes*, *Equisetum, Angiopteris*, *Osmunda*, *Pteris* and *Azolla*.

UNIT III: Gymnosperms **(18 Hours)**

General characters - A general account of distribution of Gymnosperms. Morphology, anatomy, reproduction, phylogeny and classification (K.R.Sporne, 1965). Economic importance of Gymnosperms.

UNIT IV: Gymnosperms **(18 Hours)**

Structure (Exomorphic and endomorphic), anatomy, reproduction and life histories of the following genera: *Cycas,Pinus, Araucaria, Podocarpus, Gnetum*and *Ephedra*.

UNIT V: Paleobotany **(18 Hours)**

Geological Scale; Radiocarbon dating; Contribution of BirbalSahni to 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*.

Teaching Methodology	PPT, Video, Chalk and talk, charts

Books for Study

1. Vashishta, P. C., Sinha, A. K., & Kumar, A. (2016). *Botany for degree students - Gymnosperms*. S. Chand and Company Ltd.
2. Singh, V., Pande, P. C., & Jain, D. K. (2021). *A textbook of botany*. Rastogi Publications.
3. Bhatnagar, S. P., & Moitra, A. (2020). *Gymnosperms*. New Age International (P) Ltd.
4. Sharma, O. P. (2017). *Pteridophyta*. McGraw Hill Education.
5. Vashishta. P. C., Sinha, A. K., & Kumar, A. (2018). *Botany for degree students - Gymnosperms*. S. Chand and Company Ltd.
6. Johri, R. M., Lata, S., & Tyagi, K. (2005). *A textbook of gymnosperm.* Dominate Publishers and Distributers.

Books for Reference

1. Parihar, N. S. (2019). *An introduction to embryophyta: Pteridophytes* (5th ed.). Surjeet Publications.
2. Pandey, S. N., & Trivedi, P. S. (2015). *A textbook of botany* (Vol. 2) (12th ed.) (Paperback). Vikas Publishing.
3. Rashid, A. (2013). *An introduction to pteridophyta – diversity, development and differentiation* (2nd ed.). Vikas Publications.
4. Arnold A. C. (2005). A*n introduction to paleobotany*. Agrobios (India).
5. Sporne, K. R. (2017). *The morphology of pteridophytes (The structure of ferns and allied plants)* (Paperback). Andesite Press.
6. Sporne, K. R. (1967). *The morphology of gymnosperms*. Hutchinson & Co.
7. Taylor, E., Taylor, T., & Krings, M. (2008). *Paleobotany: The biology and evolution of fossil plants* (2nd ed.). Academic Press.

Websites and eLearning Sources

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
9. https://trove.nla.gov.au/work/11471742?q&versionId=46695996

Course Outcomes		
CO No.	**CO-Statements** On successful completion of this course, students will be able to	**Cognitive Levels (K - Level)**
CO1	recall on classification, recent trends in phylogenetic relationship, general characters of Pteridophytes and Gymnosperms.	**K1**
CO2	learn the morphological/anatomical organization, life history of major types of Pteridophytes and Gymnosperms.	**K2**
CO3	comprehend the economic importance of Pteridophytes, Gymnosperms, and fossils.	**K3**
CO4	understanding the evolutionary relationship of Pteridophytes and Gymnosperms.	**K4**
CO5	awareness on fossil types, fossilization and fossil records of Pteridophytes and Gymnosperms.	**K5**
CO6	develop entrepreneurship skill through industrially important organisms.	**K6**

Relationship Matrix											
Semester	**Course code**	**Title of the Course**								**Hours**	**Credits**
1	**23PBO1CC02**	**Core Course - 2:** Plant Diversity – 2 (Pteridophytes, Gymnosperms and Paleobotany)								**6**	**5**
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	**3**	**2**	**3**	**2**	**2**	**3**	**2**	**2**	**3**	**2**	**2.4**
CO2	**2**	**3**	**2**	**3**	**2**	**3**	**2**	**3**	**2**	**1**	**2.3**
CO3	**2**	**2**	**3**	**2**	**1**	**3**	**3**	**2**	**3**	**1**	**2.2**
CO4	**3**	**3**	**2**	**3**	**2**	**3**	**3**	**2**	**3**	**2**	**2.6**
CO5	**2**	**2**	**3**	**2**	**1**	**3**	**2**	**3**	**2**	**1**	**2.1**
CO6	**2**	**1**	**2**	**2**	**1**	**2**	**3**	**2**	**3**	**2**	**2.0**
Mean overall Score											**2.3 (High)**

Semester	Course Code	Title of the Course	Hours/Week	Credits
1	23PBO1CP01	**Core Practical - 1**: Plant Diversity -1 and 2	6	4

Course Objectives
To learn how to employ the use of instruments, technologies and methodologies related to thallophytes and non-flowering plant groups.
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.
To comprehend the fundamental concepts and methods used to identify Bryophytes, Pteridophytes and Gymnosperms through morphological changes and evolution, anatomy and reproduction.
To develop the technical abilities in staining, sectioning, sterilizing, and characterizing. Thallophytes and other varieties of non-flowering plants.
To compare the structural diversity of fossil and extant plant species.

Experiments

UNIT I: 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 the following living forms: *Oscillatoria*, *Caulerpa, Ulva, Codium,* Diatoms*, Sargassum*and *Gracillaria*(depending on availability of the specimen).

To record the local algal flora–Study of their morphology and structure.

Identification of algae to species level (at least One).

Preparation of culture media and culture of green algae in the laboratory (Demonstration).

UNIT II: Fungi

Study of morphological and reproductive structures of the following living forms: *Plasmodiophora*, *Rhizopus*, *Pilobulus*, *Polyporus* and *Colletotrichum* (depending on availability of the specimen).

Preparation of culture media and culture of fungi in the laboratory.

Isolation and identification of fungi from soil, air, and Baiting method.

LICHENS: Study of morphological and reproductive structures of the genera *Usnea*.

UNIT III: Bryophytes

External morphology and internal anatomy of the vegetative and reproductive organs of thefollowing living forms: *Marchantia,Porella, Anthoceros*and *Polytrichum*(depending onavailability of thespecimen).

UNIT IV: Pteridophytes

External morphology and internal anatomy of the vegetative and reproductive organs of the following living forms: *Isoetes, Equisetum,Angiopteris, Osmunda, Pteris* and*Azolla*(depending onavailability of thespecimen).

Fossilslidesobservation:*Rhynia, Lepidocarpon, Calamites.*

UNIT V: Gymnosperms

External morphology and internal anatomy of the vegetative and reproductive organs of thefollowinglivingforms:*Cycas,Pinus, Araucaria, Podocarpus, Gnetum*and *Ephedra* (depending onavailability of thespecimen).

Fossil slides observation: *Cordaites* and *Lyginopteris*.

Teaching Methodology	Demonstration, videos, chart, PPT,

Books for Study

1. Kumar, H. D. (1999). *Introductory phycology*. Affiliated East-West Press.
2. Das, S. & Saha, R. (2020). *Microbiology practical manual*. CBS Publishers and Distributors (P) Ltd.
3. Sharma, O. P. (2012). *Pteridophyta*. Tata McGraw-Hills Ltd.
4. Sharma O. P., & Dixit, S. (2002). *Gymnosperms*. Pragati Prakashan.
5. Johri, R. M., Lata, S., & Tyagi, K. (2005). *A textbook of gymnosperm.* Dominate Publishers and Distributers.

Books for Reference

1. Chmielewski, J. G., & Krayesky, D. (2013). *General botany laboratory manual*. Author House.
2. Webster, J., & Weber, R. (2007). *Introduction to fungi* (3rd ed.). Cambridge University Press.
3. Sharma, O. P. (2017). *Bryophyta*, MacMillan India Ltd.
4. Bendre, A.,. & Kumar, A. (2010). *A textbook of practical botany: algae, fungi, lichen, bryophyta, pteridophyta, gymnosperms and palaeobotany* (Rev. ed.). Revised edition. Rastogi Publications.
5. Gangulee, H. C., & Kar, A. K. (2013). *College botany* (5th ed.). S. Chand.

Websites and eLearning Sources

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=gy mnosperms&printsec=frontcover
7. https://www.amazon.in/Paleobotany-Biology-Evolution-Fossil-Plants/dp/0123739721

Course Outcomes		
CO No.	**CO-Statements** On successful completion of this course, students will be able to	**Cognitive Levels (K - Level)**
CO1	recall and applying the basic keys to distinguish at species level identification of important algae and fungi through its structural organizations	**K1**
CO2	demonstrate practical skills in thallophytes, Pteridophytes and Gymnosperms	**K2**
CO3	describe the structure of algae, fungi, lichens, Bryophytes, Pteridophytes and Gymnosperms	**K3**
CO4	determine the importance of structural diversity in the evolution of plant forms	**K4**
CO5	formulate techniques to isolate and culture of alga and fungi as well as to understand the diversity of plant forms	**K5**
CO6	develop entrepreneurship skill through industrially important organisms	**K6**

Relationship Matrix

Semester	Course code	Title of the Course	Hours	Credits
1	23PBO1CP01	**Core Practical - 1**: Plant Diversity -1 and 2	6	4

Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	3	2	2	3	2	2	3	2	2.4
CO2	2	3	2	3	2	3	2	3	2	1	2.3
CO3	2	2	3	2	1	3	3	2	3	1	2.2
CO4	3	3	2	3	2	3	3	2	3	2	2.6
CO5	2	2	3	2	1	3	2	3	2	1	2.1
CO6	2	1	2	2	1	2	3	2	3	2	2.0
									Mean overall Score		2.3 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
1	23PBO1ES01	**Elective - 1:** Microbiology, Immunology and Plant Pathology	5	3

Course Objectives
The goal of the course is to provide students with basic understanding of microbiology, immunology, plant pathology and the etiology of specific plant diseases.
To provide comprehensive knowledge about microbes and its effect on man and environment.
To provide comparative analysis of major groups of microbes.
To study the principles of immune system, immunizing agents like antibodies and vaccines and gene therapy methods.
To enhance the knowledge and skills needed for self-employment using the microbial derived products.

UNIT I: Bacteria **(15 Hours)**

General characteristic of bacteria – Outline classification of Bergey's manual of 9thedition. Classification of bacteria based on Morphological, cultural, physiological and molecular characteristics. Bacterial growth – batch culture and continuous culture. Growth Curve. Factors affecting growth, Reproduction:Methodsof preservation of Bacterial cultures.

UNIT II: Viruses **(15 Hours)**

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.

UNIT III: Food Microbiology **(15 Hours)**

Beneficial role of microbes – yoghurt, Olives, Cheese, Bread, Wine, Tempeh, Miso and Fermented green tea. Spoilage of fruits, vegetables, meats, poultry, eggs, bakery products and dairy products. Food poisoning and Food borne infections. Methods of food preservation. Soil Microbiology: Importance of Microbial flora of soil and factors affecting the microbial community in soil. Environmental Microbiology: Microbiology of water and air. Water borne diseases: diphtheria, chicken pox. Air borne diseases: Tuberculosis and Swine flu

UNIT IV: Immunology **(15 Hours)**

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.

UNIT V: Plant Pathology **(15 Hours)**

Concepts of Plant disease, history and significance of plant pathology.General symptoms and Classification of plant diseases,Pathogenesis:pathogens and their mode of dissemination, pre-penetration, penetration and post penetration changes. Role of Chemical Weapons (Enzymes, Toxins) in disease development. Disease triangle. Defence mechanism in plants – structural and biochemical defences. Important diseases of crop plants in India –yellow vein Mosaic of Bhindi, Bacterial blight of rice, Late blight of potato and Little leaf of Brinjal. Principles of disease management: Cultural practices, physical, chemical and biological methods.

Teaching Methodology	Demonstration, videos, chart, PPT

Books for Study

1. Singh, R. S. (2018). *Introduction to principles of plant pathology* (4th ed.).
2. Bilgrami, K. S., & Dube, H. C. (2010). *A textbook of modern plant pathology*. Vikas Publishing House (P) Ltd.
3. Mehrotra, R. S., & Aggarwal, A. (2017). *Plant pathology*. McGraw Hill Publisher.
4. Dube, H. C. (2010). *A textbook of fungi, bacteria and viruses* (3rd ed.). Agrobios India.
5. Rao, C. V. (2006). *Immunology* (2nd ed.). Narosa Publisher.
6. Murphy, K. (2017). *Janeway's immunobiology*. (9th ed.). Garland Publisher.
7. Sullia, S. B., & Shantharam, S. (1998). *General microbiology*. Oxford and IBH Publishing Co. Pvt. Ltd.
8. Adams, M. R., & Moss, M.O. (2008). *Food microbiology*. Royal Soc. Chem.

Books for Reference

1. Agrios, A. G. (2007). *Plant pathology*, Elsevier.
2. Jeffery, C., & Pommerville. (2014). *Alcamo's fundamentals of microbiology*. (10th ed.). Johnsand Bartlett Learning.
3. Pelczar, M. J. (2007). *Microbiology* (35th ed.). Tata-McGraw Hill Publications.
4. Ravichandra, N. G. (2013). *Fundamentals of plant pathology*. Phi Learning.
5. Willie, J., & Sherwood, L. (2016). *Prescott's microbiology* (10th ed.). McGraw-Hill Education.
6. Chaube, H. S. & Singh, R. (2015). *Introductory plant pathology*. CBS Publishers.
7. Rangasamy, G. (2006). *Disease of crop plants in India* (4th ed.). Tata McGraw Hill.
8. Mishra, A., Bohra, A., & Mishra, A. (2011). *Plant pathology-disease and management*. Agro Bios.

Websites and eLearning Sources

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

Course Outcomes		
CO No.	**CO-Statements** On successful completion of this course, students will be able to	**Cognitive Levels (K - Level)**
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**
CO6	appreciate the role of immune system in conferring disease resistance.	**K6**

Relationship Matrix											
Semester	**Course code**	**Title of the Course**								**Hours**	**Credits**
1	**23PBO1ES01**	**Elective - 1:** Microbiology, Immunology and Plant Pathology								**5**	**3**
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	**3**	**2**	**3**	**2**	**2**	**3**	**2**	**2**	**3**	**2**	**2.4**
CO2	**2**	**3**	**2**	**3**	**2**	**3**	**2**	**3**	**2**	**1**	**2.3**
CO3	**2**	**2**	**3**	**2**	**1**	**3**	**3**	**2**	**3**	**1**	**2.2**
CO4	**3**	**3**	**2**	**3**	**2**	**3**	**3**	**2**	**3**	**2**	**2.6**
CO5	**2**	**2**	**3**	**2**	**1**	**3**	**2**	**3**	**2**	**1**	**2.1**
CO6	**2**	**1**	**2**	**2**	**1**	**2**	**3**	**2**	**3**	**2**	**2.0**
Mean overall Score											**2.3 (High)**

Semester	Course Code	Title of the Course	Hours/Week	Credits
1	23PBO1ES02	**Elective - 2:** Herbal Technology	5	3

Course Objectives
To understand various plants-based drugs used in Ayurveda, Unani, Homeopathy and Siddha.
To apply the knowledge to cultivate medical plants.
To know the pharmacological importance of medicinal plants.
To enlist phytochemicals and secondary metabolites of market and commercial value.
To design and develop their own business prepositions such as the making of herbal insecticides.

UNIT I: Herbal Medicines and Pharmacognosy (15 Hours)

Definition and importance of Herbal medicines. Pharmacognosy scope and importance – source – Crude Drugs – Scope and Importance, Classification (Taxonomical, Morphological Chemical, Pharmacological); Cultivation, Collection and processing of crude drugs. Cultivation and utilization of medicinal and aromatic plants in India. National Medicinal Plants Board of India.

UNIT II: Plant Tissue Culture as Source of Plant material production for Medicines

(15 Hours)

Plant tissue culture as source of medicines, Role of plant tissue culture in enhancing secondary metabolite production (*Withaniasomnifera, Rauwolfia93erpentine, Catheranthusroseus, Andrographispaniculata* and*Dioscorea*sp) – Elicitation – Biotransformation, Hairy root culture. Factors affecting secondary metabolites production.

Unit III: Standardization of Plant Drug Materials and Phytochemicals (15 Hours)

Methods of Drug evaluation (Morphological, microscopic, physical and chemical). Phytochemical investigations – standardization and quality control of herbal drugs. Preliminary screening, Assay of Drugs – Biological evaluation/assays, Microbiological methods – Chemical Methods of Analysis, Detection of Adulterants: Chemical estimations, Spectrophotometry and fluorescence analysis. Drug adulteration – Types of adulterants.

Unit IV: Analysis of Phytochemicals and Biological Screening (15 Hours)

Carbohydrates and derived products: Glycosides – extraction methods (*Digitalis, Dioscorea*); Tannins (Hydrolysable and Condensed types); Volatile oils – extraction methods (Clove, Mentha). Study of some herbal formulation techniques as drug cosmetics.

Unit V: Types of Phytochemicals **(15 Hours)**

Alkaloids – extraction methods (*Taxus, Cinchona*); Flavonoids- extraction methods, Resins-extraction method: Application of phytochemicals in phytopharmacueticals; Biocides, Biofungicides, Biopesticides. Women entrepreneurship development – marketing cultivated medicinal plants.

Teaching Methodology	PPT, chalk and talk, herbal preparations and practical demonstration.

Books for Study

1. Kokate, C. K., Purohit, A. P., & S.B. Gokhale. (1996). *Pharmacognosy* (4th ed.). Nirali Prakashan.
2. Roseline, A. (2011). *Pharmacognosy*. MJP publishers.
3. Tilgner, S. M. (2018). *Herbal ABC's: The foundation of herbal medicine*. Wise Acres LLC.
4. Hornok, L. (1997). *Natural products in medicine: A biosynthetic approach*. Wiley.
5. Chichister, U. K. J. (1999). *Cultivation and processing of medicinal plants*. Wiley & Sons. Trease and Evans.
6. Mukherjee, P. K. (2008). *Quality control of herbal drugs* (3rd ed.). Business Horizons Pharmaceutical Publishers.
7. Kirtikar, K. R., & Basu, B. D. (2012). *Indian medicinal plants*. University Bookstore.
8. Biswas, P. K. (2006). *Encyclopedia of medicinal plants* (Vol. 1-7). Dominant Publishers.
9. Chaudhuri, A. B. (2007). *Endangered medicinal plants*. Daya Publishing House.

Books for Reference

1. Wallis, T. E. (1999). *Textbook of pharmacognosy*. CBS Publishers and Distributors,
2. Kumaresan, V., & Regland, A. (2004). *Taxonomy of angiosperms: Systematic botany, economic botany, botany & ethnobotany*.
3. Anonymous. (2004). *Cultivation of selected medicinal plants*. National Medicinal Plants Board, Govt. of India.
4. Rao, A.V. (2000). *Herbal cure for common diseases*. Diamond books Pvt. Ltd.
5. Dey, A.C. (1998). *Indian medicinal plants used in ayurvedic preparations*. Bishen Singh Mahendra Pal Singh.
6. Sathya, S., Jaiganesh, K.P., & Sudha, T. (2019). *Current trends in herbal drug technology*. Pharmacy Council of India.
7. Lewis, W. H., & Elwin-Lewis, M. P. F. (1976). *Medical botany: Plants affecting man's health*. Wiley Inter Science Publication. John Wiley and Sons.

Websites and eLearning Sources

1. https://www.kopykitab.com/Herbal-Science
2. https://kadampa.org/books/free-ebook-download-howtotyl?gclid=CjwKCAiA6vXwBRBKEiwAYE7iS5t8yenurClUCTdV9olKo9TbyAh4fsoFqPYWGs5qBTbytD22z7lo0BoCYnUQAvD_BwE
3. https://www.barnesandnoble.com/b/free-ebooks/nook-books/alternative-medicine-natural-healing/herbal-medicine/_/N-ry0Z8qaZ11iu
4. http://cms.herbalgram.org/heg/volume8/07July/HerbalEBooks.html?t=1310004932&ts=1579066352&signature=1dd0d5aef818b19bcdcd6c063a78e404

5. https://www.dattanibookagency.com/books-herbs-science.html
6. https://www.springer.com/gp/book/9783540791157

Course Outcomes		
CO No.	**CO-Statements** On successful completion of this course, students will be able to	**Cognitive Levels (K - Level)**
CO1	recollect the importance of herbal technology.	**K1**
CO2	understand the classification of crude drugs from various botanical sources.	**K2**
CO3	analyze on the application of secondary metabolites in modern medicine.	**K3**
CO4	create new drug formulations using therapeutically valuable phytochemical compounds for the healthy life of society.	**K4**
CO5	comprehend the current trade status and role of medicinal plants in socio economic growth.	**K5**
CO6	develop entrepreneurship skill through learning preparation processes of herbal drugs and phytoconstituents.	**K6**

Relationship Matrix											
Semester	**Course code**		**Title of the Course**							**Hours**	**Credits**
1	**23PBO1ES02**		**Elective - 2:** Herbal Technology							**5**	**3**
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	**3**	**2**	**3**	**2**	**2**	**3**	**2**	**2**	**3**	**2**	**2.4**
CO2	**2**	**3**	**2**	**3**	**2**	**3**	**2**	**3**	**2**	**1**	**2.3**
CO3	**2**	**2**	**3**	**2**	**1**	**3**	**3**	**2**	**3**	**1**	**2.2**
CO4	**3**	**3**	**2**	**3**	**2**	**3**	**3**	**2**	**3**	**2**	**2.6**
CO5	**2**	**2**	**3**	**2**	**1**	**3**	**2**	**3**	**2**	**1**	**2.1**
CO6	**2**	**1**	**2**	**2**	**1**	**2**	**3**	**2**	**3**	**2**	**2.0**
Mean overall Score											**2.3 (High)**

Semester	Course Code	Title of the Course	Hours/Week	Credits
1	23PBO1AE01	**Ability Enhancement Course:** Nursery and Gardening	2	1

Course Objectives
To recognize the importance of nursery and gardening.
To gain an understanding of nursery management.
To develop skills necessary to manage a wholesale nursery.
To acquire knowledge regarding theory and practice of rising plants.
To develop an interest to become an entrepreneur.

UNIT I: Nursery **(6 Hours)**

Definition, objectives and scope and building up of infrastructure for nursery, planning and seasonal activities – Planting: direct seeding and transplants.

UNIT II: Seed **(6 Hours)**

Structure and types - Seed dormancy; causes and methods of breaking dormancy - Seed storage: Seed banks, factors affecting seed viability, genetic erosion - Seed production technology - seed testing and certification.

UNIT III: Vegetative Propagation **(6 Hours)**

Air-layering, cutting, selection of cutting, collecting season, treatment of cutting, rooting medium and planting of cuttings - Hardening of plants - green house - mist chamber, shed root, shade house and glasshouse.

UNIT IV: Gardening **(6 Hours)**

Definition, objectives and scope - different types of gardening - landscape and home gardening - parks and its components - plant materials and design - computer applications in landscaping.

UNIT V: Gardening Operations **(6 Hours)**

Soil laying, manuring, watering, management of pests and diseases and harvesting. Sowing/ raising of seeds and seedlings: Transplanting of seedlings - Study of cultivation of different vegetables: cabbage, brinjal, lady's finger, onion, garlic, tomato and carrot - Storage and marketing procedures.

Teaching Methodology	PPT, videos and practical demonstration.

Books for Study

1. Bose, T. K., & Mukherjee, D. (1972). *Gardening in India.* Oxford & IBH Publishing Co.
2. Sandhu, M. K. (1989). *Plant propagation.* Wile Eastern Ltd.
3. Kumar, N. (1997). *Introduction to horticulture*. Rajalakshmi Publications.
4. Agrawal, P. K. (1993). *Handbook of seed technology*. Dept. of Agriculture and Cooperation, National Seed Corporation Ltd.

Books for Reference

1. Prasad, S., & Kumar, U. (2005). *Greenhouse management for horticultural crops* (2nd ed.). Agrobios.
2. Acquaah, G. (2002). *Horticulture: Principles and practices*. Prentice Hall of India Pvt. Ltd.
3. Abraham, A., & Vatsala, P. (1981). *Introduction to orchids*. Tropical Botanic Garden and Research Institute.
4. Hartman, H. T., & Kester, D. E. (1989). *Plant propagation*. Prentice Hall Ltd.

Websites and eLearning Sources

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

Course Outcomes		
CO No.	**CO-Statements** On successful completion of this course, students will be able to	**Cognitive Levels (K - Level)**
CO1	compare and contrast cultivation of different vegetables and growth of plants in nursery and gardening.	**K4**
CO2	develop new strategies to enhance growth and quality of nursery plants.	**K5**
CO3	develop necessary skill in different propagation techniques in gardening	**K6**

Relationship Matrix

Semester	Course code	Title of the Course					Hours	Credits			
1	23PBO1AE01	**Ability Enhancement Course:** Nursery and Gardening					2	1			
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	3	2	3	2	3	3	2	3	2	2.6
CO2	2	2	3	2	1	3	2	3	2	1	2.1
CO3	2	1	2	2	1	2	3	2	3	2	2.0
Mean overall Score											2.2 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
2	23PBO2CC03	**Core Course - 3:** Plant Physiology	6	6

Course Objectives
Develop an advanced understanding of plant physiological processes, including photosynthesis, respiration, and nutrient regulation at multiple levels.
Gain research expertise in plant physiology, encompassing experimental design, data analysis, and modern research tools.
Apply plant physiology knowledge to address practical challenges in agriculture, environment, and biotechnology through critical thinking.
Enhance communication skills for effectively conveying scientific ideas in both written and oral formats to diverse audiences.
Promote ethical research practices in plant physiology with a focus on sustainability and environmental responsibility.

UNIT I **(18 Hours)**

Water and Plant cells: Diffusion and osmosis, water potential. Water balance of plants: absorption by roots, transport through the xylem, transpiration. Mineral nutrition: essential nutrients, deficiencies, plant disorders. Solute transport: passive and active transport, molecular basis of inter and intracellular uptake and transport. Pattern, pathway and mechanism of translocation in the phloem.

UNIT II **(18 Hours)**

Photosynthesis: The light reactions-nature of light, properties and various roles of pigments, organisation of photosynthetic apparatus and light absorbing antenna systems, molecular basis of electron transport and its coupling to ATP synthesis. The carbon reactions- The Calvin-Benson cycle, photorespiration, inorganic carbon concentrating mechanisms (The C4 carbon cycle, Crassulacean Acid Metabolism), and carbon allocation (starch and sucrose).

UNIT III **(18 Hours)**

Respiration: Glycolysis, gluconeogenesis and their regulation. Oxidation of pyruvate and the Citric Acid cycle. Pasteur effect, anaplerotic reactions, amphibolic nature of the Citric Acid cycle. Oxidative pentose phosphate pathway and its roles. Respiratory chain complexes and oxidative phosphorylation, internal and external NAD(P) Hdehydrogenase, alternative oxidase. Nonphosphorylating mechanisms and their roles. Bottom-upregulation of plant respiration. The Glyoxylate cycle.

UNIT IV **(18 Hours)**

Nitrogen in the environment; assimilation of nitrate and ammonium-GS- GOGAT; biological nitrogen fixation. Plant responses to light signals: the phytochromes and the blue-light responses (cryptochromes, phototropins and zeaxanthin). Biosynthesis, metabolism, transport, physiological and developmental effects of auxin, gibberellin, cytokinin, ethylene and abscisic acid.

UNIT V **(18 Hours)**

Flowering and fruit development: Floral evocation, Circadian rhythm, photoperiodism, vernalisation. Physiology of fruit development and ripening. Physiology of seed development, maturation, dormancy, germination and tropisms. Ageing and senescence-types and physiological/ biochemical changes. Abiotic stress (drought, heat and salinity): Plant responses and mechanisms of tolerance.

Teaching Methodology	Lecture, technologies, and group learning

Books for Study

1. William, G.H., & Norman, P.A. (2009). *Introduction to Plant Physiology* (4th Ed.). John Wiley & Sons.
2. Taiz, L., Zeiger, E., Moller, I. M., & Murphy, A. (2015). *Plant Physiology*. (6th Ed.). Sinauer Associates.

Books for Reference

1. Noggle, G.R., & Fritz, G.J. (2001). *Introductory Plant Physiology.* Prentice-Hall.
2. Devlin, R. M. (2000). *Plant Physiology.* Affiliated East West Press Pvt. Ltd.
3. Epstein, E. (2000). *Mineral Nutrition in Plants - Principles and Perspectives*, Wiley.
4. Salisbury, F. B., & Ross, C. W. (1992). *Plant Physiology* (4th Ed.). Wadsworth Publishing CO.

Websites and eLearning Sources

1. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5593313/
2. https://www.nobelprize.org/prizes/chemistry/1997/boyer/25946-the-binding-change-mechanism/
3. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3645666/
4. https://www.frontiersin.org/articles/10.3389/fpls.2018.01771

Course Outcomes		
CO No.	**CO-Statements** On successful completion of this course, students will be able to	**Cognitive Levels (K- Level)**
CO1	recall and describe fundamental principles of plant physiology, such as photosynthesis, respiration, and nutrient uptake, demonstrating basic knowledge retention.	**K1**
CO2	explain the intricate molecular and cellular mechanisms underlying key physiological processes in plants, showcasing a deeper understanding of plant physiology concepts.	**K2**
CO3	apply advanced knowledge of plant physiology to design and conduct experiments, demonstrating the ability to integrate theoretical concepts into practical research.	**K3**
CO4	analyze and interpret complex data sets related to plant physiological experiments, showcasing proficiency in data analysis and critical thinking skills.	**K4**
CO5	communicate scientific findings effectively through well-structured written reports and articulate presentations, demonstrating advanced communication skills tailored to diverse audiences.	**K5**
CO6	evaluate ethical considerations in plant physiology research, demonstrating an understanding of the importance of responsible conduct and sustainable practices in the field.	**K6**

Relationship Matrix											
Semester	**Course Code**			**Title of the Course**						**Hours**	**Credits**
2	**23PBO2CC03**			**Core Course - 3:** Plant Physiology						**6**	**6**
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	3	3	2	2	3	3	3	2	3	**2.7**
CO2	3	3	3	2	2	3	3	3	2	2	**2.6**
CO3	3	3	3	3	3	3	3	3	2	3	**2.9**
CO4	3	3	3	2	2	3	3	3	2	2	**2.6**
CO5	3	3	3	3	3	3	3	3	3	3	**3**
CO6	3	3	3	2	2	3	3	3	2	2	**2.6**
Mean Overall Score											**2.73 (High)**

Semester	Course Code	Title of the Course	Hours/Week	Credits
2	23PBO2CC04	**Core Course - 4:** Plant Anatomy, Embryology and Morphogenesis	5	5

Course Objectives
To understand the primary and secondary structure of dicots and monocots with reference to root, stem and leaves.
To attain basic knowledge of the structure and development of male and female gametophytes in plants
To know the process of development in microsporogenesis and megasporogenesis.
To know fertilization, post fertilization changes and developmental process in embryology.
To understand the mechanisms underlying the developmental flexibility of plants.

UNIT I **(15 Hours)**

General account on theories of organization of shoot and root apical meristem, quiescent centre. Structural diversity and phylogenetic trends of specialization of xylem and phloem, Cambium - origin, cellular structure, cell division, storied and non-storied types. Role of cambium in budding, grafting and in wound healing. Trichomes, periderm and lenticels.

UNIT II **(15 Hours)**

Anatomical characteristics and vascular differentiation in primary and secondary structure of root and stem (Dicot and Monocot), Origin of lateral roots, Root stem transition, Anatomy of Dicot and Monocot leaf. Leaf abscission, stomata types, nodal anatomy, petiole anatomy, vascularization of flower and seedling.

UNIT III **(15 Hours)**

Microsporangium - Microsporogenesis, Microspores - morphology, ultrastructure, Microgametogenesis, Pollen - Stigma - Incompatibility, Methods to overcome incompatibility. Megasporangium - Megagametogenesis, Female gametophyte - Monosporic, Bisporic and Tetrasporic, Nutrition of embryo sac and fertilization.

UNIT IV **(15 Hours)**

Endosperm - Types, haustoria, Cytology and physiology and functions of endosperms, Embryo development - Dicot and Monocot, Nutrition of embryo. Polyembryony - Causes. Apomixis - Causes. Apospory - their role in plant improvement programs and seed development.

UNIT V **(15 Hours)**

Morphogenesis- Definition, morphogenesis and its relation to morphology, Turing's diffusion reaction theory, Morphogenetic factors - growth regulators, genetic and environment, polarity. Molecular basis of morphogenesis, Cellular level morphogenesis, Asymmetric divisions and their significance, Morphogenesis at tissue level - Differentiation, dedifferentiation and redifferentiation of vascular tissue *in vitro* and *in vivo* and in wounds. Plant galls and their importance in morphogenesis.

Teaching Methodology	PPT, videos and practical demonstration

Books for Study

1. Fahn, A. (1989). *Plant Anatomy*. Maxwell Pvt. Ltd.
2. Bhojwani, S.S., & Bhatnagar, S.P. (1981). *Embryology of Angiosperms*. Vikas Publishing House Pvt. Ltd.

Books for Reference

1. Bard, J. (1990). *Morphogenesis*. Cambridge University Press.

2. Agarwal, S. B. (1990). *Embryology of Angiosperms - a fundamental approach*. SahityaBhawan.
3. Pandey, B. P. (1989). *Plant Anatomy*. S. Chand & Co. Ltd.

Websites and eLearning Sources

1. https://academic.oup.com/book/53725/chapter-abstract/422168601?redirectedFrom=fulltext
2. https://www.jove.com/science-education/11094/plant-morphogenesis-growth-differentiation-and-communication
3. http://www.uprtou.ac.in/other_pdf/12_01_2023_DCBY_105.pdf

CO No.	Course Outcomes CO-Statements On successful completion of this course, students will be able to	Cognitive Levels (K- Level)
CO1	acquire knowledge about the tissues of stem, root and leavesin plants.	**K1**
CO2	describe the primary and secondary structure of dicots andmonocots with reference to root, stem and leaves.	**K2**
CO3	attain basic knowledge of the structure and development ofmale and female gametophytes in plants.	**K3**
CO4	compare and determine the structure and development ofdicot and monocot embryos.	**K4**
CO5	integrate the morphogenesis, endosperm development and polyembryony.	**K5**
CO6	gain knowledge about morphogenesis at cellular level.	**K6**

Relationship Matrix											
Semester	**Course Code**				**Title of the Course**					**Hours**	**Credits**
2	**23PBO2CC04**				**Core Course - 4:** Plant Anatomy, Embryology and Morphogenesis					**5**	**5**
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	2	3	2	2	3	2	2	2	2	**2.3**
CO2	2	3	2	2	1	2	3	2	2	2	**2.1**
CO3	2	2	3	2	1	3	3	2	3	1	**2.2**
CO4	3	3	2	1	1	2	1	2	1	2	**2.1**
CO5	2	3	2	2	3	2	3	2	2	3	**2.6**
CO6	2	1	2	3	2	2	3	2	1	2	**2.0**
Mean Overall Score											**2.2 (High)**

Semester	Course Code	Title of the Course	Hours/Week	Credits
2	**23PBO2CP02**	**Core Practical - 2:** Plant Physiology	**3**	**2**

Experiments

1. Determination of water potential (Shardakov's method).
2. Determination of solute potential.
3. Hills reaction.
4. Estimation of total acidity in CAM plants.
5. Apparent photosynthesis.
6. Effect of CO2 concentration on photosynthesis
7. Effect of quality of light on photosynthesis
8. Estimation of total free aminoacids and proline.
9. *In vivo* assay of NR and NiR.
10. Estimation of IAA.
11. Estimation of starch by perchloric method.
12. Estimation of nitrogen (Nessler's method).
13. Determination of activity of peroxidase and lipase

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Semester	Course Code	Title of the Course	Hours/Week	Credits
2	**23PBO2CP03**	**Core Practical - 3:** Plant Anatomy, Embryology and Morphogenesis	**3**	**2**

Plant Anatomy and Embryology

- Study of stem and root anatomy in dicot and monocot.
- Study of leaf anatomy - structure, types of stomata, Trichomes.
- Study the anomalous secondary features in *Boerhaavia* and *Bignonia*.
- Micrometry of xylem elements.
- study of pollen morphotypes (Malvaceae and Asteraceae)
- Isolation of different stages of embryo and polyembryony in citrus, Jamun (*Syzygium cumini*)
- Tests for pollen viability using stains and *in vitro* germination. Pollen germination using hanging drop technique.

Semester	Course Code	Title of the Course	Hours/Week	Credits
2	23PBO2SP01	**Self-paced Learning:** Plant Breeding and Evolution	-	2

Course Objectives
To outline the progress made in the field of plant breeding.
To comprehend the principles, techniques, modes of reproductionin crops and applications of plant breeding.
To demonstrate the theories of evolution.
To analyse the hybridization techniques.
To test the knowledge on heterosis, mutation and polyploidy.

UNIT I

Plant Breeding: Historical aspect of plant breeding and genetic basis. Breeding methods: sexual, asexual and apomitic reproduction. Floral Biology in relation to selfing and crossing techniques. Centres of diversity and origin of cultivated plants. Role of National and International Institutes.

UNIT II

Hybridization: Objectives, choice of parents, problems and causes of failure of hybridization. Incompatibility and sterility, Methods of handling genetic consequence of hybridization, method of handling segregation material for isolation of superior strains - Bulk method and pedigree method of selection. Role of interspecific and intergeneric hybridization in plant improvement.

UNIT III

Inbreeding depression and heterosis: Genetic basis and application in plant breeding. Steps in the production of single cross, double cross, three-way cross; induced polyploidy in plant breeding; role of auto- and allopolyploidy, Heteroploid, Mutation and crop improvement. Population genetics: Hardy-Weinberg principle; gene frequencies and the factors that change it.

UNIT IV

Back Crossing: Theory and procedure for transferring various types of character. Preservation and utilization of germplasm. Breeding of rice, sugarcane, groundnut and maize. Application of biotechnology to plant breeding - embryo rescue, somaclonal variation, doubled haploid, protoplast fusion and transgenic.

UNIT V

Evolution: Origin of life, theories of evolution of life forms: Lamarkism, Darwinism and Speciation. Variations - Definition, causes and types, Mutations (Principles of Hugo de Veries), Role of mutations in speciation. Evidences for evolution, adaptive radiation, biological evolution. Impact of evolution on human life.

Teaching Methodology	JOSTEL, Course material

Books for Study

1. Chaudhari, R. C. (2017*). Introductory Principles of Plant Breeding*. Kindle Edition.
2. Singh, P. (2017). *Fundamentals of Plant Breeding*. Kalyani Publishers,

3. Manokaran, K. V. (2010). *Essentials of Plant Breeding.* PHI Learning Private Limited Publishers.

Books for Reference

1. Brown, P.C. & Campos, H. (2014). *Introduction to Plant Breeding*. (2nd Ed.). Wiley Blackwell Publishers.
2. Izak, B., & Caligari, P. (2007). *Selection Methods in Plant Breeding*. Springer.

Websites and eLearning Sources

1. https://link.springer.com/chapter/10.1007/978-981-19-5434-4_1
2. https://www.seedworld.com/the-evolution-of-plant-breeding/
3. https://evolution.berkeley.edu/evolution-101/an-introduction-to-evolution/

CO No.	Course Outcomes **CO-Statements** On successful completion of this course, students will be able to	Cognitive Levels (K - Level)
CO1	acquire knowledge on floral biology and selection of proper breeding method	**K1**
CO2	critically analyze information about life and its origins	**K2**
CO3	cultivate skill in emasculation and pollination of various crop plants	**K3**
CO4	gain expertise on hybrid seed production techniques	**K4**
CO5	learn to use the descriptors in various crops for selection of superior genotypes	**K6**
CO6	able to understand the importance of evolution in plant breeding.	**K5**

Relationship Matrix											
Semester	**Course Code**		**Title of the Course**							**Hours**	**Credits**
2	**23PBO2SP01**		**Self-paced Learning:** Plant Breeding and Evolution							**-**	**2**
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	3	2	2	2	2	3	3	1	2	**2.3**
CO2	2	3	2	2	3	2	3	2	3	1	**2.3**
CO3	2	3	2	3	1	2	3	3	2	3	**2.4**
CO4	1	3	2	3	2	2	3	2	3	2	**2.3**
CO5	2	2	2	3	2	2	3	2	3	3	**2.4**
CO6	3	1	2	3	2	3	2	2	3	2	**2.3**
Mean Overall Score											**2.4 (High)**

Semester	Course Code	Title of the Course	Hours/Week	Credits
2	23PBO2ES03A	**Elective - 3:** Biophysics and Instrumentation	5	4

Course Objectives
To acquire knowledge on various types of centrifugation, spectroscopy andtracer techniques.
To relate the importance of biophysics in modern biology.
To apply the laws of thermodynamics in biology.
To evaluate and illustrate the concept of redox potential in biologicalsystem.
To integrate various types of microscopy and their applications.

UNIT I **(15 Hours)**

Introduction to biophysics, its importance in modern biology. Bioenergetics: First and second law of thermodynamic, internal energy, enthalpy, entropy, concept of free energy, standard free energy change of a chemical reaction, ATP and high energy phosphate compounds.

UNIT II **(15 Hours)**

Biophotonics: Redox potential, Oxidation and reduction, redox potential and its calculation by Nernst equation, examples of redox potential in biological system. Osmosis and osmotic pressure, the role of osmosis in cell volume regulation. The iso, hypo, and hypertonic solutions, their influence on the cell.Ionic diffusion. Active and passive bioelectric properties of membranes.

UNIT III **(15 Hours)**

Microscopy: Bright field microscopy-magnification, resolving power and contrast. Dark field microscopy, phase-contrast microscopy, fluorescent microscopy, electron microscopy (SEM andTEM). Electrophoresis: AGE, PAGE, SDS-PAGE.

UNIT IV **(15 Hours)**

Centrifugation: Principle, procedure and application. Types of centrifugation - density gradient centrifugation, ultracentrifugation and differential centrifugation. Chromatography: Principles, instrumentation, and applications of Paper, thin layer, column chromatography, gas chromatography, HPTLC and GC-MS.

UNIT V **(15 Hours)**

Spectrophotometry: principles and instrumentation of UV/Vis, Atomic absorption spectrophotometer (AAS), NMR, ESR. Tracer techniques: Important stable radioisotopes and their uses in research. Radiation hazards and precautions in handling radioisotopes. Measurement of radioactivity- autoradiography, GM counter and scintillation counter.

Teaching Methodology	PPT, videos and practical demonstration

Books for Study

1. Banerjee, P.K. (2008). *Introduction to Biophysics*. S. Chand.
2. McMahon, G. (2007). *Analytical Instrumentation: A Guide to Laboratory, Portable and Miniaturized Instruments*. John Wiley & Sons, Ltd. ISBN: 9780470027950.

Books for Reference

1. Roy, R.N. *A text book of Biophysics*. New Central Book Agency Pvt. Ltd.
2. Upadhyay, Upadhyay & Nath. *Biophysical Chemistry*. Himalaya Publ. House.

3. Mohan Arora. *Biophysics*. Himalaya Publishing House.

Websites and eLearning Sources

1. https://microbenotes.com/microscope/
2. https://microbenotes.com/centrifugation-principle-types-and-applications/
3. https://www.nrc.gov/about-nrc/radiation/health-effects/measuring-radiation.html

CO No.	Course Outcomes **CO-Statements** On successful completion of this course, students will be able to	Cognitive Levels (K - Level)
CO1	know the kinds of energy and differentiate entropy and enthalpy.	**K1**
CO2	value the importance of cell wall and the manipulation of cell wall.	**K2**
CO3	understand the basic principles and applications of microscope.	**K3**
CO4	apply the principles of centrifugation in biology.	**K4**
CO5	value the importance of radioisotopes in biology.	**K5**
CO6	integrate various types of chromatographic and spectroscopic techniques.	**K6**

Relationship Matrix											
Semester	**Course Code**	**Title of the Course**								**Hours**	**Credits**
2	23PBO2ES03A	**Elective - 3:** Biophysics and Instrumentation								**5**	**4**
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	3	2	1	2	2	3	2	1	2	**2.1**
CO2	2	3	2	2	3	2	3	2	2	1	**2.2**
CO3	2	2	3	2	1	2	2	3	2	2	**2.1**
CO4	1	2	2	3	2	1	3	2	3	2	**2.1**
CO5	1	2	2	3	2	2	3	2	2	3	**2.2**
CO6	2	2	2	2	1	2	1	2	3	3	**2.0**
										Mean Overall Score	**2.1 (High)**

Semester	Course Code	Title of the Course	Hours/Week	Credits
2	23PBO2ES03B	**Elective - 3:** Plant Pathology	5	4

Course Objectives
To acquire knowledge on pathogenesis and disease establishment inplants
To learn the process of mode of dissemination and disease development
To recognize the effect of Microbe infection on host physiology
To comprehend the various different types of disease control mechanism
To familiarize the concepts in plant immunity and various defence mechanism in plants

UNIT I **(15 Hours)**

Concept of plant disease - definitions of disease, disease cycle and pathogenicity. General symptoms and Classification of plant diseases. History of Plant Pathology with special references to Indian work.

UNIT II **(15 Hours)**

Pathogenesis- pathogens and their mode of dissemination, pre-penetration, penetration and post penetration changes. Role of Chemical Weapons (Enzymes, Toxins and Growth regulators) in disease development.

UNIT III **(15 Hours)**

Effect of infection on physiology of host *viz*. photosynthesis, respiration, carbohydrate metabolism, nitrogen metabolism, phenols, shikimic acid pathway, importance of phenol oxidation in plant diseases.

UNIT IV **(15 Hours)**

Plant diseases: causal organisms, symptoms, disease cycle and control measures for the following diseases: White rust of Crucifers, Bacterial blight of paddy, Yellow vein Mosaic of Bhindi, covered smut of Barley, Spike disease in Sandal. Integrated Disease Management (IDM) -Plant diseases control: Cultural, physical, chemical and biological methods.

UNIT V **(15 Hours)**

General concepts on plant immunity: morphological, structural defence mechanisms and biochemical defence mechanisms, pre-existing defence mechanisms. Phytoalexins, defence through induced synthesis of proteins and enzymes. Molecular Basis of Defence Mechanism: Signal Transduction, Recognition of the pathogen by the host, transmission of the alarm signal to the host defence providers.

Teaching Methodology	PPT, videos and practical demonstration

Books for Study

1. Singh, R.S. (2018). *Introduction to Principles of Plant Pathology,* (4th Ed.). Scientific International.
2. Mehrotra, R.S., & Aggarwal, A. (2017). *Plant Pathology*. McGraw Hill Publisher Co. Ltd.

Books for Reference

1. Sharma, P.D. (2001). *Microbiology and plant pathology*. Rastogi publications.
2. Rangasamy, G. (1998). *Diseases of crop plants in India*. Prentice- Hall of India.
3. Mukherjee, K.G., & Jayanti, B. (1986). *Plant diseases of India*. Tata MacGraw-Hill.
4. Harsfall, J.G., & Cowling, E.B. (1979). *Plant Disease, an Advanced Treatise.* Academic Press.

Websites and eLearning Sources

1. http://www.jnkvv.org/PDF/11042020102651plant_pathology.pdf

2. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3218475/#:~:text=Two%20layers%20of%20plant%20immune,perception%20of%20microbe%20general%20elicitors.

CO No.	Course Outcomes **CO-Statements** On successful completion of this course, students will be able to	Cognitive Levels (K- Level)
CO1	acquaint with the structure, vector relationship, biology and management of plant-pathogen interaction.	**K1**
CO2	introduce the subject of Plant Pathology, its concepts and principles.	**K2**
CO3	recognize the effect of Microbe infection on host physiology	**K3**
CO4	learn the various methods/techniques/instruments used in the study of plant diseases/pathogens.	**K4**
CO5	educate about the nature, prevalence, etiology, factors affecting disease development and control measures of crop diseases.	**K5**
CO6	gain knowledge the molecular interaction of defence mechanism.	**K6**

Relationship Matrix												
Semester	**Course Code**					**Title of the Course**					**Hours**	**Credits**
2	23PBO2ES03B					**Elective - 3:** Plant Pathology					**5**	**4**
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**		
CO1	2	2	2	2	2	3	3	3	2	2	**2.3**	
CO2	2	3	2	2	2	3	2	2	2	3	**2.3**	
CO3	2	2	2	2	2	3	3	2	2	2	**2.5**	
CO4	2	2	2	2	2	3	3	3	2	2	**2.2**	
CO5	2	2	3	2	2	2	3	3	2	2	**2.3**	
CO6	2	3	2	2	2	3	2	2	2	3	**2.3**	
Mean Overall Score											**2.3 (High)**	

Semester	Course Code	Title of the Course	Hours/Week	Credits
2	23PSS2SE01	**Skill Enhancement Course:** Soft Skills	4	3

Course Objectives
To provide a focused training on soft skills for students in colleges for better job prospects
To communicate effectively and professionally
To help the students take active part in group dynamics
To familiarize students with numeracy skills for quick problem solving
To make the students appraise themselves and assess others

Unit I: Effective Communication & Professional Communication (12 Hours)

Definition of communication, Barriers of Communication, Non-verbal Communication; Effective Communication - Conversation Techniques, Good manners and Etiquettes; Speech Preparations & Presentations; Professional Communication.

Unit II: Resume Writing & Interview Skills (12 Hours)

Resume Writing: What is a résumé? Types of résumés, - Chronological, Functional and Mixed Resume, Purpose and Structure of a Resume, Model Resume.

Interview Skills: Types of Interviews, Preparation for an interview, Attire, Body Language, Common interview questions, Mock interviews & Practicum

Unit III: Group Discussion & Personal effectiveness (12 Hours)

Basics of Group Discussion, Parameters of GD, Topics for Practice, Mock GD & Practicum & Team Building.

Personal Effectiveness: Self Discovery; Goal Setting with questionnaires & Exercises

Unit IV: Numerical Ability (12 Hours)

Introducing concepts Average, Percentage; Profit and Loss, Simple Interest, Compound Interest; Time and Work, Pipes and Cisterns.

Unit V: Test of Reasoning (12 Hours)

Introducing Verbal Reasoning: Series Completion, Analogy; Data Sufficiency, Assertion and Reasoning; and Logical Deduction. Non-Verbal Reasoning: Series; and Classification

Teaching Methodology	Chalk and talk, Lectures, Demonstrations, PPT.

Book for study

1. Melchias G., Balaiah, J. & Joy, J. L. (Eds). (2018). *Winner in the Making: A Primer on soft Skills.* Trichy, India: St. Joseph's College.

Books for References

1. Aggarwal, R. S. (2010). *A Modern Approach to Verbal and Non-Verbal Reasoning.* S. Chand.
2. Covey, S. (2004). *7 Habits of Highly effective people.* Free Press.
3. Gerard, E. (1994). *The Skilled Helper* (5th Ed.). Brooks/Cole.
4. Khera, S. (2003). *You Can Win.* Macmillan Books.
5. Murphy, R. (1998). *Essential English Grammar*, (2nd Ed.). Cambridge University Press.
6. Sankaran, K., & Kumar, M. (2010). *Group Discussion and Public Speaking* (5th Ed.). M.I. Publications.
7. Trishna, K. S. (2012). *How to do well in GDs & Interview*s? (3rd Ed.). Pearson Education.
8. Yate, M. (2005). *Hiring the Best: A Manager's Guide to Effective Interviewing and Recruiting*

Course Outcomes		
CO No.	CO-Statements On successful completion of this course, students will be able to	Cognitive Levels (K - Level)
CO1	recall various soft skill sets	K1
CO2	understand personal effectiveness in any managerial positions	K2
CO3	apply verbal and non-verbal reasoning skills to solve problems	K3
CO4	differentiate problems at work and home; and design solutions to maintain work-life balance	K4
CO5	assess growth and sustainability and infuse creativity in employment that increases professional productivity	K5
CO6	construct plans and strategies to work for better human society	K6

Relationship Matrix											
Semester	Course Code			Title of the Course				Hours			Credits
2	23PSS2SE01			Skill Enhancement Course: Soft Skills				4			3
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	3	2	3	2	3	2	3	2.7
CO2	3	3	3	2	3	3	3	3	3	3	2.9
CO3	3	2	2	3	3	3	3	3	3	3	2.8
CO4	3	3	2	2	3	3	3	3	3	3	2.8
CO5	3	3	3	2	2	3	3	3	3	3	2.8
CO6	3	3	3	2	2	3	3	3	3	3	2.8
Mean Overall Score											2.8 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
2	23PBO2EG01	**Generic Elective - 1 (WS):** Medicinal Botany	4	3

Course Objectives
To understand principle and importance of various Traditional system of medicines.
To comprehend the current trade status and role of medicinal plants insocio economic growth.
To investigate the suitable conservation method for medicinal plants usingmodern biotechnology tools.
To inculcate the medicinal value of plants.
To formulate newer drugs for various therapeutics.

UNIT I **(12 Hours)**

Key Historical events, Scope and importance of medicinal plants. Traditional medicinal systems: Siddha, Ayurvedha, Homeopathy, Chinese medicine, Unani, Naturopathy and Aromatherapy. Status of Indian medicinal plant trade, medicinal plants prohibited from export, leading companies in India in trade of medicinal plants.

UNIT II **(12 Hours)**

Classification of herbal drugs based on the Alphabetical, Morphological, Taxonomical, Chemical and pharmacological. Collection and processing of herbal raw materials for drugs preparation-Post Harvesting care, Drying, Dressing, Packing and Storage. Conservation and mass propagation of important medicinal plants through *In vitro* propagation methods. Role of NMPB, CDRI and CIMAP onmedicinal plants conservation and research development.

UNIT III **(12 Hours)**

Ethnobotany - concept, scope and objectives; Ethnobotany as an interdisciplinary science. The relevance of ethnobotany in the present context; Role of ethnobotany in modern Medicine. Medico-Ethnobotanical sources - Eg. Contribution of Kani Tribes. Ethnobotany and plant genetic resources. Major tribes of South India and their ethno botanical knowledge.

UNIT IV **(12 Hours)**

Phytotherapeutic compounds of medicinal plants - Alkaloids, Glycosides, Terpenoids, Tannins, Flavonoids and Phenols. Patent guidelines for Phytotherapeutic compounds. Identification and utilization of the medicinal herbs in curing various ailments - *Catharanthus roseus* (Anti-cancer), *Aegle marmelos* (Cardiotonic), *Withania somnifera* (Drugs acting on nervous system), *Cardiospermum halicacabum* (Anti-rheumatic) and *Centella asiatica* (Memory booster), *Phyllanthus emblica* (Rejuvenating) and *Phyllanthus niruri* (Hepato-protective).

UNIT V **(12 Hours)**

Medicinally useful plant parts: Root - *Hemidesmus indicus* and *Rauvolfia serpentina*; Rhizome - *Acorus calamus* and *Curcuma longa*; Stem- *Tinospora cordifolia* and *Santalum album*,; Bark - *Terminalia arjuna* and *Saraca asoca*; Leaf - *Andrographis paniculata* and *Cynodon dactylon*; Flowers -*Crocus sativus* and *Syzygium aromaticum* ; Fruits - *Piper longum* and *Terminalia chebula*; Seeds - *Azadirachta indica* and *Trigonella foenum-graecum*.

Teaching Methodology	PPT, videos and practical demonstration

Books for Study

1. Evans. (2009). *Pharmacognosy.* Elsevier Publications.
2. James, G. (2000). *Herbal Medicine-Maker's Handbook.* Crossing Press.
3. Weiss, Rudolf, F. (2000). *Herbal Medicine,* (2nd Ed.). Thieme Medical Publishers
4. Kokate, C.K., Purokit, A.P., & Gokahale. (2006). Pharmacognosy. Nirali Prakashan.
5. Somasundara, S. (1997). *Maruththuva Thavaraiyal*. Ilangovan Padhippagam.
6. Farooqui, A.A., & Sreeramu, B.S. (2004). *Cultivation of Medicinal and Aromatic crops*.
7. Trivedi, P.C. (2006). *Medicinal Plants: Ethnobotanical Approach,* Agrobios.
8. Purohit., & Vyas. (2008). *Medicinal Plant Cultivation: A Scientific Approach*, (2nd Ed.). Agrobios.
9. Pulok, K.M. (2019). *Quality control and evaluation of Herbal Drugs*

Websites and eLearning Sources

1. http://www.gallowglass.org/jadwiga/herbs/preparations.html
2. http://shawnacohen.tripod.com/thetribaltraditions/id51.html
3. http://www.vasundharaorissa.org /GlobalisationAndMedicinalplantsOfOrissa.pdf
4. http://www.emea.europa.eu/docs/en_GB/document_library/Scientific_guideline/2009/09/WC500003393.pdf

CO No.	Course Outcomes **CO-Statements** On successful completion of this course, students will be able to	Cognitive Levels (K - Level)
CO1	understand the history and relevance of herbal drugs in Indian system of medicine	**K1**
CO2	value the important contribution of Tribals in health care systems.	**K2**
CO3	get an awareness on the conservation practices of medicinal plants	**K3**
CO4	understand the techniques for drug evaluation (Chemical, Physical and Biological), Phytochemical investigations, standardization and quality control of herbal drugs	**K4**
CO5	understand that the parts used as medicine in various herbal plants	**K5**
CO6	useful of certain medicinal plants for some basic health issues.	**K6**

Relationship Matrix											
Semester	**Course Code**				**Title of the Course**				**Hours**		**Credits**
2	23PBO2EG01				**Generic Elective - 1 (WS):** Medicinal Botany				**4**		**3**
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	2	3	1	3	3	3	1	2	2	**2.3**
CO2	3	2	3	3	3	1	2	3	3	2	**2.5**
CO3	3	3	3	2	3	2	3	3	2	3	**2.7**
CO4	3	1	3	2	3	2	3	1	2	2	**2.2**
CO5	2	3	2	2	3	1	1	2	3	2	**2.1**
CO6	2	3	2	3	2	2	3	2	2	2	**2.3**
Mean Overall Score											**2.3(High)**