

**ANNEXURE - 15**  
**DEPARTMENT OF BOTANY**

**VISION**

To stress the necessity of eco friendly environment among the students and enrich the campus natural environment and to make better future.

**MISSION**

- To nurture the students understanding of nature and floral kingdom through allied paper
- To create and maintain a green campus and make it better dwelling

**CHOICE BASED CREDIT SYSTEM - LEARNING OUTCOMES-BASED  
CURRICULUM FRAMEWORK**

**Those who have joined from the Academic year 2023-24 onwards**

**ANCILLARY BOTANY**

**(FOR II YEAR MAJOR ZOOLOGY STUDENTS)**

<b>Part</b>	<b>Course</b>	<b>Subject</b>	<b>Code</b>	<b>Cr.</b>	<b>Hr.</b>
III	Al. Bot.	Allied Botany – I (Plant Diversity, Cell Biology And Genetics)	232403321	4	4
	Al.Bot. Lab	Allied Botany Practical - I	-	-	2
III	Al. Bot.	Allied Botany –II Plant Taxonomy, Anatomy, Embryology And Physiology	232403421	3	4
	Al. Bot.lab	Allied Botany Practical - I	232403422	2	2
		<b>TOTAL</b>		<b>9</b>	<b>12</b>

<b>Title of the Course</b>		<b>Allied Botany – I (PLANT DIVERSITY, CELL BIOLOGY AND GENETICS)</b>						
<b>Part</b>		<b>III</b>						
<b>Category</b>	EC – 3 T	<b>Year</b>	II	<b>Credits</b>	4	<b>Course Code</b>	<b>232403321</b>	
		<b>Semester</b>	III					
<b>Instructional Hours per week</b>		<b>Lecture</b>	<b>Tutorial</b>	<b>Lab Practice</b>	<b>Total</b>	<b>CIA</b>	<b>External</b>	<b>Total</b>
		4	-	-	4	25	75	100
<b>Learning Objectives</b>								
✍ To study morphological and anatomical adaptations of plants of various habitats.								
✍ To demonstrate techniques of plant tissue culture.								
✍ To familiarize with the structure of DNA, RNA.								
✍ To carryout experiments related with plant physiology.								
✍ To perform biochemistry experiments.								
<b>UNIT</b>	<b>Details</b>							<b>No. of Periods for the Unit</b>
<b>I</b>	<b>Algae:</b> General characters of algae - Structure, reproduction and life cycle of the following genera - <i>Anabaena</i> and <i>Sargassum</i> and economic importance of algae.							<b>12</b>
<b>II</b>	<b>Fungi, Bacteria and Virus:</b> General characters of fungi, structure, reproduction and life cycle of the following genera - <i>Penicillium</i> and <i>Agaricus</i> and economic importance of fungi. Bacteria - general characters, structure and reproduction of <i>Escherichia coli</i> and economic importance of bacteria. Virus - general characters, structure of TMV, structure of bacteriophage.							<b>12</b>
<b>III</b>	<b>Bryophytes, Pteridophytes and Gymnosperms:</b> General characters of Bryophytes, Structure and life cycle of <i>Funaria</i> . General characters of Pteridophytes, Structure and life cycle of <i>Lycopodium</i> . General characters of Gymnosperms, Structure and life cycle of <i>Cycas</i> .							<b>12</b>
<b>IV</b>	<b>Cell Biology:</b> Prokaryotic and Eukaryotic cell- structure /organization. Cell organelles - ultra structure and function of chloroplast, mitochondria and nucleus. Cell division - mitosis and meiosis.							<b>12</b>
<b>V</b>	<b>Genetics and Plant Biotechnology:</b> Mendelism - Law of dominance, Law of segregation, Incomplete dominance. Law of independent assortment. Monohybrid and dihybrid cross - Test cross - Back cross. Plant tissue culture - <i>In vitro</i> culture methods. Plant tissue culture and its application in biotechnology.							<b>12</b>

<b>Course Outcomes</b>	
<b>Course Outcomes</b>	On completion of this course, students will be able;
<b>CO1</b>	Increase the awareness and appreciation of human friendly algae and their economic importance.
<b>CO2</b>	Develop an understanding of microbes and fungi and appreciate their adaptive strategies
<b>CO3</b>	Develop critical understanding on morphology, anatomy and reproduction of Bryophytes, Pteridophytes and Gymnosperms.
<b>CO4</b>	Compare the structure and function of cells and explain the development of cells.
<b>CO5</b>	Understand the core concepts and fundamentals of plant biotechnology and genetic engineering.

<b>Text Books (Latest Editions)</b>	
1	Singh, V., Pande, P.C and Jain, D.K. 2021. A Text Book of Botany. Rastogi Publications, Meerut.
2	Bhatnagar, S.P and Alok Moitra. 2020. Gymnosperms, New Age International (P) Ltd., Publishers, Bengaluru.
3	Sharma, O.P. 2017. Bryophyta, MacMillan India Ltd. Delhi.
4	Lee, R.E. 2008. Phycology, IV Edition, Cambridge University Press, New Delhi.
5	Rao, K., Krishnamurthy, K.V and Rao, G.S. 1979. Ancillary Botany, S. Viswanathan Pvt. Ltd., Madras.
<b>References Books (Latest editions, and the style as given below must be strictly adhered to)</b>	
1	Parihar, N.S. 2012. An introduction to Embryophyta –Pteridophytes - Surjeet Publications, Delhi.
2	Alexopoulos, C.J. 2013. Introduction to Mycology. Willey Eastern Pvt. Ltd.
3	Vashishta, P.C. 2014. Botany for Degree Students Gymnosperms. Chand & Company Ltd, Delhi.
4	Coulter, M. Jhon, 2014. Morphology of Gymnosperms. Surjeet Publications, Delhi.
6	Vashishta, P.C. 2014. Botany for Degree Students Algae. 2014. Chand & Company Ltd, Delhi.
7	Parihar, N.S. 2013. An introduction to Embryophyta –Bryophytes -, Surjeet Publications, Delhi.
8	Pandey B.P. 1986, Text Book of Botany (College Botany) Vol I &II, S.Chand and Co. New Delhi.
<b>Web Resources</b>	
1	<a href="https://www.kobo.com/us/en/ebook/the-algae-world">https://www.kobo.com/us/en/ebook/the-algae-world</a>
2	<a href="http://www.freebookcentre.net/biology-books-download/Fungi-(PDF-15P).html">http://www.freebookcentre.net/biology-books-download/Fungi-(PDF-15P).html</a>
3	<a href="http://scitec.uwichill.edu.bb/bcs/bl14apl/bryo1.htm">http://scitec.uwichill.edu.bb/bcs/bl14apl/bryo1.htm</a>
4	<a href="https://www.toppr.com/guides/biology/plant-kingdom/pteridophytes/">https://www.toppr.com/guides/biology/plant-kingdom/pteridophytes/</a>
5	<a href="https://arboretum.harvard.edu/wp-content/uploads/2013-70-4-beyond-pine-cones-an-introduction-to-gymnosperms.pdf">https://arboretum.harvard.edu/wp-content/uploads/2013-70-4-beyond-pine-cones-an-introduction-to-gymnosperms.pdf</a>
6	<a href="https://www.us.elsevierhealth.com/medicine/cell-biology">https://www.us.elsevierhealth.com/medicine/cell-biology</a>
7	<a href="https://www.us.elsevierhealth.com/medicine/genetics">https://www.us.elsevierhealth.com/medicine/genetics</a>
8	<a href="https://www.kobo.com/us/en/ebook/plant-biotechnology-1">https://www.kobo.com/us/en/ebook/plant-biotechnology-1</a>

**Mapping with Programme Outcomes:**

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
<b>CO 1</b>	3	3	3	3	3	3	3	3	3	3
<b>CO 2</b>	3	3	3	3	3	3	3	3	3	3
<b>CO 3</b>	2	3	3	3	3	1	3	3	3	3
<b>CO 4</b>	3	3	2	3	3	3	2	3	2	3
<b>CO 5</b>	3	2	2	2	2	2	2	1	2	1

**3 – Strong, 2 – Medium , 1 – Low**

<b>Title of the Course</b>		<b>ALLIED BOTANY –II PLANT TAXONOMY,ANATOMY, EMBRYOLOGY AND PHYSIOLOGY</b>							
<b>Category</b>	EC – IV T	<b>Year</b>	II	<b>Credits</b>	3	<b>Course Code</b>	232403421		
		<b>Semester</b>	IV						
<b>Instructional Hours per week</b>	<b>Lecture</b>	<b>Tutorial</b>	<b>Lab Practice</b>	<b>Total</b>	<b>CIA</b>	<b>External</b>	<b>Total</b>		
	4	-	--	4	25	75	100		
<b>Learning Objectives</b>									
☞ To be familiar with the basic concepts and principles of plant systematic.									
☞ Learn the importance of plant anatomy in plant production systems.									
☞ Understand the mechanism underling the shift from vegetative to reproductive phase.									
☞ To learn about the physiological processes that underlie plant metabolism.									
☞ To know the energy production and its utilization in plants.									
<b>UNIT</b>	<b>Details</b>							<b>No. of Periods for the Unit</b>	
<b>I</b>	<b>MORPHOLOGY OF FLOWERING PLANTS:</b> Plant and its parts. Structure and function of root and stem. Leaf and its parts. Leaf types- simple and compound. Phyllotaxy and types. Inflorescence - Racemose, Cymose and Special types. Terminology with reference to flower description.							<b>12</b>	
<b>II</b>	<b>TAXONOMY:</b> Study of the range of characters and plants of economic importance in the following families: Rutaceae, Caesalpinaceae, Asclepiadaceae, Euphorbiaceae and Cannaceae							<b>12</b>	
<b>III</b>	<b>ANATOMY</b> Tissue systems: Simple and complex tissues. Anatomy of monocot and dicot roots - anatomy of monocot and dicot stems - anatomy of dicot and monocot leaves.							<b>12</b>	
<b>IV</b>	<b>EMBRYOLOGY</b> Structure of mature anther and ovule - Types of ovules, structure of embryo sac, pollination -double fertilization, structure of dicotyledonous and monocotyledonous seeds.							<b>12</b>	
<b>V</b>	<b>PLANT PHYSIOLOGY</b> Absorption of water, photosynthesis - light reaction - Calvin cycle; respiration - Glycolysis - Krebs cycle - electron transport system. Growth hormones - auxins and cytokinins and their applications.							<b>12</b>	

<b>Course Outcomes</b>	
<b>Course Outcomes</b>	On completion of this course, students will be able;
<b>CO1</b>	Understand the fundamental concepts of plant anatomy and embryology.
<b>CO2</b>	Analyze and recognize the different organs of plants and secondary growth
<b>CO3</b>	Understand water relation of plants with respect to various physiological processes.
<b>CO4</b>	Classify aerobic and anaerobic respiration.
<b>CO5</b>	Classify plant systematics and recognize the importance of herbarium and virtual herbarium

<b>Text Books (Latest Editions)</b>	
1	Sharma, O.P. 2017. Plant Taxonomy. (II Edition).The McGraw Hill Companies.
2	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.
3	Maheshwari, P. 1963. Recent Advances in Embryology of Angiosperms. Intl. Soc. Plant Morphologists, New Delhi.
4	Salisbury, F. B.C.W. Ross.1991. Plant Physiology. Wassworth Pub. Co. Belmont.
5	Ting, I.P. 1982. Plant Physiology. Addison Wesley Pb. Philippines.
<b>References Books (Latest editions, and the style as given below must be strictly adhered to)</b>	
1	Lawrence.G.H.M. 1985. An Introduction to Plant Taxonomy, Central Book Depot, Allahabad.
2	Bhojwani, S.S and Bhatnagar, S.P. 2000. The Embryology of Angiosperms (4th revised and enlarged edition). Vikas Publishing House, New Delhi.
3	Pandey, B.P. 2012. Plant Anatomy. S Chand Publishing.
4	Jain, V.K. 2006. Fundamentals of Plant Physiology, S. Chand and Company Ltd
5	Rajni Gupta. 2012. Plant Taxonomy: Past, Present and Future. <a href="#">Vedams (P) Ltd. New Delhi.</a>
6	Jain, V.K. 2006. Fundamentals of Plant Physiology, S.Chand and Company Ltd., New Delhi.
7	Verma, S.K. 2006. A Textbook of Plant Physiology, S.K.Chand & Co., New Delhi.
<b>Web Resources</b>	
1	<a href="https://books.google.co.in/books/about/Plant_Taxonomy.html?id=0bYs8F0Mb9gC&amp;redir_esc=y">https://books.google.co.in/books/about/Plant_Taxonomy.html?id=0bYs8F0Mb9gC&amp;redir_esc=y</a>
2	<a href="https://books.google.co.in/books/about/PLANT_TAXONOMY_2E.html?id=Roi0lwSXFuUC&amp;redir_esc=y">https://books.google.co.in/books/about/PLANT_TAXONOMY_2E.html?id=Roi0lwSXFuUC&amp;redir_esc=y</a>
3	<a href="https://archive.org/EXPERIMENTS/plantanatomy031773mbp">https://archive.org/EXPERIMENTS/plantanatomy031773mbp</a>
4	<a href="https://www.amazon.in/Embryology-Angiosperms-6th-S-P-Bhatnagar-ebook/dp/B00UN5KPQG">https://www.amazon.in/Embryology-Angiosperms-6th-S-P-Bhatnagar-ebook/dp/B00UN5KPQG</a>
5	<a href="https://www.crcpress.com/Plant-Physiology/Stewart-Globig/p/book/9781926692692">https://www.crcpress.com/Plant-Physiology/Stewart-Globig/p/book/9781926692692</a>

**Mapping with Programme Outcomes:**

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
<b>CO 1</b>	3	3	3	3	3	3	3	3	3	3
<b>CO 2</b>	3	3	3	3	3	3	3	3	3	3
<b>CO 3</b>	2	3	3	3	3	1	3	3	3	3
<b>CO 4</b>	3	3	2	3	3	3	3	2	3	2
<b>CO 5</b>	3	2	2	2	2	2	2	1	2	2

**3 – Strong, 2 – Medium , 1 – Low**

<b>Title of the Course</b>		<b>ALLIED BOTANY PRACTICALS - I</b>						
<b>Part</b>		<b>III</b>						
<b>Category</b>	EC – 3 P	<b>Year</b>	II	<b>Credits</b>	1	<b>Course Code</b>	232403422	
		<b>Semester</b>	IV					
<b>Instructional Hours per week</b>		<b>Lecture</b>	<b>Tutorial</b>	<b>Lab Practice</b>	<b>Total</b>	<b>CIA</b>	<b>External</b>	<b>Total</b>
		2	-	-	2	25	75	100
<b>Learning Objectives</b>								
<p>☞ To enhance information on the identification of each taxonomical group by developing the skill-based detection of the morphology and microstructure of microorganisms, algae, and fungi.</p>								
<p>☞ To comprehend the fundamental concepts and methods used to identify Bryophytes, Pteridophytes and Gymnosperms through morphological changes and evolution, anatomy and reproduction.</p>								
<p>☞ To be familiar with the basic concepts and principles of plant systematics.</p>								
<p>☞ Understanding of laws of inheritance, genetic basis of loci and alleles.</p>								
<p>☞ To learn about the physiological processes that underlie plant metabolism.</p>								
<b>EXPERIMENTS</b>								
<ol style="list-style-type: none"> <li>1. Make suitable micro preparation of the types prescribed in Algae, Fungi, Bryophytes, Pteridophytes and Gymnosperms.</li> <li>2. Micro photographs of the cell organelles ultra structure.</li> <li>3. Simple genetic problems.</li> <li>4. To describe in technical terms, plants belonging to any of the family prescribes and to identify the family.</li> <li>5. To dissect a flower, construct floral diagram and write floral formula.</li> <li>6. Demonstration experiments               <ol style="list-style-type: none"> <li>1. Ganong's Light screen</li> <li>2. Ganong's respiroscope</li> </ol> </li> <li>7. To make suitable micro preparations of anatomy materials prescribed in the syllabus.</li> <li>8. Spotters - Algae, Fungi, Bryophytes, Pteridophytes, Gymnosperms and Angiosperm anatomy, Embryology, Cell biology and Biotechnology.</li> </ol>								

<b>Course Outcomes</b>	
<b>Course Outcomes</b>	On completion of this course, students will be able to;
<b>CO1</b>	To study the internal organization of algae and fungi.
<b>CO2</b>	Develop critical understanding on morphology, anatomy and reproduction of Bryophytes, Pteridophytes and Gymnosperms
<b>CO3</b>	To study the classical taxonomy with reference to different parameters.
<b>CO4</b>	Understand the fundamental concepts of plant anatomy and embryology
<b>CO5</b>	To study the effect of various physical factors on photosynthesis.
<b>Text Books (Latest Editions)</b>	
1	Sharma, O.P. 2017. Bryophyta, MacMillan India Ltd, New Delhi.
2	Sharma, O.P. 2012. Pteridophyta, Tata McGraw-Hills Ltd, New Delhi.
3	Subramaniam, N.S. 1996. Laboratory Manual of Plant Taxonomy. Vikas Publishing House Pvt. Ltd., New Delhi.
4	Benjamin, A. Pierce. 2012. Genetics- A conceptual Approach. W.H. Freeman and Company, New York, England.
5	Noggle G.R and G.J. Fritz. 2002. Introductory Plant Physiology. Prentice Hall of India, New Delhi.

<b>References Books</b> (Latest editions, and the style as given below must be strictly adhered to)	
1	Strickberger, M.W. 2005. Genetics (III Ed). Prentice Hall, New Delhi, India.
2	Nancy Serediak and M. Huynh. 2011. Algae identification lab Guide. Accompanying manual to algae identification field guide, Ottawa Agriculture and Agri food Canada publisher.
3	Mohammed Gufran Khan, Shite Gatew and Bedilu Bekele. 2012. Practical manual for Bryophytes and Pteridophytes. Lambert Academic Publishing.
4	Aler Gingauz. 2001. Medicinal Chemistry. Oxford University Press & Wiley Publications.
5	Steward, F.C. 2012. Plant Physiology Academic Press, US
<b>Web Resources</b>	
1	<a href="https://www.amazon.in/Practical-Manual-Pteridophyta-Rajan-Sundara/dp/8126106883">https://www.amazon.in/Practical-Manual-Pteridophyta-Rajan-Sundara/dp/8126106883</a>
2	<a href="https://www.google.co.in/books/edition/Gymnosperms/3YrT5E3Erm8C?hl=en&amp;gbpv=1&amp;dq=gymnosperms&amp;printsec=frontcover">https://www.google.co.in/books/edition/Gymnosperms/3YrT5E3Erm8C?hl=en&amp;gbpv=1&amp;dq=gymnosperms&amp;printsec=frontcover</a>
3	<a href="https://www.amazon.in/Computational-Phytochemistry-Satyajit-Dey-Sarker-ebook/dp/B07CV96NZJ">https://www.amazon.in/Computational-Phytochemistry-Satyajit-Dey-Sarker-ebook/dp/B07CV96NZJ</a>
4	<a href="https://medlineplus.gov/genetocs/understanding/basics/cell/">https://medlineplus.gov/genetocs/understanding/basics/cell/</a>
5	<a href="https://apan.net/meetings/apan45/files/17/17-01-01-01.pdf">https://apan.net/meetings/apan45/files/17/17-01-01-01.pdf</a>
6	<a href="http://www.cuteri.eu/microbiologia/manuale_microbiologia_pratica.pdf">http://www.cuteri.eu/microbiologia/manuale_microbiologia_pratica.pdf</a>
6	<a href="https://www.amazon.in/Manual-Practical-Bryophyta-Suresh-Kumar/dp/B0072GNFX4">https://www.amazon.in/Manual-Practical-Bryophyta-Suresh-Kumar/dp/B0072GNFX4</a>

**Mapping with Programme Outcomes:**

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
<b>CO 1</b>	3	3	3	3	3	3	3	3	3	3
<b>CO 2</b>	3	3	3	3	3	3	3	3	3	3
<b>CO 3</b>	2	3	3	3	3	1	3	3	1	3
<b>CO 4</b>	3	3	2	3	3	3	3	2	3	3
<b>CO 5</b>	3	2	2	2	2	2	2	1	2	2

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