

Semester: 6				
Course : Major 1				
Paper Title: Plant Physiology and Developmental Anatomy				
Paper code: C3BT230612T-P			Credits: Th (4) + Pr (1)	
Hours/week : 6				
Category: Core/MDC/SEC/VAC : Core				
Theory / Practical / Composite : Composite				
No of Modules : 2				
Course Overview:				
This composite course provides a comprehensive study of essential plant physiological processes, including photosynthesis, nitrogen fixation, and growth regulation by hormones, alongside light signaling. It also covers the fundamentals of plant anatomy, focusing on tissue systems, primary and secondary growth, apical meristem organization, and the genetic basis of floral development. The practical component introduces experimental techniques in both physiology and anatomy.				
Course Outcome: At the completion of the course, a student should be able to:				
1. Describe and explain the fundamental physiological processes in plants, such as photosynthesis, nitrogen fixation, and the role of various growth regulators as well as important anatomical and developmental plant features.				
2. Analyze the molecular mechanisms and signaling pathways (e.g., light signaling, hormone signaling) that regulate plant physiological processes and different growth patterns in higher plants.				
3. Classify and differentiate between various plant tissue systems and anatomical structures (primary/secondary/anomalous growth, meristems).				
4. Evaluate the role of floral organ identity genes using the ABCD and ABCDE models				
5. Apply the principles of plant anatomy in specialized fields like forensics, pharmacognosy, and dendrochronology				
6. Perform hands-on experiments to study plant physiology, biochemical processes, and anatomical features.				
Prerequisites: Basic knowledge of Molecular and Cell Signalling, Plant Physiology and Plant structure				
SYLLABUS				
UNIT/Module	CONTENT	HOURS or NUMBER OF CLASSES	CO Mapping	COGNITIVE LEVEL
MODULE I Unit I	Photosynthesis: Pigments, two photosystems, light reactions, cyclic and non-cyclic photophosphorylation; fixation, Calvin's cycle, plants, CAM plants, photorespiration,	10 Classes	CO 1 to CO6	K1 to K4

	compensation point. Nitrogen fixation.			
Unit II	Growth and development: Plant growth regulators (auxin, gibberellin, cytokinin, abscisic acid, ethylene): Biosynthesis, transport, signaling, application.	10 Classes	CO 1 to CO6	K1 to K4
Unit III	Light signaling in Plants: Phytochrome, cryptochrome, phototropins, concept of photoperiodism and circadian rhythm.	4 Classes	CO 1 to CO6	K1 to K4
MODULE II Unit IV	1. Plant tissue systems, primary and secondary growth, anomalous secondary growth. 2. Patterning of indeterminate growth; Shoot and root apical meristem and their histological organization. 3. Leaf Anatomy; formation and specification of lateral organs. 4. Floral organ identity genes and their role; ABCD and ABCDE models. 5. Applications of anatomy in forensics, pharmacognosy and dendrochronology.	12 Classes	CO 1 to CO6	K1 to K6
Practical	1. Auxin estimation 2. Assay of enzymes involved in plant 3. Estimation of Chlorophyll 4. Microscopic studies on anatomical features of stem and root including a few anomalous structures	36 (12x 3) Classes	CO5 and CO6	K3 to K6
Text Books:				
1. Plant Physiology- Taiz & Zeiger				
2. Biochemistry & Molecular Biology of Plants – Buchanan				
3. Plant Structure and Development – Charles B. Beck, Cambridge University Press; 2011				
Suggested Readings:				
1. Plant Anatomy – A Fahn; Permagon Press 1972.				
2. Esau's Plant Anatomy; Ray F. Evert, John Wiley & Sons; 2006				
3. Essentials of Developmental Plant Anatomy Taylor A. Steeves and Vipen K. Sawhney; Oxford University Press; 2017				
Web Resources:				

<p>1. Online Atlas of Plant Anatomical Images:</p> <ul style="list-style-type: none"> • https://botweb.uwsp.edu/Anatomy/
<p>2. Forensic Plant Anatomy:</p> <ul style="list-style-type: none"> • https://www.kew.org/read-and-watch/how-forensic-botany-plant-science-solve-crimes • https://botany.org/home/resources/plant-talking-points/crime-scene-botanicals-forensic-botany.html
<p>Theory: CIA- 10 Assignment – 02 Attendance - 03 End Semester Exam- 45 Practical: CA- 30; Attendance – 02; Semester Exam- 08</p>
<p>Paper Structure for Theory Semester Exam Module :</p> <p>Module A (30 Marks):</p> <ul style="list-style-type: none"> • Compulsory short questions - 10 marks [2 x 5] • Subjective two questions out of three, 10 marks each, i.e. 10 x 2= 20 marks [subparts not less than 2 marks] <p>Module B (15 Marks):</p> <ul style="list-style-type: none"> • Compulsory objective question - 5 marks [1 X 5] • One question 10 marks out of two, i.e. 10 x 1=10 [May have subparts not less than 2 Marks]

COURSE OUTCOMES (COS) AND COGNITIVE LEVEL MAPPING

COs	CO Description	Cognitive levels
CO1	<p>Remember</p> <ul style="list-style-type: none"> • Recall the basic concepts of photosynthesis, respiration, nitrogen fixation, and plant growth regulation. • Identify plant tissue systems and recognize primary, secondary, and anomalous secondary growth patterns. • Memorize key terminology and pathways and mechanisms such as Calvin cycle, C₄/CAM pathways, photoperiodism and circadian rhythm 	K1 to K4
CO2	<p>Understand</p> <ul style="list-style-type: none"> • Summarize the mechanisms of photosynthetic light reactions, carbon fixation, and photorespiration. • Interpret the roles of plant growth regulators, their biosynthesis, transport, and signaling. • Describe histological organization of shoot and root apical meristems, leaf and floral organ development. • Demonstrate understanding of plant anatomy applications in forensics, pharmacognosy, and dendrochronology 	K1 to K4
CO3	<p>Apply</p> <ul style="list-style-type: none"> • Perform laboratory experiments to estimate chlorophyll, auxin, and assay enzymes related to plant physiology. • Apply microscopic techniques to study anatomical features in stems and roots, including anomalous structures. 	K1 to K4
CO4	<p>Analyze</p>	K3 to K6

	<ul style="list-style-type: none"> • Differentiate between C₃, C₄, and CAM pathways and evaluate their ecological significance. • Compare and contrast roles of different plant hormones in growth and development. • Examine tissue organization patterns in indeterminate growth and identify variations in plant structures. • Analyze experimental results from physiology and anatomy practicals to interpret biological significance. 	
CO5	<p>Evaluate critically the efficiency of photosynthetic and signaling pathways, role of growth regulators and light signaling in crop improvement strategies.</p> <p>Evaluate the reliability of anatomical features in forensic and evolutionary studies.</p>	K3 to K6
CO6	<p>Create innovative approaches in sustainable agriculture and biotechnology by integrating concepts from physiology, signaling, and developmental anatomy to conceptualize real world scenarios associated with climate change.</p>	K3 to K6