



P.B. SIDDHARTHA COLLEGE OF ARTS & SCIENCE

Siddhartha Nagar, Vijayawada – 520 010

Autonomous - ISO 9001 – 2015 Certified

Title of the Paper (Plant Physiology and Metabolism)

Offered to: BSc. BZC with Programme code **US03**

Course Type: Core (TH)

Year of Introduction: 2021-2022

Year of Revision:

Percentage of Revision:

Semester: III/IV

Credits: 04

Hours Taught: 60 hrs. per Semester

Max. Time: 3 Hours

Course Prerequisites: Knowledge of Plant Physiology and Metabolism at +2 level.

Course Description:

This course will provide one with a basic and comprehensive understanding of plant water relations. Enable the student with depth of topics and helps them to gain appreciation of the mineral nutrition, enzymes and respiration. On the other hand, importance of understanding photosynthesis and photorespiration are also learnt. A part from these the student will be enhanced with the knowledge of nitrogen and lipid metabolism. The course provides a vast knowledge in plant growth development and stress physiology.

Course Objectives

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

1. To understand the plant water relations.
2. To understand the mineral nutrition, enzymes and respiration.

3. To understand the photosynthesis and photorespiration.
4. To understand the nitrogen and lipid metabolism.
5. To understand the plant growth-development and stress physiology.

Course Outcomes:

At the end of this course, students should be able to:

CO1: Comprehend the importance of water in plant life and mechanisms for transport of water and solutes in plants.

CO2: Evaluate the role of minerals in plant nutrition and their deficiency symptoms, Interpret the role of enzymes in plant metabolism.

CO3: Critically understand the light reactions and carbon assimilation processes responsible for synthesis of food in plants.

CO4: Analyze the biochemical reactions in relation to Nitrogen and lipid metabolisms.

CO5: Evaluate the phytohormones that regulate growth and development in plants, examine the role of light on flowering and explain physiology of plants under stress conditions.

Syllabus

Course Details

Unit	Learning Units	Lecture Hours
I	<p>Plant-Water relations</p> <ol style="list-style-type: none"> 1. Importance of water to plant life, physical properties of water, diffusion, imbibition, osmosis. water potential, osmotic potential, pressure potential. 2. Absorption and lateral transport of water; Ascent of sap 3. Transpiration: stomata structure and mechanism of stomatal movements (K^+ ion flux). 4. Mechanism of phloem transport; source-sink relationships. 	12
II	<p>Mineral nutrition, Enzymes and Respiration</p> <ol style="list-style-type: none"> 1. Essential macro and micro mineral nutrients and their role in plants; symptoms of mineral deficiency 2. Absorption of mineral ions; passive and active 	12

	<p>processes.</p> <p>3. Characteristics, nomenclature and classification of Enzymes. Mechanism of enzyme action, enzyme kinetics.</p> <p>4. Respiration: Aerobic and Anaerobic; Glycolysis, Krebs cycle; electron transport system, Mechanism of oxidative phosphorylation, Pentose Phosphate Pathway (HMP shunt).</p>	
III	<p>Photosynthesis and Photorespiration</p> <p>1. Photosynthesis: Photosynthetic pigments, absorption and action spectra; Red drop and Emerson enhancement effect</p> <p>2. Concept of two photosystems; mechanism of photosynthetic electron transport and evolution of oxygen; photophosphorylation</p> <p>3. Carbon assimilation pathways (C₃, C₄ and CAM);</p> <p>4. Photorespiration - C₂ pathway</p>	12
IV	<p>Nitrogen and lipid metabolism</p> <p>1. Nitrogen metabolism: Biological nitrogen fixation – asymbiotic and symbiotic nitrogen fixing organisms. Nitrogenase enzyme system.</p> <p>2. Lipid metabolism: Classification of Plant lipids, saturated and unsaturated fatty acids.</p> <p>3. Anabolism of triglycerides, β-oxidation of fatty acids, Glyoxylate cycle.</p>	12
V	<p>Plant growth - development and stress physiology</p> <p>1. Growth and Development: Definition, phases and kinetics of growth.</p> <p>2. Physiological effects of Plant Growth Regulators (PGRs) - Auxins, Gibberellins, Cytokinins, ABA,</p>	12

	<p>Ethylene and Brassino steroids.</p> <p>3. Physiology of flowering: Photoperiodism, role of phytochrome in flowering.</p> <p>4. Seed germination and senescence; physiological changes.</p>	
--	---	--

Textbook:

- Botany – IV (Vrukshasastram-II): Telugu Academy, Hyderabad
- Pandey, B.P. (2013) *College Botany, Volume-III*, S. Chand Publishing, New Delhi

Recommended Reference book:

- Aravind Kumar & S.S. Purohit (1998) *Plant Physiology – Fundamentals and Applications*, Agro Botanica, Bikaner
- Datta, S.C. (2007) *Plant Physiology*, New Age International (P) Ltd., Publishers, New Delhi

Course Delivery method: Face-to-face / Blended.

Course has focus on: Foundation

Websites of Interest:

https://youtu.be/4to_4guDx50

<https://youtu.be/j0BN8RfeqD0>

<https://youtu.be/Uc4lDTd1JXs>

<https://youtu.be/LVxdoH9MLU4>

<https://youtu.be/MSsVrzYibI8>

<https://youtu.be/YoNgSOIsk0A>

Co-curricular Activities:

Question and answer session at the end of class.

Observing animations.

Written assignments.

Group Discussion (GD)/ Quiz.

Power Point Presentations.

Model Question Paper Structure for SEE

Max. Marks : 70

Max. Time : 3 Hrs

SECTION -A

Answer all Questions. (5 X 4 =20)

(Restrict to a maximum of 2 subdivisions)

1 (a) Identify the role of water potential in plants. 4M L1

OR

(b) Explain about the stomata structure. 4M L1

2 (a) Explain about the carrier concept. 4M L2

OR

(b) Discuss the role of mineral elements in plants. 4M L2

3 (a) Describe a note on CAM plants. 4M L2

OR

(b) Explain the emerson enhancement effect. 4M L2

4 (a) Classify the plant lipids. Explain 4M L3

OR

(b) Explain the Biological Nitrogen Fixation in plants. 4M L3

5 (a) Explain about brassino steriods. 4M L3

OR

(b) Explain about phytochrome induced plant responses .4M L3

SECTION –B

Answer all Questions. (5 X 10 = 50)

(Restrict to a maximum of 2 subdivisions)

6. (a) Explain osmosis, diffusion and imbibition with the help of experiments. 10M L1

OR

(b) Explain the various theories on mechanism of stomatal movements. 10M L1

7. (a) Define enzymes. Illustrate the properties and structure. Mention the mechanism of enzyme action. 10M L2

OR

(b) Explain the bio chemical reactions that occur in kreb's cycle. 10M L2

8. (a) Explain carbon assimilation how many methods of carbon assimilation are shown by plants explain carbon assimilation in C3 plants. 10M L1

OR

(b) What is photorespiration? Differentiate photorespiration and respiration in plants? Explain photorespiration. 10M L1

9. (a) what is biological nitrogen fixation? Explain types of biological nitrogen fixation.
10M L2

OR

(b) what are lipids? Give an account of classification of plant lipids. 10M L2

10. (a) What are phyto hormones? Analyse the physiological effects of cytokinines in plant growth. 10M L2

OR

(b) What is photo periodism? Distinguish the role of phytochrome in physiology of flowering. 10M L2
