ST. JOSEPH’S COLLEGE FOR WOMEN (AUTONOMOUS) VISAKHAPATNAM

IV SEMESTER **BOTANY** TIME: 4HRS/WEEK

B 4103 (3) **PLANT PHYSIOLOGY AND METABOLISM** MARKS: 100

w.e.f. 20AH **SYLLABUS**

**OBJECTIVES:** To be able to-

* Gain knowledge about the role of water in plant life
* Know the physiology of transpiration, water absorption and importance of essential mineral nutrients and their deficiency symptoms.
* Understand the physical aspects of plant physiology.
* Understand the metabolic processes in plants.
* Get an insight into growth and developmental aspects of plants.

**COURSE OUTCOMES:**

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

CO 1: Comprehend the importance of water and mechanisms for transport of water and solutes in plants.

CO 2: Evaluate the role of minerals in plant nutrition, their deficiency symptoms and interpret the role of enzymes in plant metabolism.

CO 3: Critically understand the light reactions and carbon assimilation processes responsible for synthesis of food in plants.

CO 4: AnalyzethebiochemicalreactionsinrelationtoNitrogenandlipidmetabolisms.

CO 5:

Evaluatethephysiologicalfactorsthatregulategrowthanddevelopmentinplants.

CO 6: Study the role of light on flowering and explain physiology of plants under stress conditions.

# UNIT–I: PLANT-WATER RELATIONS

* + 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 stomata movements (K+ ion flux).
    4. Mechanism of phloem transport; source-sink relationships.

# UNIT–II: MINERAL NUTRITION, ENZYMES AND RESPIRATION

1. Essentialmacroandmicromineralnutrientsandtheirroleinplants;symptomsofmineral deficiency
2. Absorption of mineral ions; passive and active processes.
3. Characteristics, no menclature and classification of Enzymes. Mechanism of enzyme action, enzyme kinetics.
4. Respiration: Aerobic and Anaerobic; Glycol sis, Krebs cycle; electron transport system, mechanism of oxidative phosphorylation, Pentose Phosphate Pathway (HMP shunt).

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# UNIT–III: PHOTOSYNTHESIS AND PHOTORESPIRATION

1. Photosynthesis:Photosyntheticpigments,absorptionandactionspectra;ReddropandEmerson enhancement effect
2. Conceptoftwophotosystems;mechanismofphotosyntheticelectrontransportandevolution of oxygen;photophosphorylation
3. Carbonassimilationpathways(C3,C4andCAM);
4. Photorespiration -C2 pathway

# UNIT–IV: NITROGEN AND LIPID METABOLISM

1. Nitrogenmetabolism:Biologicalnitrogenfixation–a symbiotic andsymbioticnitrogenfixingorganisms. Nitrogen as enzyme system.
2. Lipidmetabolism:ClassificationofPlantlipids,saturatedandunsaturatedfattyacids.
3. Anabolismoftriglycerides,β-oxidationoffattyacids,Glyoxylatecycle.

# UNIT–V: PLANT GROWTH – DEVELOPMENT ANDSTRESS PHYSIOLOGY

1. Growth and Development: Definition, phases and kinetics of growth.
2. Physiological effects of Plant Growth Regulators(PGRs)-auxins, gibberellins, cytokinins, ABA, ethylene and brassinosteroids.
3. Physiology of flowering: Photoperiodism, role of phytochrome in flowering.
4. Seed germination and senescence; physiological changes.

# TEXTBOOKS:

* Pandey, B.P.(2013)CollegeBotany,Volume-III,S.ChandPublishing,NewDelhi
* Ghosh,A.K.,K.Bhattacharya&G.Hait(2011)ATextBookofBotany,Volume-III,New CentralBook AgencyPvt.Ltd.,Kolkata

# BOOKSFORREFERENCE:

* + - Aravind Kumar & S.S. Purohit (1998) Plant Physiology – Fundamentals andApplications,AgroBotanica,Bikaner
    - Datta, S.C. (2007) Plant Physiology,New Age International (P) Ltd., Publishers,NewDelhi
    - Hans-Walterheldt(2005) PlantBiochemistry,AcademicPress,U.S.A.
    - Hopkins, W.G. & N.P.A. Huner (2014)Introduction to Plant Physiology, WileyIndiaPvt.Ltd., New Delhi
    - Noggle Ray & J. Fritz (2013)Introductory Plant Physiology, Prentice Hall (India),NewDelhi
    - Pandey, S.M. &B.K.Sinha (2006)Plant Physiology, Vikas Publishing House, NewDelhi
    - Salisbury, Frank B. & Cleon W. Ross (2007)Plant Physiology,Thomsen &Wadsworth,Austalia&U.S.A
    - Sinha, R.K. (2014) Modern Plant Physiology, Narosa Publishing House,NewDelhi
    - Verma,V.(2007)TextBookofPlantPhysiology,AneBooksIndia,New Delhi

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ST. JOSEPH’S COLLEGE FOR WOMEN (AUTONOMOUS) VISAKHAPATNAM

IV SEMESTER **BOTANY** TIME: 2Hrs/WEEK

B 4153(2) **PLANT PHYSIOLOGY AND METABOLISM** MAX.MARKS: 50

w.e.f. 20 AH **PRACTICAL SYLLABUS**

**OBJECTIVES:** To enable the student to

* Perform experiments, record observations, analyze the results and draw logical conclusions of different physiological processes.
* Apply the experimental technique related to plant metabolism, growth & development.

**COURSE OUTCOMES:** On successful completion of this practical course, students shall be able to:

CO 1: Conduct lab and field experiments pertaining to Plant Physiology, that is,biophysical and biochemical processes using related glassware, equipment,chemicalsand plant material.

CO 2: Estimate the quantities and qualitative expressions using experimental results andcalculations

CO 3: Demonstratethefactors responsibleforgrowthanddevelopmentinplants.

# PRACTICALSYLLABUS:

1. Determinationofosmoticpotentialofplant cell sapbyplasmolyticmethod using

Rhoeo/Tradescantialeaves.

1. Calculationofstomatalindex andstomatalfrequencyofamesophyte andaxerophyte.
2. Determination of rate of transpiration using Cobalt chloride method / Ganong’spotometer(at leastforadicot and amonocot).
3. Effectof Temperature on membranepermeabilitybycolorimetricmethod.
4. Studyof mineral deficiencysymptoms usingplant material/photographs.
5. Demonstrationofamylaseenzyme activityand studythe effectofsubstrate andEnzyme concentration.
6. Separationofchloroplastpigments usingpaper chromatographytechnique.
7. DemonstrationofPolyphenoloxidaseenzymeactivity(Potatotuber orApple fruit)
8. Anatomyof C3, C4 and CAM leaves
9. Estimation of protein bybiuret method/Lowry method
10. Minor experiments – Osmosis, Arc-auxonometer, ascent of sap through xylem,cytoplasmicstreaming.

**REFERENCE BOOKS:**

1.Text book of Practical Botany (Vol. II) – Ashok Bendra & Kumar, Rastogi Publications, Meerut – 2001-2002

2.Practical Botany (Vol.II) – H.N. Srivastava, Pradeep Publications, Jallandhar – 200.

3.Modern Practical Botany – B. P. Pandey – S. Chand & Co., New Delhi – 1988.

4. College Botany Practical (Vol.1) – S. C. Santra, T. P. Chatterjee & A. P. Das; New Central Book Agency (P) Ltd, Kolkata, India.

5. Practical Book of Botany, Dr. M. Raghuram, Technical Publishers, Guntur, India; 2010.

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