**BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE (PILANI), HYDERABAD CAMPUS**

**1st SEM 2022-23, MID-SEMESTER EXAMINATION**

**PLANT PHYSIOLOGY, BIO F312**

Date: 3rd November 2022 Max. Time: 90 min. Max. Marks: 60

1. Answer the following questions about short distance transport of water **leading to xylem loading**:
   1. Arrange the following cells in order of increasing water potential (lower to higher)-endodermis, epidermis, cortex, root hair. Justify your answer. (4M)
   2. What is the special phenomenon that happens at the endodermis? Which anatomical feature of the endodermis facilitates this phenomenon? (4M)
   3. Explain how this process influences transportation of photosynthate in the phloem. (6M)
2. While continuously open stomata can help in feeding plants, they can also dehydrate the plants. With respect to this statement, answer the following questions:
3. What are the anatomical peculiarities in C4 plants that help them overcome this paradox along-with the wasteful process of photorespiration? Justify your answer. (4M)
4. Which two processes do CAM plants “temporally” and “spatially” separate in order to take care of this issue and how? (6M)
5. Zeaxanthin is a pigment that helps in the blue light reception of Arabidopsis leaves. Imagine an Arabidopsis mutant that is compromised in its ability to biosynthesize this pigment. Explain the precise impact of this mutation on stomatal opening. (6M)
6. Despite the presence of optimal concentrations of phosphate salts in the soil, plants may still have problems in P uptake. Explain why. Describe how nature has provided such plants with “friends” that help them obtain the necessary amounts of P from the soil. (6M)
7. Na+ is a necessary evil for plant cells. While it is needed in small quantities, slightly higher quantities can become toxic to the cells. Conversely, K+, even in relatively higher concentrations is non-toxic. With respect to these facts, answer the following questions.
   1. One of the mechanisms that plant cells adapt is to “antiport” the excess Na+ into the vacuole, in case some excess is “symported” into the cytoplasm from the apoplast. Explain the mechanisms of these two processes. (6M)
   2. The membrane potential across the plasma membrane of a root cortical cell at a certain time period is 40 mV. Assuming that, at that time period, there is no difference in concentration of K+ across the membrane, calculate the difference in electrochemical potential of (across that membrane. Ignore all other ions. RT at 25oC =2.478 L MPa mol-1. Faraday’s constant (23.06 kcal V–1 mol–1). (6M)
8. Complete the following table: (4x3=12M)

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| --- | --- | --- | --- |
|  | Mutation | Phenotype | Justification |
| (a) | Ectopic over-expression of *KN-1* in maize leaves |  |  |
| (b) | *WUS* Knock-out in *Arabidopsis thaliana* |  |  |
| (c) | CLV-1 knock-out in  *Arabidopsis thaliana* |  |  |