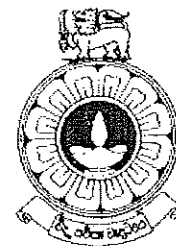


The Open University of Sri Lanka  
Faculty of Natural Sciences  
B.Sc/ B. Ed Degree Programme



Department	: Botany
Level	: 4
Name of the Examination	: Final Examination
Course Code and Title	: <b>BYU 4300</b>
Academic Year	: 2019/20
Date	: February 10, 2021(rescheduled)
Time	: 9.30 am – 11.30 am
Duration	: Two (2) hours

### General Instructions

1. Read all instructions carefully before answering the questions.
2. This question paper consists of **six (6)** questions in **five (5)** pages.
3. Answer any **four (4)** questions only. All questions carry equal marks.
4. Answer for each question should commence from a new page.
5. Draw fully labelled diagrams where necessary
5. Relevant log tables are provided where necessary.
6. Having any unauthorized documents/ mobile phones in your possession is a punishable offense
7. Use blue or black ink to answer the questions.
8. Circle the number of the questions you answered in the front cover of your answer script.
9. Clearly state your index number in your answer script

Specific instructions

There are two (2) parts in this paper with six (6) questions in five (05) pages. You have to answer only FOUR (4) questions selecting at least TWO (2) questions from each part. Please note that answers must be written clearly and legibly. Answers to each question must start with a new page in your answer book.

**Part 1**

1. Questions in this section are based on the part of the abstract extracted from a research publication.

**Abstract:** Stomata usually open when leaves are transferred from darkness to light. However, reverse-phase stomatal opening in succulent plants has been known. CAM plants such as cacti, *Opuntia ficus-indica* achieve their high-water use efficiency by opening their stomata during the cool, desert nights and closing them during the hot, dry days. Signal transduction pathway for stomatal opening by blue-light photoreceptors including phototropins and the carotenoid pigment zeaxanthin has been suggested. Blue light regulated signal transduction pathway on stomatal opening could not be applied to CAM plants, but the most possible theory for a nocturnal response of stomata in CAM plants is photoperiodic circadian rhythm. (J. S. Lee, *J. Plant Biol.* (2010) 53:19–23)

- a) Explain the photoperiodic circadian rhythm?
- b) What do you think as the reason behind the cause of action underlined in above abstract?
- c) Describe in detail what the reverse-phase stomatal opening is?
- d) Describe a method you follow to calculate the percentage difference of stomata opened in a plant under the light and dark condition?
- e) Discuss possible relationship between CAM photosynthesis and stomatal opening.

2. Questions in this section are based on the following abstracted extracted from a research publication (Karaba, A. *et al.*, Proceedings of the National Academy of Sciences (2007) 104:39 PP 15270-15275)

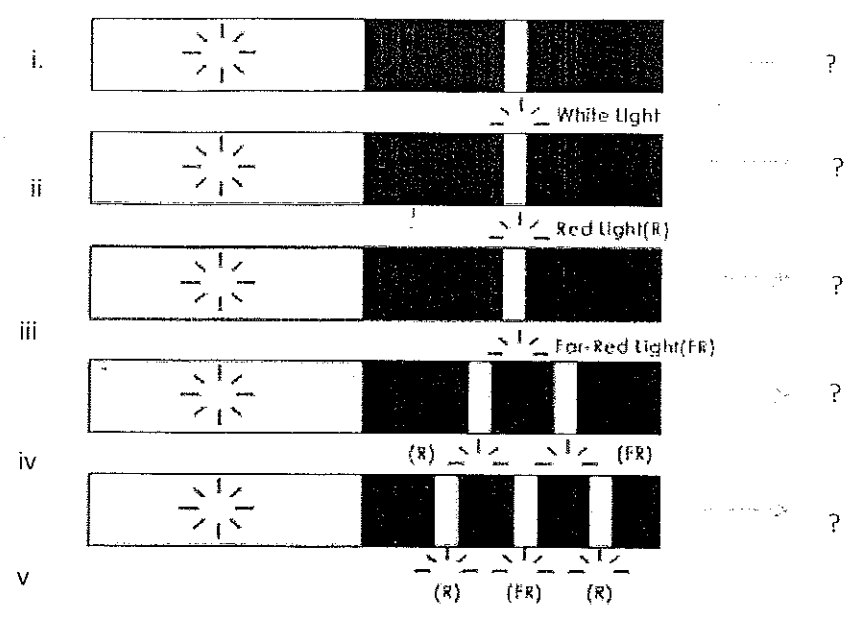
Freshwater is a limited and dwindling global resource; therefore, efficient water use is required for food crops that have high water demands, such as rice, or for the production of sustainable energy biomass. We show here that expression of the Arabidopsis HARDY (HRD) gene in rice improves water use efficiency, the ratio of biomass produced to the water used, by enhancing photosynthetic assimilation and reducing transpiration. These drought-tolerant, low-water-consuming rice plants exhibit increased shoot biomass under well irrigated conditions and an adaptive increase in root biomass under drought stress.

- a. Describe the measurements obtained to calculate the water use efficiency of plants?
  - b. Describe the physiological parameters used to assess water status of plants.
  - c. What is drought tolerance and drought escape in plants?
  - d. Describe how the water content in soil change when it shifts from saturated status to drought stress level?
  - e. Discuss the adaptive responses of plants to drought stress.
3. Questions in this section are based on the figure and its description extracted from the research publication; Ivana Machakova et al. *Physiologia Plantarum* 1998;102: 272-278

Some lines of *Solanum tuberosum* spp. *andigena* are strictly photoperiodic, forming tubers only in short days and flowers only in long days. We used this advantageous phenomenon to study phytohormone involvement in the development of the plants, mainly that of tuber formation. Plants grown for 2 months under short days (SD) of 14 h darkness, night break (1 h white light in the middle of the 14-h dark period) and continuous light (LD) were compared. Short day-grown plants formed tubers, while plants in LD flowered. Night break prevented tuber formation, but caused flowering, although it was weaker than in LD. Plants grown under night break displayed many growth characteristics intermediate between SD and LD. Under LD and night break regimes ABA levels in all organs were about one-fourth of those under SD. An opposite trend was found for gibberellin content: it was very low in SD-grown plants and 4-10 times higher under both other conditions with the exception of roots and stolons in night break. The ratio of ABA/GA, known to be important for tuber formation.

- a. Illustrate the design of treatments in the above experiment and their outcomes using arrow diagrams.
- b. What is the conclusion you arrive at from the above experiment?
- c. Describe the physiological mechanism of perceiving the day length in plants.
- d. If the above *Solanum tuberosum* spp. *andigena* plants were grown in the following conditions what would be the outcome in terms of flowering, tuber formation, GA concentrations? Duration of daylight in all cases is 10 hours.

Flowering	Tuber formation	GA concentration



e. What would be the reason behind poor or no flowering in some of the traditional rice varieties when grown in *Yala* season while improved rice cultivars are flowering? (5 marks for any 6 points)

Part 2

4. Write a proposal to the government to persuade farmers to use plant growth regulators to minimize post-harvest loss in vegetables and fruits.
5. "Water uptake, transpiration and translocations are interdependent functions in the plant." Discuss this statement.
6. Explain the following phenomena with your knowledge in physiology
  - a. Adding fertilizer to soil does not guarantee availability of nutrients to the plants
  - b. Hydroponic culture of plants has several disadvantages
  - c. The glycolytic pathway is not the only pathway available for the oxidation of glucose in plants.
  - d. Although tea plant (*Camelia sinensis* L.) is Aluminum accumulator, Aluminum is not found at toxic levels in tea leaves.
  - e. Plant leaves at their developing stage appears in various colours.
  - f. Reaction between Ribulose1-5-bisphosphate with oxygen is considered as a loss of photosynthate
  - g. Artificial lighting can be deployed to optimize plant productivity under the control environments agriculture.

