

School of Chemical and Life Sciences
Ph.D. Course Work Examinations (October 2023)
Elective Paper: PHBO 102: Plant Physiology, Tissue Culture & Genetic Engineering

Time: Three Hours**Maximum Marks: 75**

(Write your Roll No. at the top immediately on receipt of this question paper)

Answer ALL questions. All parts of a question must be answered in continuation. Start answering each question on a new page. Cite examples and draw labelled diagrams.

1. Answer any 10 of the following (not more than half a page) (10× 1.5 = 15)

- a. What are the unique properties of water that enable it to act as a solvent and be readily transported through the plant body?
- b. What is the role of aquaporins in plants?
- c. Differentiate between passive and active transport.
- d. Enlist the *criteria of essentiality of an element* in a plant's life.
- e. Differentiate between chresard and echard.
- f. Mention any **TWO** effects of water deficit on plant anatomy and physiology.
- g. What is temperature compensation point? What happens at temperatures above the temperature compensation point in case of fruit and vegetable bearing plants?
- h. What is the basis of *in vitro* plant tissue culture?
- i. Give any **TWO** methods of obtaining virus-free plants.
- j. Differentiate between an asymmetric hybrid and cybrid.
- k. Name any **TWO** methods of plant tissue culture which are used for developing instant homozygous inbred lines.
- l. What is the size range of inserts for cloning using cosmids?
- m. Can one use *Taq* DNA polymerase for amplifying PCR product for protein expression? Justify.
- n. What is the single most important characteristic aspect of type II restriction endonucleases which facilitated their large-scale application in genetic engineering?
- o. How one can avoid re-circularization of a vector and ensure its ligation to an insert?

2. Answer any 4 of the following (not more than two pages) (4× 5 = 20)

- a. *The soil is a nutrient reservoir* – Justify.
- b. Highlight the role of *beneficial elements* in the physiology of plants.
- c. How plants counter and mitigate oxidative stress?
- d. Bring out significant differences between direct and indirect organogenesis.
- e. Comment briefly on a method of genetic transformation that is common to bacteria, fungi and plants.
- f. What is the basis of blue-white screening of recombinant vs. non-recombinant bacterial colonies?

Q.3. Answer any 2 of the following (no limit of pages)

(2×20=40)

- a. What are HSPs? How HSPs, ABA, SA and calcium mediate thermotolerance responses in plants?
- b. Differentiate between macro- and micro-nutrients. Tabulate their general functions and the respective deficiency symptoms they elicit in plants.
- c. What is micropropagation? Details the steps involved in it and also highlight its merits and demerits.
- d. Why *Agrobacterium tumefaciens* is known as the *Nature's* genetic engineer? Briefly detail the steps involved in the transfer of genetic material using *Agrobacterium tumefaciens*. List the merits and demerits of indirect gene transfer in plants.
- e. Give a vivid account of steps involved in generation of genomic and cDNA libraries.