JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

Comprehensive Examination – ODD SEM 2025

Ph.D (BT)

COURSE NAME: Plant and Agricultural Biotechnology

COURSE INSTRUCTORS: Dr. Jata Shankar, Dr. Anil Kant and Dr. Hemant Sood

MAX. MARKS: 100 MAX. TIME: 3 Hours

Note: *(a) All questions are compulsory.*

Sec A - Basic Techniques and methods in Plant Biotech (33 Marks)

Q.No	Question	Marks
Q1	Explain the principle of the Sanger sequencing method. How does incorporation of dideoxynucleotides (ddNTPs) lead to chain termination, and how are these fragments separated for sequence determination? Compare methodology and application with Pyrosequencing?	10
Q2	What is DNA microarray technology. How does hybridization between complementary DNA strands enable the measurement of gene expression levels? Describe the difference between cDNA microarrays and oligonucleotide microarrays. How are fluorescent dyes (e.g., Cy3 and Cy5) used in microarray experiments enable to distinguish between control and test samples?	12
Q3	Outline the main conceptual steps in the TRIzol RNA extraction procedure and state the purpose of each step. Explain the purpose of using isopropanol and ethanol during RNA precipitation and washing. Discuss the significance of temperature and sample handling conditions during RNA isolation?	11

Sec B - Biotechnology for Crop Improvement (33 Marks)

Q.No	Question	Marks
Q4	What is golden rice? Who and where it was developed? Describe the pathway modification, genes introduced, first and second generation of golden rice, and latest update on its adoption and commercialization.?	5
Q5	Elaborate on the specific research conducted for development of transgenic crops fortified with vitamins and minerals (Vitamin E, iron, zinc etc). Include examples of genes, promoters, and transformation techniques used in such programs.?	5
Q6	Discuss the discovery of Bt toxin, classification of Cry proteins, and their mode of action against insect pests. Include examples of Bt transgenic crops developed and the status of their adoption in world and in India?	5
Q7	Describe the genetic engineering strategies used to develop herbicide-tolerant crops. Explain the mode of action of herbicide glyphosate and gene, their sources used to engineer crops tolerant of this herbicide. Also present a worldwide scenario of adoption of germicide tolerant crops?	5
Q8	Discuss the concept of haploid and double haploid production in plants. Explain their role in accelerating crop improvement with examples. Cite recent crop varieties developed via this route?	5
Q9	What are somaclonal variations? Explain why these are peril for micropropagation but can be in crop improvement. Discuss at least three examples of improved crop varieties developed through somaclonal variation.?	4
Q10	Discuss the use of protease inhibitors and α-amylase inhibitors as biotechnological tools for insect resistance in plants. Cite and two latest examples or reference of development testing of crops using these principles?	4

Sec C- Adv. Plant Biotechnology Tools & Applications (34 Marks)

Q.No	Question	Marks
Q11	Which techniques are applied for the large-scale clonal propagation of orchids? How you are maintaining the genetic stability of those clones? Explain the complete process of latest methodology according to you used for the production of clones of Orchids. How its genetic stability will be certified?	10
Q12	How would you like to develop a genetically modified apple having anti- ageing genes from grapes? How would you like to proceed via Agrobacterium – mediated method for the desired gene transfer and mention the complete process for the same? Explain the method to check the successful integration of foreign gene and its expression in the host plant?	12
Q13	Which factors are responsible for the successful development of transgenic Basil having anti –microbial activity? How you would like to use the direct DNA delivery system for the same? Design a protocol for the development of the mentioned transgenic Basil plants. Do you think utilization of CRISPR-Cas9 would be more useful to edit the existing genes?	12