Name:

Enrolment No:

UPES

End Semester Examination, May 2025

Course: Animal and Plant Biotechnology **Semester: 6**

Program: BT-BIOTECHNOLOGY **Duration: 3 Hours**

Course Code: HSBT3007 **Max. Marks: 100**

Instructions: Attempt all the questions

S. No.	Section A Short answer questions/ MCQ/T&F (20Qx1.5M= 30 Marks)	Marks	COs
Q 1	**The ability of plant cells to regenerate a whole plant is called:** A. Plasticity B. Embryogenesis C. Totipotency D. Morphogenesis	**1.5**	**CO1**
Q 2	**Which is *not* a sterilization method in plant tissue culture?** A. Autoclaving B. UV exposure C. Ethanol D. Chlorophyll extraction	**1.5**	**CO2**
Q 3	**Murashige and Skoog (MS) medium is widely used for:** A. Bacterial culture B. Plant tissue culture C. Animal cell culture D. DNA extraction	**1.5**	**CO1**
Q 4	**Somatic hybridization involves fusion of:** A. Zygotes B. Protoplasts C. Seeds D. Nuclei	**1.5**	**CO3**
Q 5	**Organogenesis refers to the formation of:** A. Embryos B. Organs like shoots and roots C. Seeds D. Flowers	**1.5**	**CO3**
Q 6	**Somatic embryogenesis occurs from:** A. Fertilized eggs B. Somatic cells	**1.5**	**CO5**

	C. Gametes D. Apical meristems		
Q 7	Protoplast isolation is useful in: A. Tissue hardening B. Cell wall formation C. Hybrid formation D. Genetic stability	**1.5**	**CO5**
Q 8	**An example of synthetic seed production involves:** A. Use of fertilizers B. Encapsulating somatic embryos C. Grafting D. Spray drying	**1.5**	**CO2**
Q 9	**Meristem culture is primarily used for:** A. Somatic variation B. Embryo rescue C. Virus elimination D. Hybrid seed production	**1.5**	**CO2**
Q 10	**Genetic fidelity in micropropagation is checked using:** A. ELISA B. DNA markers C. Starch tests D. Microscopy	**1.5**	**CO1**
Q 11	**Agrobacterium tumefaciens naturally transfers DNA via:** A. T-DNA B. mRNA C. Viral vector D. RNAi	**1.5**	**CO1**
Q 12	**A. rhizogenes is used for inducing:** A. Tumors B. Roots C. Callus D. Embryos	**1.5**	**CO5**
Q 13	**Transplastomics involves genetic modification of:** A. Mitochondria B. Plastids C. Endoplasmic reticulum D. Nucleus	**1.5**	**CO4**
Q 14	**Direct gene transfer in plants *does not* include:** A. Electroporation B. Microinjection C. Agrobacterium infection D. Biolistic methods	**1.5**	**CO5**
Q 15	**Promoters used in plant vectors control:** A. Protein folding	**1.5**	**CO2**

	B. Gene expression C. DNA replication D. Enzyme digestion		
Q 16	**A commonly used reporter gene in plant transformation is:** A. GUS B. Bt C. Actin D. Tubulin	**1.5**	**CO2**
Q 17	**Transgene silencing refers to:** A. Amplification of gene expression B. Complete gene knockout C. Suppression of introduced gene expression D. RNA replication	**1.5**	**CO3**
Q 18	**Copy number analysis is done to:** A. Identify bacterial species B. Detect DNA damage C. Count the number of gene insertions D. Measure chlorophyll	**1.5**	**CO3**
Q 19	**Marker-free transgenics are preferred because they:** A. Are easier to grow B. Have no selectable markers like antibiotic resistance C. Are cheaper D. Grow faster	**1.5**	**CO5**
Q 20	**Which trait has been successfully introduced using genetic engineering in plants?** A. Insect resistance B. Faster ripening C. Salt tolerance D. All of the above	**1.5**	**CO1**
Section B (4Qx5M=20 Marks)			
Q 1	**Suppose a farmer asks you to quickly develop virus-free plants of an endangered species.** Which plant tissue culture technique would you recommend and why?	**5**	**CO3**
Q 2	**Marker-assisted selection sounds complex to farmers.** Explain the concept to a layperson using a **real-life analogy** (e.g., identifying a ripe fruit without cutting it open).	**5**	**CO4**
Q 3	**How would you use synthetic seeds in areas where natural propagation is difficult?** Give **one practical example** and briefly describe the process involved.	**5**	**CO5**
Q 4	**What are the advantages of using transplastomic plants over nuclear transgenics?** Explain in simple terms with one example crop or trait.	**5**	**CO2**
Section C			

(2Qx15M=30 Marks)			
Q 1	**Create a comparison chart** between the three major genome editing tools – **CRISPR-Cas9, TALENs, and Zinc-Finger Nucleases**. 1. Highlight at least **five parameters** (e.g., ease of use, cost, precision, off-target effects, applications). *(7.5 Marks)* 2. Then, based on your comparison, **recommend the best choice** for editing a gene in tomato plants for disease resistance. *(7.5 Marks)*	**15**	**CO2**
Q 2	**Imagine you are part of a regulatory committee evaluating a genetically modified plant** with herbicide resistance. 1. What **molecular analyses** would you perform to assess the transgene's stability and expression? *(5 Marks)* 2. What **environmental or ethical factors** would you consider before approval? *(5 Marks)* 3. Conclude with your **verdict** and justification for approval or rejection. *(5 Marks)*	**15**	**CO4**
Section D **(2Qx10M=20 Marks)**			
Q 1	**List and explain the different types of nutrient media** used in **plant tissue culture**. *(5 Marks)* Include the role of **plant growth regulators** in in vitro regeneration processes. *(5 Marks)*	**10**	**CO5**
Q 2	**Discuss the significance of marker genes and reporter genes** in genetic transformation studies. *(5 Marks)* Explain their functions with **examples** and describe how they help confirm successful transformation. *(5 Marks)*	**10**	**CO2**