Name: **Enrolment No:**	

UPES

End Semester Examination, May 2025

Course: Genome Editing — **Semester : VI**

Program: B.Tech Biotechnology — **Duration : 3 Hours**

Course Code: HSBT3010 — **Max. Marks: 100**

Instructions: Read all questions carefully

S. No.	Section A Short answer questions/ MCQ/T&F (20Qx1.5M= 30 Marks)	Marks	COs
Q 1	A recombinant DNA molecule is produced by (A) joining of two DNA fragments (B) joining of two or more DNA fragments (C) both A and B (D) joining of two or more DNA fragments originating from different organisms	1.5	CO1
Q 2	Restriction enzymes are also called as (A) biological scissors (B) molecular scalpels (C) molecular knives (D) all of these	1.5	CO1
Q 3	The DNA molecule to which the gene of insert is integrated for cloning is called (A) carrier (B) transformer (C) vector (D) none of these	1.5	CO1
Q 4	The mechanism of intake of DNA fragments from the surrounding medium by a cell is called (A) transformation (B) transduction (C) both A and B (D) conjugation	1.5	CO1
Q 5	Which enzyme is used to join together two different types of DNA molecules? (A) ligase (B) endonuclease (C) exonuclease (D) protease	1.5	CO2
Q 6	DNA libraries are collection of _____ (A) ribonucleic acid (B) cloned DNA fragments (C) bacteriophages (D) viral particles	1.5	CO2
Q 7	Which of the following bacterium is considered as ‘natural genetic engineer’? (A) *Agrobacterium tumefaciens* (B) *Agrobacterium radiobactor* (C) *Psueudomonas putida*	1.5	CO2

	(D) *Thermus aquaticus*		
Q 8	The method widely used for transforming *invitro* animal cell cultures that uses lipid vesicles or liposomes (A) lipotransformation (B) liposome mediated transformation (C) lipofection (D) lipid mediated DNA transfer	1.5	CO2
Q 9	Which of the following is NOT an application of qPCR? A) Gene Expression Analysis B) DNA Sequencing C) Pathogen Detection D) Cancer Research	1.5	CO3
Q 10	In qPCR, what is the purpose of the fluorescent probes? A) To amplify DNA B) To detect specific DNA sequences C) To provide energy for the reaction D) To digest unwanted DNA	1.5	CO3
Q 11	The gene formed by the joining of DNA segments from two different sources are called as (A) recombinant gene (B) joined gene (C) both A and B (D) chimeric gene	1.5	CO3
Q 12	Which of the following enzyme is used to cut DNA molecules in rDNA technology (A) ligase (B) phosphatase (C) ribonuclease (D) restriction enzymes	1.5	CO3
Q 13	The DNA segment to be cloned is called (A) gene segment (B) DNA fragment (C) DNA insert (D) all of these	1.5	CO4
Q 14	Which of the following statements are true regarding rDNA technology (A) rDNA technology is used to obtain large number of copies of specific DNA fragments (B) rDNA technology is used to obtain large quantities of the protein produced by the concerned gene (C) rDNA technology is used to integrate gene of interest into chromosomes where it expresses itself (D) all of these	1.5	CO4
Q 15	The virus-mediated gene transfer using genetically modified bacteriophages is called (A) transfection (B) transduction (C) transformation (D) conjugation	1.5	CO4
Q 16	Recombinant plasmids are added to a bacterial culture that has been pretreated with _____ ions. (A) iodine (B) magnesium (C) calcium (D) ferric	1.5	CO4

Q 17	Which of the following can be used to clone DNA sequence of size larger than 25 kb? (A) YAC (B) SV40 (C) Plasmid (D) Bacteriophage	1.5	CO5
Q 18	DNA solution injected directly into the cell using micromanipulators is called (A) macroinjection (B) micromanipulator mediated DNA delivery (C) microfection (D) microinjection	1.5	CO5
Q 19	What is a challenge associated with the use of CRISPR-Cas9 for genome editing? A) High cost B) Off-target effects C) Limited target range D) Difficulty in obtaining reagents	1.5	CO5
Q 20	In the Taqman qPCR, reporter-quencher set up is used. Which of the statement holds true for this methodology? (A) It allows detection of all double stranded molecules (B) The reporter and quencher are the molecules present on the same probe (C) The quencher is having a fluorescent group (D) Fluorescence is observed only when both the groups are present in proximity to each other	1.5	CO5
Section B (4Qx5M=20 Marks)			
Q 1	Describe restriction endonuclease and its types.	5	CO1
Q 2	Explain BAC and list its applications.	5	CO2
Q 3	Describe the principle of the $CaCl_2$-mediated transformation.	5	CO3
Q 4	What is single cell sequencing? Explain the application of single cell sequencing.	5	CO1
Section C (2Qx15M=30 Marks)			
Q 1	A biotechnology company is exploring the use of Transcription Activator-Like Effector Nucleases (TALENs) to improve crop traits. They aim to create crops that are resistant to a specific pathogen that has been causing significant yield losses. A. What are TALENs, and how do they differ from other genome editing tools like CRISPR-Cas9? (5 marks) B. Outline the steps involved in using TALENs to introduce resistance to the pathogen in crops. Include	15 (5+5+5)	CO2

	how specificity is achieved and how the desired trait is incorporated into the plant's genome. (5 marks) C. Discuss the potential advantages and limitations of using TALENs in crop improvement compared to traditional breeding methods. Consider factors such as efficiency, time, and regulatory considerations.		
Q 2	A team of researchers is utilizing CRISPR-Cas9 technology in their biomedical research to study the role of a specific gene in cancer development. They aim to create cellular models with precise gene modifications for their studies. A. Explain the significance of CRISPR-Cas9 in biomedical research. How does it enable precise gene editing in cellular models? B. Describe the process of using CRISPR-Cas9 to create cellular models with specific gene modifications for cancer research. Include the steps from designing the guide RNA to verifying the edited cells. C. Discuss the potential applications of CRISPR-Cas9 in cancer research beyond creating cellular models. How might this technology contribute to understanding cancer biology and developing novel therapies?	15 (5+5+5)	CO3
Section D **(2Qx10M=20 Marks)**			
Q 1	Explain the principle and procedure of agrobacterium-mediated gene delivery with an illustration	10	CO4
Q 2	Compare the different chemistries used in the qPCR technique with illustrations	10	CO5