Name: **Enrolment No:**	

UPES

End Semester Examination, May 2024

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	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	CO1
Q 2	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	CO1
Q 3	The DNA segment to be cloned is called (A) gene segment (B) DNA fragment (C) DNA insert (D) all of these	1.5	CO1
Q 4	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	CO1
Q 5	The virus-mediated gene transfer using genetically modified bacteriophages is called (A) transfection (B) transduction (C) transformation (D) conjugation	1.5	CO2
Q 6	Recombinant plasmids are added to a bacterial culture that has been pretreated with _____ ions. (A) iodine (B) magnesium (C) calcium (D) ferric	1.5	CO2

Q 7	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	CO2
Q 8	DNA solution injected directly into the cell using micromanipulators is called (A) macroinjection (B) micromanipulator mediated DNA delivery (C) microfection (D) microinjection	1.5	CO2
Q 9	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	CO3
Q 10	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	CO3
Q 11	The Cas9 enzyme in CRISPR-Cas9 originates from which bacteria? A) *E. coli* B) *Streptococcus pyogenes* C) *Pseudomonas aeruginosa* D) *Bacillus subtilis*	1.5	CO3
Q 12	All are genome sequencing strategies except (A) Edman degradation method (B) Shotgun Library (C) Whole genome shotgun sequencing (D) Directed gene sequencing	1.5	CO3
Q 13	What is the threshold cycle (Ct) in qPCR? A) The cycle at which DNA amplification begins B) The cycle at which fluorescence surpasses background levels C) The cycle at which DNA denaturation occurs D) The cycle at which the PCR reaction ends	1.5	CO4
Q 14	What is the potential benefit of using genome editing to treat genetic diseases? A) Introducing healthy genes to correct mutations B) Increasing the number of chromosomes C) Speeding up cell division D) Disabling essential genes	1.5	CO4
Q 15	Which organism is NOT commonly used in genome editing research?	1.5	CO4

	A) Fruit fly (*Drosophila melanogaster*) B) Bacteria (*Escherichia coli*) C) Yeast (*Saccharomyces cerevisiae*) D) Human (*Homo sapiens*)		
Q 16	What is the term used to describe unintended changes in the genome caused by editing techniques? A) Off-target effects B) Silent mutations C) Gene silencing D) Somatic variation	1.5	CO4
Q 17	Heritable genome editing refers to changes made in: A) Germline cells B) Skin cells C) Muscle cells D) Blood cells	1.5	CO5
Q 18	Which of the following is not a genome editing tool? A) CRISPR-Cas9 B) TALENs C) Zinc Finger Nucleases (ZFNs) D) RNA interference (RNAi)	1.5	CO5
Q 19	Which of the following is true about Zinc Finger Nucleases (ZFNs)? A) They are naturally occurring enzymes in bacteria. B) They are constructed from engineered modular lipoproteins. C) They have a lower precision compared to CRISPR-Cas9. D) They do not require a guide RNA for target specificity.	1.5	CO5
Q 20	In the CRISPR-Cas9 system, what is the role of the guide RNA (gRNA)? A) It serves as the "scissors" to cut DNA. B) It directs Cas9 to the target DNA sequence. C) It provides the template for DNA repair. D) It activates the immune response.	1.5	CO5
Section B (4Qx5M=20 Marks)			
Q 1	Describe DNA polymerase and its types.	5	CO1
Q 2	List different types of viral vectors and their applications	5	CO2
Q 3	Describe the principle of liposome-mediated transfection.	5	CO3
Q 4	Explain the principle of Chip-Seq and their applications in brief	5	CO3
Section C (2Qx15M=30 Marks)			

Q 1	A pharmaceutical company is developing a gene therapy approach using Zinc Finger Nucleases (ZFNs) to treat a rare hereditary disorder caused by a single gene mutation. They aim to correct the mutation in affected individuals' cells. A. Describe the structure and function of Zinc Finger Nucleases (ZFNs). How do they achieve gene editing specificity? (5 marks) B. Explain the process of using ZFNs in gene therapy to correct the mutation in the affected gene. Include the steps involved in delivering ZFNs to target cells and ensuring precise editing. (5 marks) C. Discuss the potential risks and ethical considerations associated with using ZFNs in gene therapy. Consider aspects such as off-target effects, immune responses, and consent from patients.	15 (5+5+5)	CO2
Q 2	A research team is investigating the use of CRISPR-Cas9 in treating a genetic disorder known as Duchenne muscular dystrophy (DMD). This disorder is caused by mutations in the DMD gene, leading to progressive muscle degeneration and weakness. A. Describe the CRISPR-Cas9 system and its components. How does it work on a molecular level? B. Explain how CRISPR-Cas9 can be used to target and correct the mutations in the DMD gene. What are the steps involved in this process? C. Discuss the potential benefits and challenges of using CRISPR-Cas9 in treating genetic disorders like DMD. Consider factors such as off-target effects, ethical considerations, and the potential for long-term effects.	15 (5+5+5)	CO5
Section D (2Qx10M=20 Marks)			
Q 1	Compare in detail the principle and procedures of the hierarchy shotgun sequencing and whole genome shotgun sequencing with an illustration	10	CO2
Q 2	What are CAR T cells? Explain in detail on the process of CAR T cells generation with illustrations.	10	CO4