Name:

Enrolment No:

UPES

End Semester Examination, December 2024

Course: Genetic Engineering and OMICS **Semester: Vth**

Program: INT-BMSC Microbiology **Duration: 3 hours**

Course Code: HSMB3027 **Max. Marks : 100**

Instructions: Read and attempt all questions carefully.

S. No.	Section A Short answer questions/ MCQ/T&F (20Qx1.5M= 30 Marks)	Marks	COs
Q1.	A mutation changes a codon from UUU (Phe) to UUC (Phe). What type of mutation is this? A. Missense mutation B. Silent mutation C. Nonsense mutation D. Frameshift mutation	**1.5**	**CO1**
Q2.	You need to analyze protein-DNA interactions. Identify the molecular technique would you use? A. Electrophoretic mobility shift assay (EMSA) B. Northern blotting C. CRISPR-Cas9 gene editing D. DNA sequencing	**1.5**	**CO4**
Q3.	Non-viral gene delivery vehicles like liposomes considered advantageous over viral vectors because - A. They are more efficient in delivering genes to cells. B. They have lower immunogenicity and are easier to produce. C. They integrate stably into the host genome. D. They deliver larger DNA fragments with higher precision.	**1.5**	**CO3**
Q4.	In nanopore sequencing, Illustrate the mechanism of DNA sequencing. A. By the change in ion current as DNA passes through a nanopore B. By fluorescence emission during nucleotide incorporation C. By detecting mass differences between nucleotides D. By enzymatic cleavage of labeled nucleotides	**1.5**	**CO1**

Q5.	A new vaccine for a respiratory virus is being tested. Identify the factors would you consider for evaluating its effectiveness? A. The speed of antibody production, longevity of immunity, and reduction in disease transmission B. The ease of administration and its cost-effectiveness C. The type of pathogen used in the vaccine D. The number of doses required for complete immunization	**1.5**	**CO3**
Q6.	Identify the major limitation of live attenuated vaccines in immunocompromised individuals. A. They do not provide long-term immunity. B. They can potentially revert to a virulent form and cause disease. C. They require frequent booster doses. D. They are not effective in young children.	**1.5**	**CO3**
Q7.	Identify the example of a live attenuated vaccine. A. Polio vaccine (Salk) B. Measles, Mumps, Rubella (MMR) vaccine C. Hepatitis B vaccine D. Tetanus toxoid	**1.5**	**CO3**
Q8.	_____ first human therapeutic protein expressed in plants.	**1.5**	**CO1**
Q9.	Insulin's active form is stored in pancreatic beta cells in the form of - A. Monomeric insulin B. Hexameric insulin with zinc ions C. Dimeric insulin D. Proinsulin	**1.5**	**CO1**
Q10.	Point out the primary cellular target of insulin's action in lowering blood glucose levels. A. Nuclear receptors to activate gene transcription B. Glucose transporters to facilitate glucose uptake C. Mitochondria to increase ATP production D. Ribosomes to enhance protein synthesis	**1.5**	**CO1**
Q11.	Identify the primary receptor involved in the initiation of Insulin signaling. A. Tyrosine kinase receptor B. G-protein coupled receptor C. Nuclear hormone receptor D. Ion channel receptor	**1.5**	**CO1**
Q12.	Select the genetic disorders can potentially be treated with CRISPR-Cas9. A. Sickle cell anemia B. Type 2 diabetes C. Alzheimer's disease	**1.5**	**CO1**

	D. All of the above		
Q13.	Point out the role of viral vectors in gene therapy. A. They amplify DNA sequences for therapeutic use B. They serve as carriers to deliver therapeutic genes into cells C. They silence disease-causing genes directly D. They synthesize proteins required for treatment	**1.5**	**CO1**
Q14.	Recognize the critical ethical concern related to genetic code expansion. A. The environmental impact of ncAAs. B. The potential transfer of orthogonal systems to native organisms. C. The inability to synthesize orthogonal ribosomes. D. The inability to replicate ncAA-incorporated proteins in natural systems.	**1.5**	**CO2**
Q15.	Select the potential drawback of error-prone PCR? A. It cannot amplify DNA efficiently. B. It generates a large number of off-target mutations. C. It requires expensive, high-fidelity DNA polymerases. D. It is limited to short DNA sequences.	**1.5**	**CO2**
Q16.	A scientist argues that PACE is more efficient than traditional directed evolution methods. Identify the statement supporting his claim? A. PACE automates the generation and screening of mutants. B. PACE eliminates the need for host cells during evolution. C. PACE introduces no genetic mutations. D. PACE does not rely on phage replication.	**1.5**	**CO4**
Q17.	Suggest a method to study riboswitch dynamics in living cells. A. Use fluorescence-based reporter assays to monitor riboswitch activity. B. Perform mass spectrometry to detect riboswitch-bound metabolites. C. Isolate riboswitch RNA and sequence it. D. Conduct cryo-electron microscopy of the ribosome.	**1.5**	**CO3**
Q18.	You observe that a certain lncRNA interacts with chromatin-remodeling complexes. Suggest the conclusion you draw about its role. A. It is likely involved in translational regulation. B. It likely modulates chromatin structure to influence gene expression. C. It degrades other RNAs to prevent their translation. D. It directly binds to DNA polymerase.	**1.5**	**CO2**

Q19.	Characterize the desolvation process responsible for ion generation in ESI-MS? A. Desolvation reduces the charge on the ions, stabilizing them. B. Desolvation removes neutral solvent molecules, leaving charged ions. C. Desolvation increases the fragmentation of ions. D. Desolvation causes aggregation of ions.	**1.5**	**CO3**
Q20.	Design a MALDI experiment to differentiate between two proteins of similar size but different post-translational modifications. Identify the steps you prioritize. A. Use a matrix that enhances ionization of hydrophilic residues. B. Increase laser power to detect minor differences in mass. C. Enrich the proteins using affinity purification followed by MALDI analysis. D. Combine a and c.	**1.5**	**CO4**
Section B (4Qx5M=20 Marks)			
Q1.	Explain liposome-mediated gene delivery (transfection and endocytosis) with the help of a diagram.	**5**	**CO1**
Q2.	Discuss gene therapy and explain various strategies for gene therapy.	**5**	**CO4**
Q3.	Describe the process of developing a recombinant vaccine and give an example.	**5**	**CO4**
Q4.	Explain the molecular synthesis and function of miRNA and evaluate its importance in gene regulation.	**5**	**CO4**
Section C (2Qx15M=30 Marks)			
Q1.	Define stable cell. Elaborate the method for making a stable cell line and its application.	**15**	**CO4**
Q2.	Describe a proteome-based method for bacterial species identification and explain its working principle.	**15**	**CO3**
Section D (2Qx10M=20 Marks)			
Q1.	Propose a method for comparative proteomics of drug-treated cancer cell lines.	**10**	**CO 4**
Q2.	Evaluate ESI-MS as a method and discuss its applications across different fields of biology.	**10**	**CO 4**