Name:

Enrolment No:

UPES

End Semester Examination, May 2025

Course: Discovery and Development of Biologic **Semester: VIIIth**

Program: B.Tech - Biotechnology **Duration: 3 hours**

Course Code: HSBT4005 **Max. Marks: 100**

Instructions: Carefully read and attempt all the questions.

S. No.	Section A Short answer questions/ MCQ/T&F (20Qx1.5M= 30 Marks)	Marks	COs
Q1.	**Phage display is a technique commonly used to:** A. Sequence DNA B. Improve protein crystallization C. Screen peptide or antibody libraries D. Detect RNA viruses	1.5	CO1
Q2.	**In biologics discovery, humanization of antibodies is done to:** A. Enhance antigen binding B. Reduce immunogenicity in humans C. Increase half-life in mice D. Eliminate the Fc region	1.5	CO2
Q3.	**A major challenge in biologics development compared to small molecules is:** A. Poor specificity B. High oral bioavailability C. Immunogenicity and complex manufacturing D. Low cost of production	1.5	CO1
Q4.	**Which of the following is typically not required for the approval of a biosimilar?** A. Clinical trials for efficacy in all indications B. Analytical characterization C. Comparative pharmacokinetics D. Immunogenicity testing	1.5	CO2
Q5.	**For biologics, the term interchangeability refers to:** A. A biologic that can be prescribed without physician oversight B. A biosimilar that meets additional FDA criteria and can be substituted at the pharmacy without prescriber intervention C. A small molecule with the same active ingredient D. Any protein-based therapeutic	1.5	CO3
Q6.	**In antibodies, binding site diversity is primarily generated through:** A. Somatic hypermutation and V(D)J recombination B. RNA splicing C. Protein phosphorylation D. Chromatin remodeling.	1.5	CO2

Q7.	**In phage display, diversity is introduced by:** A. Chemically modifying the DNA B. Randomizing amino acid sequences in specific regions of the protein C. Using heat shock to denature phages D. Treating phage with proteases	**1.5**	**CO1**
Q8.	**A major advantage of yeast surface display over phage display is:** A. It uses bacteria, which are easier to grow B. Yeast cells support post-translational modifications and eukaryotic protein folding C. It eliminates the need for DNA manipulation D. It doesn't require antigen labeling	**1.5**	**CO1**
Q9.	**Hybridoma cells survive in HAT medium because** A. They have antibiotic resistance B. They divide faster than other cells C. They possess functional HGPRT from the B cell and immortality from the myeloma D. They are resistant to aminopterin toxicity	**1.5**	**CO3**
Q10.	**ADCP primarily involves which immune cells?** A. Natural killer (NK) cells B. Eosinophils C. Macrophages and monocytes D. T-helper cells	**1.5**	**CO2**
Q11.	**The enzyme HGPRT is important for which biochemical pathway?** A. De novo purine synthesis B. Salvage pathway of purine synthesis C. Glycolysis D. Beta-oxidation	**1.5**	**CO2**
Q12.	**The cell-based assay for a biologic drug typically measures:** A. DNA damage B. Cytokine-induced gene expression or cell proliferation C. Protein isoelectric point D. Protein solubility	**1.5**	**CO1**
Q13.	**Both ADCC and ADCP require antibodies to:** A. Be cleaved before action B. Engage the Fab region with CD8+ cells C. Bind antigens on target cells via Fab and recruit effector cells via Fc D. Undergo somatic recombination	**1.5**	**CO2**
Q14.	**PD-1 binds to which ligand(s) to mediate immune suppression?** A. CD80 and CD86 B. PD-L1 and PD-L2 C. LAG-3 and TIM-3 D. MHC-I and MHC-II	**1.5**	**CO2**
Q15.	**Which immune checkpoint is most commonly targeted by cancer immunotherapies like pembrolizumab and nivolumab?** A. CTLA-4 B. PD-1 C. CD40 D. OX40	**1.5**	**CO2**
Q16.	**Junctional diversity refers to:** A. Switching antibody isotypes B. Recombination of light chains C. Random addition/deletion of nucleotides at V-D and D-J junctions D. Point mutations in the constant region	**1.5**	**CO1**
Q17.	**Identify the immunoglobulin class typically produced first during an immune response?** A. IgG B. IgA C. IgE D. IgM	**1.5**	**CO2**
Q18.	**CMC documentation is submitted as part of which regulatory filing?** A. IND and NDA/BLA	**1.5**	**CO1**

	B. GCP and ICH guidelines C. SDS and MSDS D. Pharmacovigilance reports		
Q19.	**Viral clearance studies in the CMC of biologics are required to:** A. Improve pharmacokinetics B. Ensure cell viability C. Demonstrate removal/inactivation of adventitious viruses D. Support clinical endpoint selection	**1.5**	**CO1**
Q20.	**Identify the critical concern related to host cell proteins (HCPs)?** A. Misfolding of the therapeutic protein B. Immunogenic reactions in patients C. Enhanced drug absorption D. Antibiotic resistance	**1.5**	**CO1**
	Section B **(4Qx5M=20 Marks)**		
Q1.	Explain with the help of diagram showing interactions of T-cells with tumor cells.	**5**	**CO3**
Q2.	List the difference between the innate and adaptive immunity.	**5**	**CO1**
Q3.	Illustrate common issues with the liquid formulations of antibodies.	**5**	**CO2**
Q4.	Describe immunoglobin isotype with the help of diagram.	**5**	**CO4**
	Section C **(2Qx15M=30 Marks)**		
Q1.	List any three alternate formats of antibody? (3) Explain advantages of these antibody alternate formats in therapeutics. (7) Give an example. (5)	**15**	**CO2**
Q2.	Describe Preclinical developability of therapeutic antibodies. (5) Draw a diagram highlighting various discoveries and early development stages for large-molecule therapeutic antibody developability. (10)	**15**	**CO4**
	Section D **(2Qx10M=20 Marks)**		
Q1.	Explain immune checkpoint inhibitors. (3) Describe their role in immunotherapy. (7)	**10**	**CO3**
Q2.	Describe CMC. (3) Explain the major challenges faced in meeting CMC filing requirements? (7)	**10**	**CO4**