Name: **Enrolment No:**	

UPES

End Semester Examination, December 2024

Course: Introduction to Biotechnology — **Semester : I**

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

Course Code: HSBT1004 — **Max. Marks: 100**

Instructions: Attempt all questions

S. No.	Section A Short answer questions/ MCQ/T&F (20Qx1.5M= 30 Marks)	Marks	COs
Q 1	What milestone marked the beginning of modern biotechnology? a) Discovery of penicillin b) Development of recombinant DNA technology c) Invention of the microscope d) Completion of the Human Genome Project	1.5	CO1
Q 2	Which component of the cell membrane acts as a barrier to polar molecules? a) Proteins b) Phospholipids c) Carbohydrates d) Cholesterol	1.5	CO1
Q 3	Which of the following describes the stationary phase of microbial growth? a) Rapid cell division b) Cell death exceeds cell division c) Equilibrium between cell division and death d) No cell growth occurs	1.5	CO1
Q 4	What is the primary focus of agricultural biotechnology? a) Development of biofuels b) Creation of genetically modified crops for higher yield c) Design of new medical therapies d) Study of soil microorganisms	1.5	CO1
Q 5	What challenge does biotechnology face in the field of biofuels? a) Low energy yield from biofuels b) High competition with food crops for resources c) Difficulty in finding microorganisms for fermentation d) Regulatory hurdles for production	1.5	CO1
Q 6	What is the function of RNA polymerase? a) To synthesize DNA	1.5	CO2

	b) To synthesize RNA from a DNA template c) To replicate RNA d) To translate proteins		
Q 7	Which of the following is a post-transcriptional modification in eukaryotes? a) Addition of a poly-A tail b) Removal of a promoter c) Helicase activity d) DNA replication	1.5	CO2
Q 8	Which of the following is an example of a recombinant protein? a) Insulin b) Hemoglobin c) DNA polymerase d) Actin	1.5	CO2
Q 9	What is the primary purpose of vaccines? a) To destroy pathogens b) To stimulate the immune system to recognize and combat pathogens c) To kill infected cells d) To neutralize toxins	1.5	CO2
Q 10	Which regulatory body approves GMOs in the United States? a) FDA b) USDA c) EPA d) All of the above	1.5	CO2
Q 11	Which technique is used to introduce genes into plant cells? a) Electroporation b) Microinjection c) Agrobacterium-mediated transformation d) All of the above	1.5	CO3
Q 12	Which method is commonly used to culture cells in animal tissue culture? a) Solid culture b) Suspension culture c) Monolayer culture d) Batch culture	1.5	CO3
Q 13	What do you understand by the term “explant”? Give an example.	1.5	CO3
Q 14	What is the main purpose of Bt cotton? a) Enhanced nutritional value b) Pest resistance c) Drought tolerance d) Faster growth	1.5	CO3
Q 15	Which animal was the first to be genetically modified? a) Dolly the sheep	1.5	CO3

	b) OncoMouse c) GloFish d) AquaAdvantage salmon		
Q 16	What is the main purpose of gel electrophoresis? a) Amplify DNA b) Separate DNA fragments by size c) Sequence RNA d) Clone genes	1.5	CO4
Q 17	What is the primary advantage of biopharmaceuticals over traditional drugs? a) Lower cost b) Higher specificity and fewer side effects c) Easier production d) Longer shelf life	1.5	CO4
Q 18	What is the purpose of Western blotting? a) To detect proteins b) To analyze DNA c) To sequence RNA d) To amplify DNA	1.5	CO4
Q 19	Define GMOs. Give an example of a transgenic animal.	1.5	CO4
Q 20	What is the difference between innate and adaptive immunity?	1.5	CO4
Section B: Short-Answer Questions (4Qx5M=20 Marks)			
Q 1	Explain the role of biotechnology in addressing global challenges, such as food security and sustainable agriculture.	5	CO1
Q 2	Discuss the process of transcription in molecular biology, emphasizing the key players involved and its significance in gene expression.	5	CO2
Q 3	Highlight the role of plant tissue culture in crop improvement and genetic modification.	5	CO3
Q 4	With the help of an example, discuss the ethical considerations in the use of GMOs in agriculture.	5	CO4
Section C: Case study (2Qx15M=30 Marks)			
Q 1	Biofuels have gained significant attention as a promising alternative to fossil fuels, with the potential to reduce greenhouse gas emissions and dependence on non-renewable energy sources. In this case study, we will explore a biofuel production project and the various environmental and ethical considerations associated with it. BioEco Fuels Ltd. is a forward-thinking company dedicated to addressing environmental concerns and promoting a sustainable energy future.	15 marks (5 marks each)	CO2

	The company has embarked on a groundbreaking project to produce biofuels from algae and non-food crops. This innovative venture has the potential to make a significant contribution to reducing carbon emissions and advancing the use of renewable energy sources. The biofuels produced by BioEco Fuels Ltd. are intended for use in both the transportation and industrial sectors. Based on your understanding about role of biotechnology in biofuel production, answer the following: A) What are the potential environmental benefits of using algae and non-food crops for biofuel production compared to traditional fossil fuels? B) What are the environmental challenges and risks associated with this project, and how can they be mitigated? C) What factors should BioEco Fuels Ltd. consider ensuring the long-term economic viability of the biofuel production project?		
Q 2	The COVID-19 pandemic, caused by the SARS-CoV-2 virus, led to an urgent global effort to develop vaccines. Traditional vaccine development typically involves using inactivated virus or protein subunits to trigger an immune response. However, mRNA vaccines, such as Pfizer-BioNTech (BNT162b2) and Moderna (mRNA-1273), represent a novel approach. These vaccines were developed rapidly and shown to be highly effective in preventing severe illness, hospitalization, and death from COVID-19. Their rapid development marked a significant milestone in biotechnology, though there were challenges around distribution, storage, and public acceptance. Based on the given case study, answer the following questions: A) How do mRNA vaccines differ from traditional vaccines in terms of their mechanism of action? B) What are the key advantages of using mRNA technology for vaccine development C) What are the challenges associated with the distribution and storage of mRNA vaccines, and how have these challenges been addressed?	15 marks (5 marks each)	CO4
Section D: Long-Answer Questions (2Qx10M=20 Marks)			
Q 1	a) What are transgenic animals? With the help of a neat and labelled diagram, explain the key steps involved in the production of transgenic animals b) List any three gene transfer methods used in producing transgenic animals.	5+5 marks	CO3

Q 2	Describe the role of nano-biotechnology in medicine, focusing on its applications in drug delivery, diagnostics, and cancer treatment. OR With the help of an example, discuss the principles of gene therapy and its potential applications in treating genetic disorders.	10 marks	CO5