JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

Comprehensive Examination – ODD SEM 2025

Ph.D (BT)

COURSE NAME: Medical Biotechnology

COURSE INSTRUCTORS: Dr. Anil Kant, Dr. Jitendraa Vashistt and Dr. Rahul Shrivastava

MAX. MARKS: 100 MAX. TIME: 3 Hours

Note: *(a) All questions are compulsory.*

Sec A - Advanced Cell & Molecular Biology (33 Marks)

Q.No	Question	Marks
Q1	Outline the basic steps involved, of gene cloning. Discuss the role of restriction enzymes, vectors, selection markers, transformation methods, and host systems?	5
Q2	Organisms also maintain the stability of their genome by repairing the DNA damage.Discuss major types of DNA repair mechanism?	5
Q3	Discuss the principle and analytical importance of real-time polymerase chain reaction (qPCR). Explain how it differs from conventional PCR?	5
Q4	Explain the molecular mechanism of protein translation, highlighting major events that occur during initiation,elongation and termination. Also include the enzymes and proteins, another factor that play a role in these stages.?	6
Q5	List and discuss the major factors that influence the level of recombinant protein expression in *E. coli*.?	6
Q6	Discuss the biochemical mechanisms that regulate programmed cell death. Include role of caspases, Bcl-2 family proteins, p53 protein in your answer?	6

Sec B - Human Physiology & Diseases (33 Marks)

Q.No	Question	Marks
Q7	A progressive dementia associated neurodegenerative disorder which majorly linked with impaired memory, thinking, and cognitive behaviour is usually characterized by plaques and tangles in the brain which lead to the brain cells death. Identify this disease and define the molecular details/biochemical pathway for above mentioned characteristics.	8
Q8	If a transcription factor of 53 kDa that binds DNA and regulates the expression of genes involved in Cell cycle arrest, DNA repair etc. get mutated results in cancer progression. Identify this protein, explain its cellular functions and also define the Mouse Double Minute 2 protein function in regulation of this above-mentioned protein.?	8
Q9	If someone experiences a persistent cough with blood-stained sputum for 2–3 weeks, accompanied by chest pain, fever, weight loss, and reduced or absent appetite, what could be the possible underlying disease? Explain how one can detect the disease and its causative organism using molecular diagnostic tests?	8
Q10	Differentiate between the following. a) Chikungunya and Dengue (4.5 M) b) Apoptosis and Necrosis (4.5 M)	9

Sec C- Immune Technology & Diagnostics (34 Marks)

Q.No	Question	Marks
Q11	Provide a comparative account of the following a. Classes & subclasses of immunoglobulins. (6 M) b. Natural and Artificial, Active and Passive Immunity (6 M)	12
Q12	With respect to Monoclonal Antibody production using hybridoma technology answer the following: a. Significance of Aminopterin for selection of Hybridoma cells. (3 M) b. Need of using HGPRT - myeloma cells for production of hybridoma cells. (3 M) c. Protocol and diagrams explaining the details of the hybridoma technology used for Monoclonal Antibody production (6 M)	12
Q13	**Case Study:** A diagnostic laboratory develops a multiplex PCR assay to simultaneously detect Salmonella spp., Shigella spp., and E. coli O157:H7 from stool samples using species-specific primers. Discuss how multiplex PCR saves time and reagents in this diagnostic setup. What primer design and reaction optimization limitations and challenges might arise when detecting multiple pathogens together? Discuss the optimum protocol designing strategy which may be used for development of multiplex PCR based methods for diagnostics.	10