

12/3/24

M.Sc. Examination 2024
Semester-I
Zoology
Course: MZCT-104
(Genetics and Molecular Biology)

Time: Three Hours

Full Marks: 40

Questions are value as indicated in the margin
Answer **four** questions from the following

1. Describe the functioning of the "Ac-Ds transposable element" in corn. Distinguish between a conservative and non-conservative transposon with suitable examples. 6+4=10
 2. What do you understand about unique and repetitive DNA sequences? Discuss about repetitive DNA sequences with suitable examples. 2+8=10
 3. Describe the catalytic action of DNA photolyases. What are AP sites? How are these generated? Elucidate the mechanism by which uracil is removed from DNA. State the function of Alk B protein. 3+1+1+3+2=10
 4. Write a brief note on Human Genome Project (HGP). Describe the procedure of "Sanger DNA sequencing". Explain the construction of a cDNA library. How is it different from genomic DNA libraries? 2+4+3+1=10
 5. Describe in brief about the six basic steps that are common to most of the recombinant DNA experiments generally performed? Write protocol of nucleic acid hybridization by "Southern blotting" and its application. 6+3+1=10
 6. Write short notes on **four** from the following: 2.5x4=10
 - (a) Wolf-Hirschhorn Syndrome
 - (b) Brief protocol for DNA chip sequencing (ChIP-seq)
 - (c) Parameters for designing a good oligonucleotide (primer) for PCR.
 - (d) Restriction endonucleases
 - (e) C- value paradox
 - (f) Ty elements
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M.Sc. Examination 2024
Semester-I
Zoology
Core Course Theory
MZCT-102 (Immunology)

Full Marks: 40

Time: Three Hours

Questions are of value as indicated in the margin
Answer **any four** questions

1. Describe with a suitable diagram the structural organization, stabilization, and activation of the first component of the classical pathway of complement activation. Mention the importance of immunoglobulins in this process. Why circulating IgM cannot activate the complement cascade? Add a note on 'anaphylatoxins' and identify the major amplification step with reasons under the classical pathway of complement activation.

$(2+1+2) + 1+1+(1+2) = 10$
2. Give an account of genes and peptides representing the HLA complex. Describe the structural organization of MHC-I with a brief description of the functional relevance of various domains. Describe briefly the involvement of non-MHC components involved in endogenous antigen processing and loading on MHC-I.

$2+(3+2)+3=10$
3. What are the significant steps of T cell activation? Describe briefly, with suitable examples, the importance of accessory molecules and co-stimulatory signals in T cell-mediated immune response. Define anergy of T cells. Add a note on the importance of CTLA-4/B7 interaction in regulating T-cell activation

$2+(2.5+2.5)+(1+2) = 10$
4. Explain the different stages of B-cell development that occur in bone marrow with suitable diagrammatic representation. Describe the B-cell activation with help of T_H -cells in secondary lymphoid organ. Write a brief note on "clonal selection" theory.

$4+4+2=10$
5. Describe in detail about germline gene organization and their rearrangement to get functional immunoglobulin (Ig) molecule having light kappa and heavy chain (μ/δ) with suitable diagrammatic representation. Add a note on "class switching" of immunoglobulins.

$2+ (3+3) +2=10$
6. Write Short notes on **any two** of the following:

$5 \times 2 = 10$

 - a) JAK-STAT pathway for cytokines function
 - b) T-cells maturation and their selection
 - c) Generation of immunoglobulin molecule diversity
 - d) Recognition and destruction of abnormal cells by Natural killer cells

27/2/25

M.Sc. Examination, 2024
Semester-I
Zoology
Core Course Theory
MZCT-101 (Fundamentals of Biochemistry)

Time: 3 hours

Full Marks: 40

Questions are of value as indicated in the margin.

*Answer **any four** questions.*

1. How do the kinetic and regulatory properties of glucokinases differ from other hexokinase isozymes? Explain the statement – 'PFK-2 activity determines the catalytic activity of PFK-1'. How does glucagon control activities of PFK-1 and pyruvate kinase in the liver? Add a note on its metabolic significance. 3+2+3+2=10
2. Name the glucose donor for glycogen synthase, and write the reaction of its formation. What is the catalytic action of glycogen synthase? How is it affected by covalent modification and allosteric regulators? Discuss in detail the effect of insulin on the regulation of glycogen synthase. 3+1+2+4=10
3. Elucidate the flow of electrons through the mitochondrial Q cycle. State the structural features and electron carriers of Complex IV of the mitochondrial electron chain. How does it catalyze tetra-electronic reduction of oxygen to water? 4+2+4=10
4. Why is electron transport said to be coupled with ATP synthesis? Name one chemical uncoupler and one biological uncoupler of oxidative phosphorylation. State the mode of action of each. With the help of a neat labeled diagram, show the arrangement of the different subunits of F_0 - F_1 ATPase. Describe the binding-change mechanism of ATP synthesis. 2+1+2+1+4=10
5. Using the titration curve of alanine, explain the relationship of pH with pKa. Why do most of the secretory proteins contain disulfide bond? Justify the statement – 'Peptide bond has a partial double bond character and thus a rigid structure'. Why silk does not stretch? – write your answer with reference to the structure of silk fibroin. 2+2+4+2=10
6. Write notes on **any four** of the following: 2.5x4=10
 - (a) Malate-aspartate shuttle
 - (b) Cytochromes
 - (c) Glucose 6-phosphatase
 - (d) Structure of Collagen
 - (e) Beta-pleated sheet
 - (f) Factors affecting stability of alpha helix

M.Sc. Examination, 2024
Semester-I
Zoology
Core Course Theory
MZCT-101 (Fundamentals of Biochemistry)

Time: 3 hours

Full Marks: 40

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