

IMMUNOLOGY
(BIOT 3201)

Time Allotted : 3 hrs

Full Marks : 70

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

Candidates are required to give answer in their own words as far as practicable.

Group - A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**
- (i) A Fab fragment
(a) is produced by pepsin treatment (b) binds antigen
(c) has no interchain disulfide bonds (d) none of the above.
- (ii) Western blots are primarily used to detect
(a) DNA (b) RNA (c) Protein (d) Lipid.
- (iii) HAT medium is used to
(a) Culture B lymphocytes
(b) Select for hybrids in hybridoma technique
(c) Fuse B-cells to myeloma cells
(d) Immortalize B lymphocytes.
- (iv) Clonal selection occurs when the antigen is encountered by
(a) T-cells (b) B-cells
(c) both T and B cells (d) none of the above.
- (v) _____ is a graft between members of the same species.
(a) Autograft (b) Allograft (c) Xenograft (d) Isograft
- (vi) BCG is used to protect against
(a) Tuberculosis (b) Rabies (c) Hepatitis B (d) Influenza.
- (vii) Tears contain _____
(a) IgA (b) IgG (c) Lysozyme (d) All of the above.
- (viii) Which of the following statements is TRUE for IgA?
(a) Is present in milk and saliva
(b) Is involved in hay fever
(c) Crosses the placenta
(d) Activates complement by the classical pathway.

- (ix) Antibody dependent cytotoxicity is associated with
(a) Type I hypersensitivity (b) Type II hypersensitivity
(c) Type III hypersensitivity (d) Type IV hypersensitivity.
- (x) The Fc region of antibody
(a) contains both heavy and light chains.
(b) is required for antigen binding.
(c) generally confers biological activity on the various molecules.
(d) is not a requirement for placental transmission.

Group- B

2. (a) Describe the functions of (i) complete antigens, (ii) haptens and (iii) adjuvants. [(CO1)(Remember/LOCQ)]
(b) What is complement reaction? Differentiate between three types of complement system by using a suitable diagram. [(CO1)(Evaluate/HOCQ)]
(2 + 2 + 2) + 6 = 12
3. (a) Describe the process of Phagocytosis with the help of a diagram. [(CO1)(Analyze/IOCQ)]
(b) Describe with suitable diagram the functions of different types of APCs. [(CO1)(Remember/LOCQ)]
(c) The process of T cell maturation is also known as 'Thymic Education'. Justify the statement. [(CO1)(Justify/HOCQ)]
4 + 4 + 4 = 12

Group - C

4. (a) Mention the forces acting upon an antigen-antibody interaction. [(CO4)(Remember/LOCQ)]
(b) Explain with a flow chart the formation of antibody heavy chain by V-D-J recombination. [(CO2)(Analyze/IOCQ)]
(c) An ELISA designed to test for the presence of serum antibody for a new strain of pathogenic bacteria is under development. Initially, a monoclonal antibody specific for a single epitope of the organism was used both to sensitize the wells of the ELISA plate and as the enzyme-labeled detecting antibody in a conventional sandwich ELISA. The ELISA failed to detect the antigen despite the use of a wide range of antibody concentrations. What is the most probable cause of this problem? [(CO3)(Evaluate/HOCQ)]
4 + 4 + 4 = 12
5. (a) Describe the preparation of Monoclonal antibodies by Hybridoma technique. [(CO3)(Understand/LOCQ)]
(b) Nowadays, antibody engineering techniques are applied to make the MAbs more efficient and target-specific. Justify the statement with examples. [(CO3)(Justify/HOCQ)]

- (c) Describe the mechanism of action of Radioimmunoassay (RIA). [[CO3](Understand/LOCQ)]
4 + 4 + 4 = 12

Group - D

6. (a) Differentiate between MHC Class I and Class II. [[CO4](Differentiate/IOCQ)]
 (b) Illustrate the mode of antigen processing and presentation for exogenous antigens. [[CO4](Analyze/IOCQ)]
 (c) Explain with reasons how tissue typing helps in organ transplantation. [[CO4](Analyze/IOCQ)]
4 + 4 + 4 = 12
7. (a) Mention the normal immune response towards a graft implantation. [[CO4](Understand/LOCQ)]
 (b) Evaluate the difference between Graft-versus host disease and Host-versus graft disease. [[CO4](Evaluate/HOCQ)]
 (c) Give a comparative account of acute, hyperacute and chronic rejection. [[CO4](Analyze/IOCQ)]
4 + 4 + 4 = 12

Group - E

8. (a) Explain graphically the stages of HIV infection. [[CO5](Remember/LOCQ)]
 (b) What is meant by clonal anergy? [[CO5](Understand/LOCQ)]
 (c) Analyze the two-signal hypothesis for T-cell activation. [[CO5](Analyze/IOCQ)]
4 + 4 + 4 = 12
9. (a) What is autoimmune disease? Use rheumatoid arthritis as a case study to explain the development of an autoimmune disease. [[CO5](Remember/LOCQ)]
 (b) What are tumour antigens? Give appropriate examples of different types of tumour antigens. [[CO6](Understand/LOCQ)]
 (c) Differentiate between the mode of action of a DNA vaccine and RNA vaccine. [[CO6](Analyze/IOCQ)]
4 + (1 + 3) + 4 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	43.75	38.33	22.92

Course Outcome (CO):

After completing the course, the students will be able to:

1. Understand the basic principles of innate and adaptive immunity and the underlying mechanisms of cellular and humoral immune responses.

2. Develop an idea about structure, biogenesis, function and molecular diversity of different antibody classes.
3. Apply the techniques of antibody engineering and antigen-antibody reactions in disease diagnostics and research.
4. Analyze the role of MHC molecules in transplantation and the diseases due to their incompatibility.
5. Understand the immunological basis of hypersensitivity, autoimmunity and immunodeficiency disorders.
6. Gain knowledge about different approaches of vaccine development and their applications in human diseases.

*LOCQ: Lower Order Cognitive Question; IOCQ: Intermediate Order Cognitive Question; HOCQ: Higher Order Cognitive Question