

**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) The association constant (K_a) at equilibrium is represented by
(a) $\frac{[\text{AgAb complex}]}{[\text{free Ag}][\text{free Ab}]}$ (b) $\frac{[\text{AgAb complex}]}{[\text{free Ag}]/[\text{free Ab}]}$
(c) $\frac{[\text{free Ag}][\text{free Ab}]}{[\text{AgAb complex}]}$ (d) $\frac{[\text{free Ag}]}{[\text{free Ab}]}$
 - (ii) B Cells are activated by
(a) Complement (b) Antibody (c) Memory cells (d) Antigen.
 - (iii) The membrane attack complex consists of
(a) OH (b) Collicins (c) C3b3b, Bb (d) C5b,6,7,8,9.
 - (iv) Clonal selection occurs when antigen is encountered by
(a) Neutrophils (b) T cells (c) Mast cells (d) Basophils.
 - (v) The complementarity determining regions
(a) are restricted to light chains
(b) are in the constant part of the Ig molecule
(c) bind to Fc receptors
(d) are concerned in antigen recognition.
 - (vi) Which of the gene clusters do not contribute to antigen binding?
(a) V_L (b) C_L (c) V_H (d) D.
 - (vii) In primary immune response, antibodies rise in plasma level within
(a) 10 days (b) 12 days (c) 7 days (d) 15 days.
 - (viii) BCG is used to protect against
(a) Tuberculosis (b) Rabies (c) Influenza (d) Hepatitis B.
 - (ix) Type IV hypersensitivity is often referred to as
(a) Immediate (b) Delayed (c) Anaphylactic (d) Anergic.

- (x) The major molecules responsible for transplant rejection is
(a) B cells (b) MHC molecules (c) T cells (d) Antibodies.

Group- B

2. (a) Describe the different steps of phagocytosis during a cellular infection. [(CO1)(Understand/LOCQ)]
(b) What are different types of cells involved in innate immunity? Discuss with functions. [(CO1)(Remember/LOCQ)]
(c) Distinguish between the function and mode of action of T cells and B cells. [(CO1)(Understand/LOCQ)]
4 + (1 + 3) + 4 = 12
3. (a) Describe the structure and functions of primary and secondary lymphoid organs. [(CO1)(Remember/LOCQ)]
(b) What is complement reaction? Differentiate between three types of complement system by using a suitable diagram. [(CO1)(Evaluate/HOCQ)]
(3 + 3) + (1 + 5) = 12

Group - C

4. (a) How can IgM exist both in secretory as well as membrane-bound forms? [(CO2)(Analyze/IOCQ)]
(b) Describe the structure of a typical antibody molecule. [(CO2)(Justify/HOCQ)]
(c) Explain how a B cell is able to switch between different isotypes. [(CO2)(Analyze/IOCQ)]
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 sandwich ELISA. [(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 endogenous antigens. [(CO4)(Analyze/IOCQ)]
(c) What do you mean by Graft versus Host disease? [(CO4)(Analyze/IOCQ)]
4 + 4 + 4 = 12

7. (a) Give a comparative account of acute, hyperacute and chronic rejection. [(CO4)(Analyze/IOCQ)]
(b) Define: Allograft, Isograft, Autograft, Xenograft. [(CO4)(Understand/LOCQ)]
(c) Discuss the phenomenon of 'Haemolytic Disease of the newborn'. [(CO4)(Justify/HOCQ)]
4 + 4 + 4 = 12

Group - E

8. (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 the advantages and disadvantages of using attenuated vaccines? [(CO6)(Understand/LOCQ)]
(c) Explain the mechanism of production of a DNA vaccine. [(CO6)(Analyze/IOCQ)]
4 + 4 + 4 = 12
9. (a) Analyze the development of immediate hypersensitivity reaction. [(CO5)(Analyze/IOCQ)]
(b) What do you mean by active and passive immunization? Give examples. [(CO5)(Analyze/IOCQ)]
(c) Site an example how you can use cytokines for cancer immunotherapy. [(CO5)(Justify/HOCQ)]
4 + 4 + 4 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	30	54	16

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