

**IMMUNOLOGY**  
**(BIOT 3201)**

**Time Allotted : 2½ hrs**

**Full Marks : 60**

*Figures out of the right margin indicate full marks.*

*Candidates are required to answer Group A and any4 (four) from Group B to E, taking one from each group.*

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

**Group - A**

1. Answer any twelve:

**12 × 1 = 12**

*Choose the correct alternative for the following*

- (i) A polymorphonuclear neutrophil (PMN)
  - (a) Is a bone marrow stem cell
  - (b) Is closely related to mast cell
  - (c) Contains microbial cytoplasmic granules
  - (d) Has granules that stain with eosin
- (ii) Clonal selection occurs when antigen is encountered by
  - (a) Basophil
  - (b) Neutrophil
  - (c) T-cells
  - (d) Mast cells
- (iii) Which of the following statements does not apply to IgG?
  - (a) Appears early in the primary immune response
  - (b) Neutralizes bacterial toxins
  - (c) Crosses the human placenta
  - (d) Opsonizes bacteria
- (iv) The affinity of an antibody can be determined by measuring
  - (a) The amount of antibody bound at various antigen concentrations
  - (b) Its concentration
  - (c) The sedimentation coefficient of the antibody
  - (d) The valency of antigen binding
- (v) Recombination of V, D and J Ig gene segments
  - (a) Only occurs in mature B-cells
  - (b) Only occurs in light chains
  - (c) Involves heptamer-spacer-heptamer flanking sequences
  - (d) Is effected by recombinase enzymes

- (vi) The foetus may be protected from maternal transplacental attack by
  - (a) Luteinizing hormone
  - (b) Presence of HLA Class-I on the foetus
  - (c) HLA-G on the extravillous cytotrophoblast
  - (d) C3 convertase on the syncytiotrophoblast
- (vii) What is a graft between different members of the same species termed?
  - (a) Autograft
  - (b) Allograft
  - (c) Isograft
  - (d) Xenograft
- (viii) Which of the following is a co-receptor for HIV?
  - (a) CD54
  - (b) CR5
  - (c) CXCR4
  - (d) None of the above
- (ix) Rhesus haemolytic disease of the foetus and newborn involves:
  - (a) Antibody to cell surfaces
  - (b) IgE
  - (c) Soluble immune complexes
  - (d) None of the above
- (x) Which of the following is a non-organ specific (systemic) autoimmune disease?
  - (a) Systemic Lupus Erythematosus (SLE)
  - (b) Myasthenia Gravis
  - (c) Type I diabetes mellitus
  - (d) All of the above

*Fill in the blanks with the correct word*

- (xi) Cleavage of IgG by \_\_\_\_\_ enzyme produces Fab segment.
- (xii) Hybridoma cells can be produced by fusing human \_\_\_\_ cells with mouse \_\_\_\_\_ cells.
- (xiii) \_\_\_\_\_ is an example of an enzyme labelled with antibodies in ELISA.
- (xiv) Cell mediated immunity is carried out by \_\_\_\_ while humoral immunity is carried out by \_\_\_\_\_.
- (xv) Immunity present since birth is called \_\_\_\_\_ .

### **Group - B**

2. (a) Analyze the role of external defence barriers in human immune system. [[CO1)(Analyse/IOCQ]]
- (b) What are Natural Killer cells and how do they cause ADCC of virus or cancer infected cells? [[CO1)(Understand/LOCQ]]

- (c) How activation of B cells produce antibodies via T dependent and T independent antigens? *[[CO1](Remember/LOCQ)]*  
**4 + 4 + 4 = 12**
3. (a) Comment on the different types of antibodies along with their functions. *[[CO1](Understand/LOCQ)]*
- (b) Distinguish between primary and secondary immune reactions. *[[CO1](Remember/LOCQ)]*
- (c) Give a detailed account of the cellular events in the inflammation process. *[[CO1](Remember/LOCQ)]*  
**4 + 4 + 4 = 12**

### Group - C

4. (a) How does the same antibody exist both in secretory as well as membrane-bound forms? *[[CO2](Analyze/IOCQ)]*
- (b) During antibody generation, an infinite diversity of specificity is generated from finite amounts of DNA. Justify this statement with respect to V-D-J recombination events. *[[CO2](Justify/HOCQ)]*
- (c) Mention the importance of Palindromic (P) nucleotides in junctional diversity of antibodies. *[[CO2](Describe/LOCQ)]*  
**4 + 4 + 4 = 12**
5. (a) Nowadays, antibody engineering techniques are applied to make the MAbs more efficient and target-specific - Justify the statement with examples. *[[CO3](Justify/HOCQ)]*
- (b) Discuss the applications of monoclonal antibodies in diagnostics and therapy. *[[CO3](Describe/LOCQ)]*
- (c) Illustrate the mechanism of Phage Display technique. *[[CO3](Remember/LOCQ)]*  
**4 + 4 + 4 = 12**

### Group - D

6. (a) Give a comparative account of acute, hyperacute and chronic rejection. *[[CO4](Compare/IOCQ)]*
- (b) Discuss the polymorphism of MHC Class-I and II genes. *[[CO4](Remember/LOCQ)]*
- (c) Justify with reasons the advantage of this polymorphism from the immunological and evolutionary perspective. *[[CO4](Apply/IOCQ)]*  
**4 + 4 + 4 = 12**
7. (a) Differentiate between Graft-versus Host Disease and Host-versus Graft Disease. *[[CO4](Differentiate/IOCQ)]*
- (b) Discuss with reasons how Tissue Typing helps in organ transplantation. *[[CO4](Discuss/IOCQ)]*
- (c) Justify with reasons why foetus is not rejected as an allograft. *[[CO4](Justify/HOCQ)]*  
**4 + 4 + 4 = 12**

## Group - E

8. (a) How are attenuated vaccines different from DNA vaccines? *[(CO6)(Remember/LOCQ)]*  
(b) Analyze the advantages and disadvantages of DNA vaccines. *[(CO6)(Analyze/IOCQ)]*  
(c) What are tumour antigens? Classify them with examples. *[(CO5)(Remember/LOCQ)]*  
**4 + 4 + (1 + 3) = 12**
9. (a) Using Grave's disease and Myasthenia Gravis as case studies illustrate the phenomenon behind autoimmune diseases. *[(CO5)(Apply/HOCQ)]*  
(b) Analyze the various stages of AIDS development with respect to antibody levels, T-cell counts, and HIV concentration after infection by using suitable diagrams. *[(CO5)(Analyze/IOCQ)]*  
(c) Discuss about the five main types of cancer vaccines. *[(CO5)(Understand/LOCQ)]*  
**4 + 4 + 4 = 12**
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Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	50	33.33	16.67

### 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.