Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/MBT, PHMB, PHMC/SEM-1/MBT, PHMB, PHMC-105/2009-10

2009

IMMUNOLOGY & VIROLOGY

Time Allotted : 3 Hours *Full Marks* : 70

The figures in the margin indicate full marks.

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

Question No. 1 and 7 are compulsory. Answer other *three* questions from each Module.

1. State whether the following statements in Yes or No : 5 × 1 = 5

   i) Do antibody molecules play any role in innate immunity ?

   ii) Could an endocytosed antigenic peptide be presented by MHC I ?

   iii) Are proteasomes essential for MHC II antigenic peptide presentation ?

   iv) Is apoptosis an integral component of cell mediated immunity ?

   v) Is blood group match/mismatch an immunological phenomenon ?

IMMUNOLOGY MODULE

Answer any *three* of the following questions. 3 × 10 = 30

2. a) List three features of smallpox that has enabled its eradication by vaccination.

   b) What prevents the complete eradication of polio today ? List one suggestion that will solve this challenge.

   c) Why (from an immunology perspective) is HIV AIDS currently incurable ? What in your opinion could be two specific improvements over current therapy strategies ?

   d) Define autoimmunity citing two specific short examples of autoimmune disease ? 3 + (1 + 1) + (1 + 2) + 2

3. a) Define immunological hypersensitivity. List the four types of hypersensitivity reactions.

   b) Mention the stages, molecules and cells associated with Type I hypersensitivity ? Why is it fatal ?

   c) Illustrate clearly with labels how $CD4^+$ and $CD8^+$ T cells get activated.

   d) Draw an immunological synapse clearly labelling all the associated molecules. (1 + 2) + (3 + 1) + (1 + 1) + 1

4. a) List the IgH constant gene segment mentioning each isotype and subclass of Ab.

b) What (chronological) gene rearrangements are associated with the formation of a functional heavy chain (IgH) gene ? (use a diagram)

c) Illustrate with clearly labelled figures the role of heptamers, nonamers and 12-23 rule associated with genetic recombination during *B* cell development.

d) Explain with figures the mechanism of generating membrane immunoglobulin (mIg) versus secreted or soluble Ig molecules. 2 + 3 + 2 + 3

5. a) What are complements (in immunology) and why were they named so ? List four complement actions.

b) Illustrate as a flow diagram the various stages and components of complement activation cascade by the classical pathway. Delineate the connection of the above activation with components of the alternate pathway.

c) Describe four mechanistic strategies of regulating complement activation pathways. (1 + 2) + (3 + 1) + 3

6. a) Describe with clearly labelled illustrations the 'signalling hypothesis' on development of $\alpha : \beta$ versus $\gamma : \delta$ *T* cells.

b) In a flow diagram illustrate the geographical location of as well as the developmental stage transitions of a stem cell into a $CD4^+$ $CD8^-$ or a $CD4^-$ $CD8^+$ *T* cells.

c) Illustrate how the α chain of the *T* cell receptor gene undergoes rearrangement to assume maturity clearly labelling its constituent regions.

d) Define immunological tolerance citing one example.

3 + 3 + 3 + 1

VIROLOGY MODULE

7. Answer any *five* of the following questions. 5 × 1 = 5

a) HIV attaches to

i) $CD4^+$ *T* cells

ii) $CD8^+$ *T* cells.

b) Lambda is a ..... phage.

i) lytic

ii) lysogenic

iii) both lytic and lysogenic.

c) Antigenic shift occurs while

i) within infected cell

ii) infecting across species.

d) Antigenic drift occurs while

i) within infected cell

ii) infecting across species.

e) Human cytomegalovirus evades the host immune system by down-regulating the amount of ..... molecules on the infected cell surface.

i) host MHC I

ii) host MHC II.

f) Epstein-Barr virus ..... cause cancer.

i) does

ii) does not.

g) Human Immunodeficiency Virus ..... cause cancer.

i) does

ii) does not.

Answer any *three* of the following questions. 3 × 10 = 30

8. a) List Koch's postulates.

   b) Describe a feature of poliovirus which led to the discovery of a novel mode of translation.

   c) Briefly state the activities of the National Polio Eradication Program. 4 + 4 + 2

9. a) What observation(s) led prions to be interpreted as slow reactive virus(es) ?

   b) Define the prion hypothesis. Explain briefly the uniqueness of such mode of disease transmission.

   c) Explain how eating parts of a BSE animal may lead to CZD in humans. 2 + 5 + 3

10. a) Illustrate (stepwise) the adsorption of HIV on the host cell surface identifying the molecules associated with the proccess.

    b) What is the sub-cellular location of reverse transcription of the HI Viral genome ?

    c) What class (their chemical nature) of drugs has been most effective against HIV ? 5 + 2 + 3

11. a) How are warts on human palms and feet caused by human papilloma viruses ?

b) Show the replication of papilloma virus in the context of epidermis differentiation.

c) How are sores formed on lips by herpes viridae different from the warts above ? 4 + 4 + 2