

**BANKURA UNIVERSITY**  
**Undergraduate End Semester -IV Examination of the A.Y. 2021 - 22**  
**ZOOLOGY**

**Course ID:** 42613

**Course Code:** SH/ZOOH/403/C-10

**Course Title:** Immunology

**Full Marks:** 25

**Time:** 1Hr 15 min

The figures in the right hand side margin indicate marks. Candidates are required to give their answers in their own words as far as practicable.

**Answer all the questions.**

**Group-A**

**1. Answer any five of the following questions. 5x1=5**

- a) Jules Bordet in the 1890s demonstrated that sheep antiserum to the *Vibrio cholerae* led to the lysis of bacteria. Subsequently he also showed that heating the antiserum destroyed the activity of lysis and that the lytic action was regained by adding fresh normal serum without antibody.  
The experimental results led to the discovery of a very important functional system of immunity by antiserum components and Bordet was later awarded Nobel Prize. What is the functional system present in the antiserum without antibody?
- b) Emil von Behring (1901), Robert Koch(1905) , Elie Metchnikoff and Paul Ehrlich(1908) were awarded Nobel Prizes for their discoveries for the development of immunological concept. Write down on their discoveries in brief.
- c) Selective and clonal-selection theories were postulated in 1900 and 1950s to elaborate antigen-antibody specificity. Write down the names of the scientists who postulated the concepts and awarded Nobel prizes.
- d) Lineages of lymphocytes may be distinguished by their expression of membrane molecules. These membrane molecules are recognized by particular antibodies. Monoclonal antibodies that react with particular membrane molecules are called CD. What is the full form of CD & what is its' chemical nature?
- e) PAMPs are recognized by PRMs or PRRs on the surface of some phagocytes. What do you mean by PAMPs and PRMs? What are the cell types which possess PRMs/PRRs?
- f) A hapten is an antigen and a hapten-carrier conjugate is the immunogen. On the basis of this postulate determine the types of antibodies development when animals are injected with:
  - i) Hapten for instance DNP,
  - ii) Protein carrier such as BSA,
  - iii) Hapten carrier conjugate as for example DNP-BSA.
- g) Distinguish between affinity and avidity of Ag-Ab interaction.

**h)** Cytokines play important roles in both innate and adaptive immunity. What are cytokines? What do you mean by lymphokines, chemokines and interleukins?

### **Group-B**

**2. Answer any two from the following questions.**

**2x5=10**

- a) The antigen-antibody interaction involves various non-covalent interactions between the epitope and the  $V_H/V_L$  domains of the antibody molecule. Write down in brief of the type of non-covalent interactions occur between these molecules.

Low-affinity antibodies bind weakly to the epitopes however high-affinity antibodies bind more tightly to the epitopes. Elaborate on the low-affinity and high-affinity binding of Ab-Ag considering the forward and reverse rate constants ( $k_1$  and  $k^{-1}$ ) as well as association and dissociation constants.

**1+2+2**

- b) Most antigens offer multiple epitopes and thus induce the formation of various B cell clones. Each of these clonal populations of B-cells recognizes a particular epitope for that antigen. Therefore the resulting serum antibodies are heterogenous giving rise to polyclonal antibodies. Kohler & Milstein in 1975 developed a method for preparing monoclonal antibody. Elaborate the method for producing monoclonal antibody with schematic representation.

**2+2+1=5**

- c) What do you mean by complement components? What do you understand by inactive and active complement components? Elaborate on the following designations of the complement components: C4a,C4b, C5b6789, C1qr<sub>2</sub>s<sub>2</sub>, C4b2a , C4b2a3b

**1+1+3=5.**

### **Group-C**

**3. Answer any one from the following questions.**

**1x10=10**

- I. MHC in mammals encodes three major classes of molecules using a collection of genes arrayed within a continuous stretch of DNA in different autosomes. The MHC genes are organized into regions referred to as HLA complex in human. Elaborate on organization of the MHC in human referring to the chromosome number, regions, gene products as well as HLA of class-I, II and III.

Briefly discuss on the kinds of cells which express these genes, nature of products and their functions.

Draw one each schematic diagram of class-I & class-II MHC molecules associated in membrane to elaborate their functions considering external domain, cytoplasmic tail and the peptide-binding cleft. . . . .       $3+3+4=10$

- II. Cytokines are regulatory proteins or glycoproteins secreted by WBC & various other cells to assist in regulation of the development of effector cells in immunity.

Cytokines possess the attributes of pleiotropy, redundancy, synergy, antagonism & cascade induction. Explain these attributes using activated TH cells which produce different cytokines which activate, proliferate, differentiate, and induce class switch to IgE, block class switch to IgE in different target cells.

Develop an ELISA to assay the presence of cytokines.

Four cytokines are provided as IL-1, TNF-alpha, IL-2, IFN-gamma for your answer in the following subjects: major cells of secretion, target cells /tissues& effects.     $4+2+4$

\*\*\*\*\*