SEMESTER: 8

COURSE: Major

PAPER TITLE: Advanced Immunology

PAPER CODE: C4BT230831T

CREDITS: 4

HOURS/WEEK: 4

CATEGORY: Core/MDC/SEC/VAC: Core

THEORY / PRACTICAL / COMPOSITE: Theory

NO OF MODULES: 2 (A + B)

COURSE OVERVIEW:

Semester IV paper, C2BT230421T introduced students to the basics of vertebrate's immune system. In this paper, the students will gain knowledge on:

- how cytokines orchestrate the entire immune response to a foreign antigen;
- the dynamicity of the humoral immune response, getting better with time through phenomena like somatic hypermutation and isotype switching;
- how improper activation of the immune system can lead to autoimmune disorders, chronic inflammatory diseases or transplant rejection;
- how immune system components mediate hypersensitivity reactions;
- how primary and secondary immunodeficiencies develop;
- how immune system combats cancer;
- how the immune system battles bacterial diseases, and how bacteria evades such host immune responses.

A thorough knowledge of both basic and applied aspects of immunology will help our students to understand the concept of immunotherapy, now recognised as specific with minimum side-effects, and motivate them to design immuno-therapeutics for certain debilitating diseases like cancer.

COURSE OUTCOME:

Modules A & B

1. Remember – Students will remember the organs/cells and molecules involved in innate and adaptive immune responses; diseases, including symptoms originating from improper immune responses; signalling pathways downstream of immune-receptors.

2. Understand – Students will develop an understanding of the mechanisms underlying:

different aspects of adaptive and immune responses to foreign antigens with special regards to somatic hypermutation and class switch recombination;

improper immune responses – cytokine storm, chronic inflammatory diseases, autoimmune disorders;

why transplant rejection occurs;

that irritating allergic symptoms are in fact results of immune response to presence of innocuous allergens with a good intention of driving them out of the host system but, if uncontrolled, can lead to severe consequences;

how our immune system helps to fight transformed cells at its initiation but with time the very same immune system's pressure can lead to worsening of the transformation, leading to cancer.

3. Apply – Students will apply their knowledge obtained from the different units of these modules to recognise and decipher mechanisms of immunopathogenesis underlying several infectious diseases like HIV/AIDS, COVID, etc.

4. Analyze – Students will analyze the scientific and clinical data encompassing the field of Immunology.

5. Evaluate – Students will critically evaluate Immunology-related scientific data to understand the underlying significance of it; clinical data (case studies) related to immunopathogenesis and understand the upstream cause(s) of the state, etc.

6. Create – Students will integrate their knowledge of Immunology to design immunotherapeutic drugs/vaccines for curing or preventing dreaded non-infectious or infectious diseases like hypersensitivity reactions, immunodeficiencies including HIV/AIDS, cancer, and emerging infectious diseases like Ebola Hemorrhagic Fever and others, or for therapeutic management of autoimmune disorders and chronic inflammatory diseases, or coming up with better immune suppressors to prevent transplant rejection.

PREREQUISITES: Must have completed the Immunology paper C2BT230421T offered in Semester IV.

SYLLABUS:

MODULE	UNIT CONTENT	HOURS or NUMBER of CLASSES	CO-MAPPING	COGNITIVE LEVEL
A	**UNIT 1:** Post-exposure to antigen, activation of mature T and B cells in secondary lymphoid organs, followed by differentiation into functional and memory cells. Somatic hypermutation and class switch recombination mechanisms in B cells for affinity maturation and isotype switching, respectively.	2 classes/week	CO1 – CO6	K1 – K6

	UNIT II: Cytokines – Cytokines and their cognate receptor signaling; cytokine storm; cytokine therapy. **UNIT III:** Tolerance and Autoimmunity - establishment and maintenance of central and peripheral tolerance; organ-specific and systemic autoimmune diseases, proposed mechanisms of onset of autoimmune disorders, immune-suppression treatments of autoimmune diseases. **UNIT IV:** Transplantation – immunological principles leading to graft rejection; target-specific or general immune-suppressive therapy for prevention of graft rejection.			
B	**UNIT V:** Allergy, Hypersensitivities, and Chronic Inflammation - Gell and Coombs Classification; Hypersensitivity Types I - IV; Chronic Inflammation. **UNIT VI:** Immunodeficiency Disorders - Primary Immunodeficiencies, including Combined Immunodeficiencies; Secondary Immunodeficiencies, including HIV/AIDS. **Unit VII:** Cancer and the Immune System - Terminology and common types of cancer; Malignant transformation of cells; Tumor	2 classes/week	CO1 – CO6	K1 – K6

	antigens; immune response to cancer; Cancer immunotherapy. **UNIT VIII:** Infectious Diseases - Importance of barriers to infection and innate response; Emerging and re-emerging infectious diseases; Bacterial infections: Immune Responses to Extracellular and Intracellular Bacteria, Bacterial Evasion of Host Defense Mechanisms.			

TEXT BOOK:

Owen JA, Punt J, Stranford SA. (2013). Kuby Immunology. 7th edition W.H. Freeman and Company, New York.

REFERNCE BOOKS:

1. Delves P, Martin S, Burton D, Roitt IM. (2006). Roitt's Essential Immunology. 11th edition Wiley-Blackwell Scientific Publication, Oxford.

2. Murphy K, Travers P, Walport M. (2008). Janeway's Immunobiology. 7th edition Garland Science Publishers, New York.

3. Abbas AK, Lichtman AH, Pillai S. (2007). Cellular and Molecular Immunology. 6th edition Saunders Publication, Philadelphia.

EVALUATION: Theory (100)

CIA- 20; Assignment – 05; Attendance – 05; Semester Exam- 70

PAPER STRUCTURE: for Semester Exam

Module A (35 Marks): Compulsory Question – 1x10 marks = 10 marks

Optional Questions – Any 2 out of 4, each carrying 12.5 marks = 25 marks (no sub-part will be more than 5 marks, and less than 1 mark)

Module B (35 Marks): Compulsory Question (objective) – 1x10 marks = 10 marks

Optional Questions – Any 2 out of 4, each carrying 12.5 marks = 25 marks (no sub-part will be more than 5 marks, and less than 1 mark)

COURSE OUTCOMES (COs) AND COGNITIVE LEVEL MAPPING (Ks)		
MODULES A & B		
COs	**CO Description**	**Cognitive levels (Ks)**
CO1	**Remember** – Students will remember the organs/cells and molecules involved in innate and adaptive immune responses; diseases, including symptoms originating from improper immune responses; signalling pathways downstream of immune-receptors.	K1
CO2	**Understand –** Students will develop an understanding of the mechanisms underlying: • different aspects of adaptive and immune responses to foreign antigens with special regards to somatic hypermutation and class switch recombination; • improper immune responses – cytokine storm, chronic inflammatory diseases, autoimmune disorders; • why transplant rejection occurs; • that irritating allergic symptoms are in fact results of immune response to presence of innocuous allergens with a good intention of driving them out of the host system but, if uncontrolled, can lead to severe consequences; • how our immune system helps to fight transformed cells at its initiation but with time the very same immune system's pressure can lead to worsening of the transformation, leading to cancer.	K2
CO3	**Apply –** Students will apply their knowledge obtained from the different units of these modules to recognise and decipher mechanisms of immunopathogenesis underlying several infectious diseases like HIV/AIDS, COVID, etc.	K3
CO4	**Analyze –** Students will analyze the scientific and clinical data encompassing the field of Immunology.	K4
CO5	**Evaluate –** Students will critically evaluate Immunology-related scientific data to understand the underlying significance of it; clinical data (case studies) related to	K5

	immunopathogenesis and understand the upstream cause(s) of the state, etc.	
CO6	**Create –** Students will integrate their knowledge of Immunology to design immunotherapeutic drugs/vaccines for curing or preventing dreaded non-infectious or infectious diseases like hypersensitivity reactions, immunodeficiencies including HIV/AIDS, cancer, and emerging infectious diseases like Ebola Hemorrhagic Fever and others, or for therapeutic management of autoimmune disorders and chronic inflammatory diseases, or coming up with better immune suppressors to prevent transplant rejection.	K6