

Semester	<b>IV</b>
Course <sup>*1</sup>	<b>Major-2</b>
Paper Code	<b>C2BT230421T</b>
Paper Title	<b>Immunology</b>
No. of Credits <sup>*2</sup>	<b>4</b>
Theory / Practical / Composite	<b>Full Theory</b>
Minimum No. of preparatory hours per week a student has to devote	4
Number of Modules	2
Syllabus	<p style="text-align: center;"><b><u>Module A: (18 marks)</u></b> <b>(1 class per week)</b></p> <p><b>UNIT I - Overview of the Immune System:</b> A historical perspective of Immunology; concept of herd immunity; humoral &amp; cellular immune responses; recognition of foreign substances by the immune system (including Clonal Selection Theory); pathogens and pathogenesis; PAMPs and PRRs; innate and adaptive immune responses (including memory responses); inappropriate or dysfunctional immune responses.</p> <p><b>UNIT II - Cells, Organs, and Micro-environments of the Immune System: Cells of the Immune System:</b> hematopoietic stem cells and hematopoiesis; cells of the myeloid lineage (granulocytes: neutrophils, basophils, mast cells and eosinophils; professional antigen-presenting cells: monocytes, macrophages, and dendritic cells); cells of the lymphoid lineage (lymphocytes: B-lymphocytes, T-lymphocytes, NK cells and NKT cells); <b>Organs of the Immune System:</b> primary lymphoid organs (bone marrow and thymus); secondary lymphoid organs (lymph nodes, spleen and mucosa-associated lymphoid tissue, including respective microenvironments); tertiary lymphoid tissues.</p> <p><b>UNIT III - Innate Immunity:</b> Anatomical barriers to infection (physical: skin and other epithelial barriers; chemical: acidic pH and antimicrobial proteins &amp; peptides; cellular: phagocytes, phagocytosis and Toll-like receptors); inflammatory responses; ubiquity of innate immunity (including plant innate immune responses).</p> <p><b>UNIT IV - The Complement System:</b> Components of the complement system; major pathways of complement activation (Classical, Lectin and Alternative) and membrane attack complex; diverse functions of complements; regulation of complement activity; complement deficiencies</p> <p style="text-align: center;"><b><u>Module B: (52 marks)</u></b> <b>(3 classes per week)</b></p> <p><b>UNIT V - The Organization and Expression of Lymphocyte Receptor Genes:</b> Immunoglobulin gene structure; Multigene organization of Ig genes; Mechanism of V(D)J recombination; B-Cell Receptor expression; T-Cell Receptor genes and expression</p>

	<p><b>UNIT VI - The Major Histocompatibility Complex and Antigen Presentation:</b> Structure and function of MHC Molecules; General organization and inheritance of MHC; Role of MHC and expression patterns; Endogenous pathway of antigen processing and presentation; Exogenous pathway of antigen processing and presentation; Cross-presentation of exogenous antigens; Presentation of nonpeptide antigens</p> <p><b>UNIT VII - T-Cell Development:</b> Early thymocyte development; Positive and negative selection; Lineage commitment; Exit from thymus and final maturation; Other mechanisms that maintain self-tolerance; Apoptosis</p> <p><b>UNIT VIII - B-Cell Development:</b> Site of hematopoiesis; B-Cell development in the bone marrow; Development of B-1 and marginal-zone B Cells; Comparison of B- and T-Cell development</p> <p><b>UNIT IX - T-Cell Activation, Differentiation, and Memory:</b> T-Cell activation and the two signal hypothesis; T-Cell differentiation; T-Cell memory</p> <p><b>UNIT X - B-Cell Activation, Differentiation, and Memory Generation:</b> T-dependent B-Cell responses; T-independent B Cell responses; Negative regulation of B Cells</p>	
Learning Outcomes * <sup>3</sup>	<ul style="list-style-type: none"> <li>• Through this paper the students will be introduced to the very complex but intriguing vertebrate immune system.</li> <li>• They will realize the significance of innate immunity and how it contributes to the activation of the adaptive branch.</li> <li>• The enormous diversity in recognition of foreign antigens resulting from the very unique “gene segment rearrangement” phenomenon will be dealt with at molecular level.</li> <li>• The students will realize the details of intricate cell-cell communication in context of activation, differentiation and memory development of the cellular components of the adaptive immune system.</li> </ul>	
Reading/Reference Lists * <sup>4</sup>	<ul style="list-style-type: none"> <li>• Owen JA, Punt J, Stranford SA. (2013). Kuby Immunology. 7th edition. W.H. Freeman and Company, New York.</li> <li>• Janeway CA, Travers P Jr, Walport M and Shlomchik MJ. (2001). Immunobiology. 5th edition. Garland Science, New York.</li> <li>• Delves P, Martin S, Burton D and Roitt IM. (2006). Roitt’s Essential Immunology. 11<sup>th</sup> edition Wiley-Blackwell Scientific Publication, Oxford.</li> </ul>	
Evaluation	<p><b>Theory (100)</b></p> <p>CIA- 20  Assignment – 05  Attendance - 05  Semester Exam- 70</p>	

Paper Structure for Theory Semester Exam	<p><b>Module A: (18 marks)</b></p> <ul style="list-style-type: none"><li>•1 Compulsory Question – objective-type (any 8 out of 10 questions; each of 1 mark): <math>1 \times 8</math> marks = 8 marks</li><li>•Any 2 out of 3 questions; each of 5 marks, with subparts (no sub-part will be more than 3 marks, and less than 1 mark): <math>2 \times 5</math> marks = 10 marks</li></ul> <p><b>Module B: (52 marks)</b></p> <ul style="list-style-type: none"><li>•1 Compulsory Question – 10 marks</li><li>•Any 3 out of 4 questions; each of 14 marks, with subparts (no sub-part will be more than 5 marks, and less than 1 mark): <math>3 \times 14</math> marks = 42 marks</li></ul>
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