

**DISCIPLINE SPECIFIC CORE COURSE – 14:
BASIC CONCEPTS OF IMMUNOLOGY**

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
MICROB-DSC502: BASIC CONCEPTS OF IMMUNOLOGY	4	3	0	1	Class XII pass with Biology/ Biotechnology/ Biochemistry	None

Learning Objectives

The Learning Objectives of this course are as follows:

- The main objective of this course is to give the students insight into how the human body tackles diseases and what mechanisms of defense are used in protection processes.
- The students will develop a clear understanding of the various components of the immune system and will become aware of the characteristics of antigens, their types and various antibodies produced by the system to defend us from the invading microorganisms.
- The student also learns about the major histocompatibility complex, the complement system, monoclonal antibodies and cytokines, which are of paramount importance in triggering an efficient immune response.

Learning outcomes

The Learning Outcomes of this course are as follows:

- The student will be able to describe various types of immune responses and the basic processes involved therein, how the immune system protects us from infection using various lines of defense.
- The student will be able to explain the characteristics and functions of the cells of the immune system as well as the structure and functioning of various organs of the immune system, and immunodiagnostic techniques.
- The student will be able to explain the important properties of antigens as well as how environmental factors affect antigen immunogenicity; the structure, types, and functions of antibodies, monoclonal and chimeric antibodies.

- The student will be able to describe the major histocompatibility complex proteins and their loci in the genome along with the two distinct pathways for processing and presentation of exogenous and endogenous antigens.
- The student will be able to discuss the mechanisms by which the complement system is activated via three distinct pathways so as to support the antibodies and phagocytes to clear microbes and damaged cells with utmost efficacy.

SYLLABUS OF DSC-14

UNIT – I (10 hours)

Basic Introduction to immune system: Components of innate immunity: Anatomical and physiological barriers, chemical mediators, non-specific defence mechanisms, inflammatory response, phagocytosis, Pattern Recognition Receptors (PRR). Features of Adaptive Immunity, Cytokines and cytokine receptor families with emphasis on IL-2R.

UNIT – II (10 hours)

Cells and organs of Immune System: Hematopoiesis, structures, functions and properties of cells of lymphoid lineage (T cell, B cell, NK cell) and myeloid lineage (macrophage, neutrophil, eosinophil, basophil, mast cell, dendritic cell). Separation of cells using Flow Cytometry. Primary and secondary immune organs (bone marrow, thymus, spleen, lymph nodes, GALT).

UNIT – III (15 hours)

Antigens and antibodies: Properties of Antigens: foreignness, molecular size, heterogeneity. Antigenicity and immunogenicity, environmental factors affecting immunogenicity of an antigen, adjuvants, epitopes of an antigen (T and B cell epitopes), T-dependent and T-independent antigens, haptens.

Elucidation of antibody structure; types, functions and properties of antibodies, antigenic determinants on antibodies (isotypic, allotypic, idiotypic), monoclonal and chimeric antibodies, immunoglobulin superfamily. Immunodiagnostics by SDS-PAGE, western blotting, ELISA and its types, immunofluorescence, immunoelectron microscopy.

UNIT – IV (5 hours)

T Cell Receptor, Major Histocompatibility Complex and Antigen Presentation: Structure and functions of TCR-CD3 complex, MHC I & MHC II molecules, organization of MHC locus (mouse and human), antigen processing pathways (cytosolic and endocytic).

UNIT – V (5 hours)

Complement and Activation Pathways: Components of complement system, Complement activation pathways (classical, alternative and lectin) and their biological consequences.

Practical component

UNIT 1: (18 hours)

Introduction to Immunology:

Student study research project: The contributions of the following scientists to the development of the field of immunology: Edward Jenner, Paul Ehrlich, Peter Medawar, MacFarlane Burnet, Neils K Jerne, Susumu Tonegawa, Jules Bordet, Peter C. Doherty & Rolf M. Zinkernagel, Cesar Milstein & Georges E. Kohler, and George Snell, Jean Dausset & Baruj Benacerraf.

Cells of Immune system:

Familiarizing students with the haemocytometer and its uses. Determining total leucocyte count in the given blood sample: making a smear of human blood and performing total and differential leukocyte count, determining percent count neutrophils, lymphocytes, eosinophils, basophils and monocytes. Study of the association of abnormal blood counts with diseases like leukopenia, leukocytosis, neutropenia.

Unit 2: (12 hours)

Basic Immunodiagnostic techniques:

Concepts of agglutination and identification of human blood groups. Understanding the concepts of immunoprecipitation by performing double immunodiffusion (Ouchterlony method). Principles, working methods and applications of Lateral Flow Test and Plate/ Dot ELISA. Performance of Plate/ Dot ELISA, and Lateral Flow Test using any diagnostic kit.

Essential/recommended readings

Theory:

1. Immunology: A short course by R. Coico. 8th edition. Wiley- Blackwell Scientific Publication, UK. 2021
2. Cellular and Molecular Immunology by A.K. Abbas, A.H. Lichtman and S. Pillai. 10th edition. Elsevier, USA. 2021.
3. Kuby Immunology by J. Punt, S. Stranford, P. Jones and J. Owen. 8th edition.
4. W.H. Freeman and Company, USA. 2018.
5. Roitt's Essential Immunology by P. Delves, S. Martin, D. Burton and I.M. Roitt. 13th edition. Wiley- Blackwell Scientific Publication, UK. 2017.
6. Janeway's Immunobiology by K. Murphy and C. Weaver. 9th edition. Garland Science Publishers, USA. 2016.
7. Basic and Clinical Immunology by M. Peakman and D. Vergani. 2nd edition. Churchill Livingstone, UK. 2009.
8. Immunology by C. Richard and S. Geoffrey. 6th edition. Wiley- Blackwell Scientific Publication, UK. 2009.

Practicals:

1. A Handbook of Practical and Clinical Immunology Volumes I & 2 by G. P. Talwar and S.K. Gupta. 2nd edition. CBS Publishers, India. 2017.
2. Practical Immunology, A Laboratory Manual by S. Balakrishnan, K. Karthik and S. Duraisamy. Lambert Academic Publishing, India. 2017.