DISCIPLINE SPECIFIC ELECTIVE COURSE -16 (BIOMED-DSE-16)

IMMUNE RESPONSE TO INFECTION AND DISEASES

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		
Immune Response to Infection and Diseases	**2**	**2**	**-**	**2**	**XII Passed**	**Basic knowledge of Immunology and Microbiology**

Learning Objectives

The students will learn:

- Molecular aspects of infections caused by various pathogenic microorganism followed by induction of host mediated immune responses.
- Defense evasive mechanisms adopted by the pathogen and their correlation with disease appearance and manifestation.
- Mechanisms associated with the generation of a huge diversity of T cell receptors and immunoglobulins from limited number of genes.
- Responses of the body during transplantation, cancer, hypersensitive reactions and autoimmune disorders.

Learning Outcomes:

Having successfully completed this course, students shall be able to learn:

- Mechanisms behind the infection and elimination of pathogens by various components of the immune system.
- Diversity of T cell receptors and antibody repertoire arisen by the different combinations of genes that can lead to detection of an enormous diversity of antigenic entities.
- Immune responses of the host during grafting and transplantation of tissues and suppression of the immune system in order to accept the graft.
- Most importantly, students will have an understanding about the different types of allergic reactions, onset of cancer from an immunological perspective, autoimmune disorders and their mechanisms.

SYLLABUS **(30 hours)**

Unit I: Overview of the Immune System: **(4 Hours)**

Components of the immune system: Innate immunity, adaptive immunity, humoral immunity and cell mediated immunity. Entry of bacteria and viruses through respiratory tract and gastrointestinal tract into the host, their establishment and infection. Factors influencing the pathogen load, role of complement and innate immune responses in early immune responses, adaptive immunity and its collaboration with innate immunity to counter pathogenic microorganisms. Lymphoid organs and their significance in immune responses.

Unit II: Mechanisms of Diversity of T cell repertoire and B cell repertoire-T Cell Receptor: Organization and Expression (6 Hours)

An introduction to cell mediated immunity, structure of TCR, germ-line organization of TCR gene segments, mechanism of TCR DNA rearrangements, assembly of rearranged TCR genes
B - Cell Receptor: Organization and Expression- An introduction to humoral immune response and role of innate immunity in the activation of humoral immune response, generation of antibody diversity, association of heavy and light chains. Class switching among constant region genes, expression of immunoglobulin gene, synthesis, assembly, and secretion of immunoglobulins as antibodies.

Unit III: Immune Response to Infectious Organisms (6 Hours)

Viral infections: Viral detection and neutralization by humoral immunity, cell mediated antiviral mechanisms, viral evasion of host defense mechanisms; with influenza virus as an example.
Bacterial infections: Immune responses to bacteria such as; *Salmonella typhi* and *Mycobacterium tuberculosis,* that causes typhoid and tuberculosis, respectively.
Parasitic diseases: Host responses to *Plasmodium* infection.

Unit IV: Immune Dysregulation & Clinical Immunology (14 Hours)
(a) Transplantation immunology
Concepts of MHC and role of HLA in tissue typing, Immunological basis of graft acceptance and rejection: Role of cell mediated responses, mechanisms involved in graft rejection. Clinical manifestations of graft rejection, general immunosuppressive therapy with cyclosporin A
(b) Hypersensitive Reactions:
Concepts of allergy, allergen and atopy. Type I-IV hypersensitive reactions and their molecular mechanisms with two examples each.
(c) Autoimmunity:
Organ specific autoimmune diseases (Myasthenia gravis), systemic autoimmune diseases (systemic lupus erythematosus and rheumatoid arthritis), mechanisms for induction of autoimmunity: Release of sequestered antigens and molecular mimicry.
(d) Cancer and the Immune System:
Immune responses to tumors: role of NK cells and macrophages, immune surveillance theory. Tumor evasion of the immune system: immunologic enhancement of tumor growth, modulation of tumor antigens, mechanism of immune evasion by tumors. Cancer immunotherapy

Practical (60 hrs)
(Wherever wet lab experiments are not possible, the principles and concepts can be demonstrated through any other material or medium including videos/virtual labs etc.)

1. To perform test for RA
2. Demonstration of immunoprecipitation
3. Analysis of antigen and antibody using immunoelectrophoresis
4. Perform quantitative precipitin assay
5. Demonstration of immunohistochemistry using kits
6. Identification and morphological characterization of various types of lymphocytes, macrophages, dendritic cells, neutrophils, basophils and mast cells using appropriate staining methods (Leishman staining, Giemsa staining etc.)
7. To perform Heamagglutination Reactions:
   a. Rh Typing,
   b. Coomb's test,
8. A visit to any regional vaccine/immunology institute to demonstrate the process of antisera production.

Essential Readings:

- Dorothy Wood, Joanne Willey, Kathleen Sandman (2022). 12th Edition. Prescott's microbiology. New York, USA: McGraw-Hill Education. ISBN-10: 1-264-77733-7 / 1264777337
- Punt, J. Stranford, S. Jones, P. and Owen, J. (2019). 8th Edition. *Kuby Immunology*. New York, USA: W.H. Freeman and Company. ISBN- 13: 978-1464189784
- Delves, P.J. Martin, S.J. Burton, D.R. and Roitt, I. M. (2017). 13th Edition. *Roitt's Essential Immunology*. New Jersey, USA: Wiley-Blackwell Science. ISBN: 13: 978- 1118415771.
- Cappuccino, J.G. and Sherman, N. (2013). 10th Edition. Microbiology: A laboratory manual. California, USA: Benjamin Cumming. ISBN-13: 978-0321840226.

Suggestive Readings:

- Willey, J. Sherwood, L and Woolverton, C.J. (2016). 10th Edition. *Prescott's Microbiology*. New York, USA: McGraw-Hill Education. ISBN-13: 978-1259281594.
- Tille, P. (2013). 13th Edition. Bailey & Scott's diagnostic microbiology. Missouri, USA: Mosby Publishers. ISBN-13: 978-0323083300.
- Madigan, M.T., Martinko, J.M., Stahl, D.A. and Clark, D.P. (2010). 13th Edition. Brock biology of microorganisms. California, USA: Benjamin Cumming. ISBN-13: 978-0321649638.
- Kindt T. J., Osborne B. A. , Goldsby R. A. (2007). 6th Edition *Kuby Immunology*. New York, USA: W.H. Freeman and Company. ISBN-13: 978-1429202114 ISBN-10: 1429202114.
- Tortora, G.J., Funke, B.R. and Case C.L. (2006). 9th Edition. Microbiology: An introduction. California, USA: Benjamin Cummings. ISBN-13: 978-0536292117.
- Hay, F.C. and Westwood, O.M.R. (2002). 4th Edition. *Practical Immunology*. New Jersey, USA: Blackwell Science. ISBN: 9780865429611.
- Pelczar, M.J (2001). 5th Edition. Microbiology. New York, USA: McGraw Hill International. ISBN-13: 9780074623206.