GUJARAT TECHNOLOGICAL UNIVERSITY
Integrated Master of Science (Biotechnology)
Semester: 8
Subject Name: Immunotechnology
Subject Code: 1380404

Prerequisite: Candidates enrolling in the Integrated MSc in Industrial Biotechnology with an elective in Microbial Biochemistry should have a solid foundation in core biological and chemical sciences.

Rationale: provide a comprehensive understanding of immunology and its applications in various fields, such as vaccine development, clinical immunology, antigen-antibody interactions, and lymphocyte maturation

Course Scheme:

Teaching Scheme			Total Credits	Assessment Pattern and Marks				Total Marks
				Theory		Practical		
L	T	PR	C	ESE (E)	PA(M)	ESE (V)	PA (I)	
4	0	0	4	70	30	0	0	100

Course Content:

Module No:	Module Content	No. of Sessions	Weightage (%)
1	**Lymphocyte maturation and cell-mediated immune response** Components of innate and acquired immunity; Important organs and cells of immune responses, complement and inflammatory responses; pathogen recognition receptors (PRR) and pathogen associated molecular pattern (PAMP); innate immune response; mucosal immunity; antigens - immunogens, haptens; Major histocompatibility complex (MHC) genes, Role of MHC in infectious diseases and disease susceptibility, HLA typing; Immunoglobulins-basic structure, classes & subclasses of immunoglobulins, antigenic determinants; multigene organization of immunoglobulin genes; B-cell receptor; Immunoglobulin superfamily; principles of cell signaling; basis of self & non-self discrimination; kinetics of immune response, memory; B cell maturation, activation and differentiation; generation of antibody diversity; T-cell maturation, activation and differentiation and T-cell receptors; functional T Cell subsets; cell-mediated immune responses, ADCC; cytokines-properties, receptors and therapeutic uses; antigen processing and presentation- endogenous antigens, exogenous antigens, non-peptide bacterial antigens and super-antigens; cell-cell co-operation.	**18**	**30**
2	**Antigen-antibody interactions**	**12**	**20**

	Precipitation, agglutination and complement mediated immune reactions; advanced immunological techniques - RIA, ELISA, Western blotting, T cell epitope prediction and ELISPOT assay, immunofluorescence, flow cytometry and immunoelectron microscopy; surface plasmon resonance, biosensor assays for assessing ligand–receptor interaction, CMI techniques- lymphoproliferation assay, mixed lymphocyte reaction, cell cytotoxicity assays, apoptosis, microarrays, transgenic mice, gene knockouts, Hybridoma and monoclonal antibodies, Applications of monoclonal antibodies; HLA-tetramer complex, Application of HLA-tetramer complex in analyzing antigen/peptide –specific T cell responses using flow cytometer.		
3	**Vaccinology** Active and passive immunization; live, killed, attenuated, subunit vaccines; vaccine technology- role and properties of adjuvants, recombinant DNA and protein based vaccines, reverse vaccinology; peptide vaccines, conjugate vaccines; antibody genes and antibody engineering- chimeric, hybrid monoclonal antibodies; catalytic antibodies and generation of immunoglobulin gene libraries, idiotypic vaccines and marker vaccines, viral-like particles (VLPs), dendritic cell based vaccines, vaccine against cancer, T cell based vaccine, edible vaccine and therapeutic vaccine ; Success stories in vaccinology *e.g.* Hepatitis, Polio, Small pox, DPT.	**12**	**20**
4	**Clinical Immunology** Immunity to infection: bacteria, viral, fungal and parasitic infections (Tuberculosis, HIV/AIDS, Schistosomiasis, Kala Azar, Chickungunya, Dengue); hypersensitivity reactions– Type I-IV; autoimmunity; types of autoimmune diseases; mechanism and role of CD4+ T cells; MHC and TCR in autoimmunity; transplantation –immunological basis of graft rejection; clinical transplantation and immunosuppressive therapy; tumor immunology – tumor antigens; immune response to tumors and tumor evasion of the immune system, cancer immunotherapy; immunodeficiency-primary immunodeficiencies, acquired or secondary immunodeficiencies, anaphylactic shock; immunosenescence: a challenge for an aging population; Immune exhaustion in the setting of chronic infections and malignancies; chronic Inflammation (Inflammaging) and immune activation; mucosal immunity and Gut Associated	**18**	**30**

	Lymphoid Tissue (GALT) in various gastrointestinal (GI) infections; complement deficiencies and human health; role of regulatory B cells (Bregs) in human disease. Monoclonal antibodies and their therapeutic role in reversing T cell functionality, Fab, F(ab)2 fragments; single-chain variable fragment (scFv), A trifunctional antibody; Bi-specific T-cell engagers (BiTEs) as artificial bispecific monoclonal antibodies for the use as anti-cancer drug.		

Reference Books:

1, Kindt, T. J., Goldsby, R. A., Osborne, B. A., & Kuby, J., Kuby Immunology, W.H. Freeman, Latest Edition

2, Brostoff, J., Seaddin, J. K., Male, D., & Roitt, I. M., Clinical Immunology, Gower Medical Pub, Latest Edition

3, Murphy, K., Travers, P., Walport, M., & Janeway, C., Janeway's Immunobiology, Garland Science , Latest Edition

4, Paul, W. E., Fundamental Immunology, Raven Press., Latest Edition

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
1	Distinguish between innate immunity and acquired immunity. Understand the structure and functions of the molecules, cells and organs involved on immunity.	UN
2	Determine the strategies that viruses and tumor cells interfere with to decrease the presentation of viral peptides on MHC class I molecules at the surface of infected cells and the consequences of such a situation on NK cells and cytotoxic T lymphocytes.	AN
3	Communicate concepts and ideas effectively.	EL
4	Transparency, honesty and ethical reasoning in handling molecular and cellular elements of the immune system.	RM

*RM: Remember, UN: Understand, AP: Apply, AN: Analyze, EL: Evaluate, CR: Create

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