DEPARTMENT OF MICROBIOLOGY				*CLASS: I M.Sc. Microbiology*				
Sem	**Course Type**	**Course Code**	**Course Title**	**Credits**	**Contact Hours/week**	**CIA**	**Ext**	**Total**
II	Major Core - 6	21P2RMC6	Immunology	4	5	25	75	100

Nature of Course				
Knowledge and skill	✓		Employability oriented	
Skill oriented			Entrepreneurship oriented	

Course Objectives

1. To describe the basic knowledge about immunity, organs and cells involved in immunity.
2. To demonstrate the mechanisms involved in initiation of specific immune responses and antibody diversity.
3. To detect the reaction by immune system leading to autoimmune, hypersensitive conditions and its consequences.
4. To assess the various serological diagnostic techniques based on antigen – antibody interaction.
5. To gain knowledge about immunologic processes governing graft rejection and therapeutic modalities for immune suppression in transplantation.

Course Learning Outcomes

On successful completion of the programme, the students will be able to

1. Summarize the fundamental concepts of immunity, compare the basic mechanism of innate and acquired immunity; humoral and cell mediated immunity.
2. Demonstrate the various antibodies and complement system
3. Analyze the significance of Major Histocompatibility Complex in terms of immune response and Realize how the MHC molecules functions.
4. Explain the interaction between the immune system and pathogens and allergic reactions.
5. Define the properties of cancer cells, immune recognition of tumors, immune evasion of cancers and basis of transplantations.

Unit	Description	Hours	K-level	CLO
I	**Unit I - Introduction to Immunology** History, Immunity- types-innate immunity (active, passive exposure), acquired (active, passive exposure). Cell mediated immunity and Humoral immunity. Immune system- Primary and Secondary lymphoid organs-lymph node, spleen, thymus, bone marrow, lymphoid tissues- GALT (Gut Associated Lymphoid Tissue), MALT (Mucosa Associated Lymphoid Tissue) SALT (Skin Associated Lymphoid Tissue). Immunoreactive cells-structure and functions-macrophages, granulocytes, NK cells, T and B lymphocytes – origin, development, differentiation, lymphocyte subpopulation in humans.	15 hrs	Up to K2	1

II	**Unit II – Antigens and Immunoglobulins** Antigens and immunogenicity- terminologies and definition- antigen, immunogen, haptens, super antigen, tolerant, epitope, paratope. Features associated with antigenicity and immunogenicity. Basis of antigen specificity. Antigen processing and presentation to T- lymphocytes. Immunoglobulins (IgA, IgD, IgG, IgE, IgM)- structure, types, distribution, biological and chemical properties - Theories of antibody production- its regulation and diversity. Production of monoclonal and polyclonal antibodies. Complement system – mode of activation- classical, alternate and lectin pathways, biological functions.	15 hrs	Up to K3	2
III	**Unit III – Immune responses and Immune disorders** Immune response – primary and secondary. Physiology of acquired immune response – various phases of HI, CMI – cellmediated cytotoxicity. Autoimmunity–Systemic-Rheumatoid arthritis-Multiple sclerosis-Systemic lupus erythematosus (SLE). Hypersensitivity – types (Types I, II, III and IV) and mechanisms.Immuno-induction, immunosuppression, immuno-tolerance, immuno-potentiation. Role of cytokines, lymphokines and chemokines., Immunodeiciency-AIDS (HIV infection).	15 hrs	Up to K3	3
IV	**Unit - IV: Antigen-Antibody reactions** Antigen – Antibody reactions –serological methods-Quantification (dilution, titer method), strength of antigen-antibody interactions (affinity, avidity), Lattice hypothesis or prozone phenomenon, Immunological tests- Blood group types-ABO system, agglutination- direct and indirect agglutination tests, types-slide, tube, coomb's, passive- latex, haemagglutination, precipitation tests- precipitation in gels, precipitation curve, tube/ring precipitation test, immunodiffusion tests-gel diffusion (Oudin, Radial, Ouchterlony).	15 hrs	Up to K4	4
V	**Unit - V: Transplantation immunology and Immunodiagnosis** Tumor and Transplantation Immunology – MHC – types and importance- distribution and function. Immunologic Basis of Graft Rejection -Allograft rejection –cells involved– GVHD – Prevention of graft rejection. Tumor Antigens –Immunity to tumor-Tumor evasion mechanisms-Immunodiagnosis – Tumor therapy. Vaccines - Immunization schedule.	15 hrs	Up to K4	5

Total 75 Hrs

Books for Study:

1. Roitt, I.M. (1998). Essentials of Immunology. Blackwell Scientific Publishers, London.
2. Kuby, J. (1994) Immunology, 2nd Edition, W.H. Freeman and Company, New York.
3. Leffel, Donnenberg, A. and Rose, W. (1997). Hand book of Human Immunology. Boca Raton Fla: C.R.C Press. Boca Raton, United States.
4. Abbas, A.K., Lichtman, A.M. and Pober, J.S. (1997). Cellular and Molecular immunology 3rd Edition W.B. Saunders, United States.
5. Ananthanarayanan, R. and Panicker, J.C.K. (1994). Text book of Microbiology. Orient Longman, Hyderabad, India.

Books for Reference:

1. Clark, W.R. (1991). The experimental foundations of modern immunology. John Wiley and Sons Inc., New York.
2. Brooks, G.F., Carroll, K.C., Butel, J.S., Morse, S.A., Melnick, J. and Adelberg. (2007). Medical Microbiology. 24th Edition. McGraw Hill Publication, New York.
3. Baron, E.J. and Finegold, S.M. (1995). Diagnostic Microbiology. Blackwell Scientific Company, New Jersey.

Web Resources:

1. https://onlinelibrary.wiley.com/journal/13652567
2. http://www.helmberg.at/immunology.pdf
3. http://www.mednotes.net/notes/immunology/
4. https://www.nejm.org/medical-research/autoimmune-disease%20Course%20Learning%20Outcomes/

Rationale for Nature of the course

Immunology deals with physiological functioning of the immune system in states of both health and disease as well as malfunctions of the immune system in immunological disorders like allergies, hypersensitivities, immune deficiency, transplant rejection and autoimmune disorders. It deals with physical, chemical and physiological characteristics of the components of immune system *in vitro*, and *in vivo*. Immunology has a vast array of uses in several disciplines of science and medical sciences.

Activities having direct impact on Skill development/Employability / Entrepreneurship

Identifying immunology related diseases and developing research initiatives for early detection.
Providing skills to work with professional regulatory bodies regarding clinical research.
Hands-on training for designing drugs and to perform serological diagnosis.

Pedagogy

Chalk and talk, PPT, Group discussion, Seminar, Screening of educational videos and quiz

Course Learning Outcomes (CLO)

On completion of this course the students will be able to

CLOs	Course Learning Outcome	Knowledge Level
CLO-1	Summarize the fundamental concepts of immunity, compare the basic mechanism of innate and acquired immunity; humoral and cell mediated immunity.	Up to K2
CLO-2	Demonstrate the various antibodies and complement system	Up to K3
CLO-3	Analyze the significance of Major Histocompatibility Complex in terms of immune response and Realize how the MHC molecules functions.	Up to K3
CLO-4	Explain the interaction between the immune system and pathogens and allergic reactions.	Up to K4
CLO-5	Define the properties of cancer cells, immune recognition of tumors, immune evasion of cancers and basis of transplantations.	Up to K4

K1 –Remembering and recalling facts with specific answers
K2 – Basic understanding of facts and stating main ideas with general answers
K3 – Application oriented – Solving Problems
K4 – Examining, analyzing, presentation and make interferences with evidences

Mapping of Course Learning Outcome with Programme Specific Outcome

	PSO1	PSO2	PSO3	PSO4	PSO5
CLO1	1	2	2	1	1
CLO2	2	2	3	2	1
CLO3	3	2	1	2	2
CLO4	1	1	1	2	1
CLO5	1	3	3	1	1

Advance application – 3, Intermediate level – 2, Basic level – 1.

Mapping of Course Outcome with Programme Outcome

	PO1	PO2	PO3	PO4	PO5
CLO1	1	2	2	1	2
CLO2	2	1	1	2	2
CLO3	1	2	2	1	1
CLO4	1	2	1	2	1
CLO5	2	2	1	2	1

Advance application – 3, Intermediate level – 2, Basic level – 1.

Learning Outcome Based Education & Assessment (LOBE)

Blue Print

Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1.	CLO 1	Up to K2	2	K2 & K2	1	K1	2 (K1&K1)	1(K2)
2.	CLO 2	Up to K3	2	K3 & K3	1	K1	2 (K3&K3)	1(K3)
3.	CLO 3	Up to K3	2	K3 & K3	1	K2	2 (K2&K2)	1(K3)
4.	CLO 4	Up to K4	2	K4& K4	1	K2	2 (K4&K4)	1(K4)
5.	CLO 5	Up to K4	2	K1& K1	1	K3	2 (K4&K4)	1(K4)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each Section			10		10		25	30

K1 –Remembering and recalling facts with specific answers
K2 – Basic understanding of facts and stating main ideas with general answers
K3 – Application oriented – Solving Problems
K4 – Examining, analyzing, presentation and make interferences with evidences

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	2	4	10	-	**16**	13.33	**35 %**
K2	2	4	10	10	**26**	21.67	
K3	4	2	10	20	**36**	30	**30%**
K4	2	-	20	20	**42**	35	**35%**
Total Marks	10	10	50	50	**120**	100.00	**100%**

K1 –Remembering and recalling facts with specific answers
K2 – Basic understanding of facts and stating main ideas with general answers
K3 – Application oriented – Solving Problems
K4 – Examining, analyzing, presentation and make interferences with evidences

LESSON PLAN

Units	Description	Staff	Hours	Mode
I Introduction to Immunology	a) Introduction- immunity- types-innate, acquired (active, passive exposure).		2	Chalk and Talk
	b) Cell mediated immunity and Humoral immunity.		2	PPT
	c) Organs of immune system: Primary and Secondary lymohoid organs- lymph node, spleen, thymus, bone marrow.		3	PPT
	d) Lymphoid tissues- GALT (Gut Associated Lymphoid Tissue), MALT (Mucosa Associated Lymphoid Tissue) SALT (Skin Associated Lymphoid Tissue).		3	Chalk and Talk
	e) Immunoreactive cells- structure and functions. macrophages, granulocytes, NK cells		2	Lecture
	f) T and B lymphocytes. Phagocytosis		3	PPT
II Antigens and Immunoglobulins	a) Antigen - types, properties. Hapten, adjuvants		3	Chalk and talk
	b) Immunoglobulins – Basic structure and classes – (IgG, IgA, IgM, IgD, IgE) and functions.		4	PPT
	c) Immunotechnology – hybridoma and monoclonal , polyclonal antibodies,		4	Lecture
	d) Complement system – mode of activation-classical, alternate and lectin pathways, biological functions.		4	Chalk and Talk
III Immune responses and immune disorders	a) Physiology of acquired immune response – various phases of HI, CMI – cell mediated cytotoxicity		4	PPT
	b) Hypersensitivity reactions - types, Antibody mediated (Type- I, Type II, Type III) and Cell mediated (Type- IV)		4	Chalk and Talk
	c) Autoimmunity–organspecific-Systemic-Rheumatoid arthritis-Multiple sclerosis-Systemic lupus erythematosus (SLE).		3	Lecture
	d) Immuno-induction, immunosuppression, immuno-tolerance, immuno-potentiation. Role of cytokines, lymphokines and chemokines.		4	Chalk and Talk

IV Antigen-Antibody reactions and Immunological techniques	a) Antigen – Antibody reactions – serological methods- Quantification (dilution, titer method).		2	PPT
	a) Strength of antigen-antibody interactions (affinity, avidity), Lattice hypothesis or prozone phenomenon		3	Chalk and Talk
	b) Immunological tests- Blood group (ABO), agglutination- direct and indirect agglutination tests, types-slide, tube, coomb's, passive- latex,haemagglutination.		3	Lecture
	c) Precipitation tests- precipitation in gels, precipitation curve, tube/ring precipitation test.		4	Chalk and Talk
	d) Immunodiffusion tests-gel diffusion (Oudin, Radial, Ouchterlony)		3	PPT
V Transplantation immunology and Immunodiagnosis	a) MHC – structure of MHC I and MHC II.		3	Chalk and talk
	b) Transplantation Immunology – Immunologic Basis of Graft Rejection		4	PPT
	c) Allograft rejection –cells involved– GVHD – Prevention of graft rejection.		3	Lecture
	d) Immunity to tumor-Tumor evasion mechanisms-Immunodiagnosis – Tumor therapy.		4	Chalk and Talk
	e) Vaccines - immunization schedule.		1	PPT
Total			**75 Hours**	

Course designers

1. Dr. S.Sree Gayathri