DEPARTMENT OF MICROBIOLOGY				*CLASS: II B.Sc. Microbiology*				
Sem	**Course Type**	**Course Code**	**Course Title**	**Credits**	**Contact Hours/week**	**CIA**	**Ext**	**Total**
IV	SBE - II	20U4RSM2	Immunology and Immunotechnology	2	2	25	75	100

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

Course Objectives:

1. To understand various immune mechanisms
2. To describe various immune cells and organs involved in immunity
3. To understand different immunological techniques used and serological diagnosis of infectious diseases
4. To understand the basis of allergy reactions, auto immune mechanisms, transplantation and cancer immunity
5. To describe the development and function of the immune system

Course Learning Outcome:

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

1. Define the basic biology of the cells of the immune system, including their development and specific functions
2. Outline how the cells interact with each other in the formation of an immune response
3. Interpret the molecular basis by which the immune system identifies pathogens
4. Perceive what occurs when there are failures of the immune system
5. Become skilled at the experimental basis and reasoning that underlies the material in the course

Unit	Description	Hours	K-level	CLO
I	**Unit I: Immunity** Introduction. Immunity – types – innate and acquired. Cell mediated immunity and Humoral immunity. Organs of immune system: Primary- Thymus and Bone marrow. Secondary – spleen –lymph nodes – GALT and MALT. Immunoreactive cells- structure and functions - macrophages, granulocytes, NK cells, T and B lymphocytes. Phagocytosis.	6 Hrs	Up to K2	1
II	**Unit II: Antigens and Immunoglobulins** Antigen - types, properties. Hapten, adjuvants, Immunoglobulins – Basic structure and classes – (IgG, IgA, IgM, IgD and IgE) and functions. Immunotechnology – hybridoma and monoclonal antibodies, antibody engineering – production of chimeric and hybrid monoclonal antibodies.	6 Hrs	Up to K3	2

III	**Unit III:MHC and Hypersensitivity** Major Histocompatibility Complex – structure of MHC I and MHC II. Hypersensitivity reactions - types, Antibody mediated (Type- I, Type II and Type III) and Cell mediated (Type IV). Autoimmunity– organ specific – Grave's disease - Myasthenia gravis – Hashimot's thyroiditis- Systemic-Rheumatoid arthritis-Multiple sclerosis-Systemic lupus erythematosus (SLE).	6 Hrs	Up to K3	3
IV	**Unit IV:Transplantation Immunology and Vaccines** Transplantation Immunology – 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 - Types - Attenuated – Killed – Purified proteins (Toxoid) – Recombinant Vaccines. Immunization schedule.	6 Hrs	Up to K3	4
V	**Unit V: Antigen-Antibody reactions and Immunological techniques** Antigen – Antibody reactions – Precipitation and agglutination reactions. Immuno electrophoresis, Radial immune diffusion (RID), Clinical applications – WIDAL, VDRL, CFT.	6 Hrs	Up to K4	5
		Total	**30 Hours**	

Books for Study

1. Coico, R., Sunshine, G., Benjamini, E. (2003) Immunology: A Short Course VI edition. WileyBlackwell, New York
2. Goldsby, R.A., T.J. Kindt., B.A. Osborne, Kuby. J.(2002). Immunology. Fifth edition. W.H. Freeman and Company, New York.
3. Arora, M.P. (2010). Immunology, Ane Books Pvt. Ltd., New Delhi.

Books for Reference

1. Abbas, A.K., A.H.Lichtman, and J.S.Pober. (2000). Cellular and Molecular immunology, Fourth Edition, W.B. Saunders Company, London.
2. Coleman, R.M., M.F.Lombard and R.E. Sicard. (1992). Fundamental Immunology, Second Edition, Wm.C.Brown Publishers, USA.
3. Cruse, J.M. and R.Lewis. (1999). Atlas of Immunology, CRC Press, New York.
4. David, M., B.Jonathan, B.R. DavidandR.Ivan.(2008). Immunology, Seventh Edition, Elsevier Publications.
5. Tizard, I.R. (2009). Immunology – An Introduction, Fourth Edition, Cengage Learning India Pvt. Ltd., New Delhi.
6. Janeway, Jr.C.A. and Travers.P.(2001). Immunobiology.5thEdition. Garland Publishing. London.
7. Khan, F.H. (2009). Elements of Immunology. Dorling Kindersley India Pvt. Ltd. India.
8. Roitt, I., J. Brostaffand D.Male, (2001). Immunology, 6th Edition. Mosby. London.
9. Rao, C.V.(2008). Immunology.2ndEdition.Narosa Publishing House. New Delhi.
10. Kuby, J. (1994) Immunology. 2nd Edition, W.H. Freeman and Company. NewYork.

Web Resources

1. https://www.hhmi.org/biointeractive/immunology/lectures.html/
2. https://bitesized.immunology.org/what-is-immunology/
3. https://onlinelibrary.wiley.com/journal/10.1111/(ISSN)1365-2567
4. https://www.helmberg.at/immunology.pdf
5. https://www.mednotes.net/notes/immunology/

Rationale for Nature of the course

Immunology involves a complex network of interacting molecules and cells that function to recognize and respond to foreign agents. 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 bearing on skill development/ employability/entrepreneurship:

- The most important aspect of immunology is research because it is the biggest portion of jobs. Immunologists work in various areas such as biomedical research, healthcare, agriculture and environmental monitoring. A career in scientific research.
- Immunology has applications in various disciplines of medicine that are virology, organ transplantation, dermatology, oncology, parasitology, bacteriology, and psychiatry.

Pedagogy

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

Course Learning Outcomes (CLO)

CLOs	**Course Learning Outcome** *On successful completion of the programme, the students will be able to*	**Knowledge Level**
CLO1	Define the basic biology of the cells of the immune system, including their development and specific functions	Up to K2
CLO2	Outline how the cells interact with each other in the formation of an immune response	Up to K3
CLO3	Interpret the molecular basis by which the immune system identifies pathogens.	Up to K3
CLO4	Perceive what occurs when there are failures of the immune system.	Up to K3
CLO5	Become skilled at the experimental basis and reasoning that underlies the material in the course.	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	2	2	2	2	3
CLO2	2	2	2	2	2
CLO3	2	2	2	3	3
CLO4	2	2	2	2	2
CLO5	2	2	3	3	2

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

Mapping of Course Outcome with Programme Outcome

	PO1	PO2	PO3	PO4	PO5
CLO1	2	1	1	2	1
CLO2	1	2	1	1	2
CLO3	2	2	1	1	1
CLO4	3	2	2	1	1
CLO5	3	2	2	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 K 3	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2.	CLO 2	Up to K 3	2	K1 & K2	1	K1	2 (K2&K2)	1(K3)
3.	CLO 3	Up to K 3	2	K1 & K2	1	K2	2 (K3&K3)	1(K3)
4.	CLO 4	Up to K 3	2	K1 & K2	1	K2	2 (K3&K3)	1(K3)
5.	CLO 5	Up to K 4	2	K1 & K2	1	K2	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	5	4	10	-	**19**	15.8	**41.6%**
K2	5	6	10	10	**31**	25.8	
K3	-	-	20	30	**50**	41.7	**41.7%**
K4	-	-	10	10	**20**	16.7	**16.7%**
Total Marks	10	10	50	50	**120**	100.00	**100%**

LESSON PLAN

Units	Description	Staff	Hours	Mode
I Immunity	a) Introduction. Immunity – types – innate and acquired		1	Chalk and Talk
	b) Cell mediated immunity and Humoral immunity.		1	Lecture
	c) Organs of immune system: Primary- Thymus and Bone marrow. Secondary – spleen –lymph nodes – GALT and MALT		1	PPT
	d) Immunoreactive cells- structure and functions.		1	Lecture
	e) Macrophages, granulocytes, NK cells,		1	Demonstration
	f) T and B lymphocytes. Phagocytosis		1	Demonstration
II Antigens and Immunoglobulins	a) Antigen - types, properties. Hapten, adjuvants		2	Chalk and talk
	b) Immunoglobulins – Basic structure and classes – (IgG, IgA, IgM, IgD andIgE) and functions.		1	PPT
	c) Immunotechnology – hybridoma and monoclonal antibodies,		2	Discussion
	d) Antibody engineering – production of chimeric and hybrid monoclonal antibodies.		1	Demonstration
III MHC and Hypersensitivity	a) Major Histocompatibility Complex (MHC) – structure of MHC I and MHC II .		1	Chalk and talk
	b) Hypersensitivity reactions - types, Antibody mediated (Type- I, Type II and Type III) and Cell mediated (Type IV).		2	Discussion
	c) Autoimmunity–organspecific – Grave's disease - Myasthenia gravis-Hashimot's thyroiditis		2	Discussion
	d) Systemic-Rheumatoid arthritis-Multiple		2	Demonstration
IV Transplantation Immunology and Vaccines	a) Transplantation Immunology – Immunologic Basis of Graft Rejection		1	Chalk and talk
	b) Allograft rejection –cells involved– GVHD – Prevention of graft rejection.		2	Demonstration
	c) Immunity to tumor-Tumor evasion mechanisms-Immunodiagnosis – Tumor therapy.		2	Discussion
	d) Vaccines - Types - Attenuated – Killed –		1	Discussion
V Antigen-Antibody reactions and Immunological	a) Antigen – Antibody reactions – Precipitation and agglutination reactions		2	PPT
	b) Immuno electrophoresis, Radial immune diffusion (RID)		2	Demonstration
	c) Clinical applications – WIDAL, VDRL, CFT.		2	Demonstration
Total			**30 Hrs**	

Course designers

1. Dr. P.N. Rajarajan