



JYOTI NIVAS COLLEGE AUTONOMOUS BANGALORE – 560 095
DEPARTMENT OF BIOTECHNOLOGY
B.Sc. VI SEMESTER BIOTECHNOLOGY PAPER VII SYLLABUS (2021 NEP
BATCH)
IMMUNOLOGY

COURSE TITLE	IMMUNOLOGY
COURSE CODE	21VIBT7 (T)
COURSE CREDITS	04
TOTAL CONTACT HOURS	60
DURATION OF ESE	3 Hours
CONTINUOUS INTERNAL ASSESSMENT (CIA)	40 Marks
END SEMESTER EXAMINATION (ESE)	60 Marks

COURSE OBJECTIVES:

1. To demonstrate the fundamentals of Immunology and to familiarize with basics of human immune system and immune responses .
2. To familiarize the basics and build in to an in-depth understanding of both humoral and cellular Immune responses
3. To facilitate comprehension of the applications of immunology in the field of medical Biotechnology.

LEARNING OUTCOMES:

After successful completion of the course the students will be able to

1. Explore the basic concepts of Immunology
2. Recognize the different immune responses rendered by the immune system
3. Assess the various types of immunological disorders.
4. Critically evaluate the immunological approach in the diagnostic and treatment of tumors

CO NO.	Course outcomes statement	Knowledge level
1	Explore the basic concepts of Immunology	K1, K3, K4
2	Recognise the different immune responses rendered by the immune system	K1
3.	Assess the various types of immunological disorders	K1, K2, K5

4.	Critically evaluate the immunological approach in the diagnostic and treatment of tumors	K2,K5
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K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	✓	✓	✓	✓	✓		✓			✓
CO2	✓	✓		✓	✓		✓			✓
CO3	✓	✓		✓		✓	✓		✓	✓
CO4	✓	✓		✓		✓	✓			✓

Programme Objectives aligned with Graduate attributes

PO1- Knowledge

PO2- Scientific thinking

PO3- Entrepreneurial skills

PO4- Analytical skills

PO5- Communication skills

PO6- Social commitment

PO7- Research and Inquiry

PO8- Conservation of Environment

PO9- Digital awareness and literacy

PO10- Academic orientation

UNIT 1 Introduction & Elements of Immune System

15 Hrs.

a) Introduction to the immune system

History, types, barriers, organs, Hematopoiesis (*Lymphoid and Myeloid lineage*).

b) Innate immunity – First line of defense- (skin & mucous membrane), Macrophages, Dendritic Cells(APC), NK Cells, granulocytes, Major histocompatibility complexes: Classification, structure, and function. Antigen processing pathways – Cytosolic and Endocytic. Lymphoid organs: Primary (*Thymus and Bone marrow*), brief note on the *Bursa of Fabricius*. Secondary (*Lymph node and spleen*). Accessory lymphoid tissues – MALT and GALT. Mechanism of the second line of defense - Inflammation, Phagocytosis (PAMPs & PRR), fever, Complement proteins -Definition importance.

Complement activation pathways (*Classical and alternative*), Messengers of the Immune system- a brief note on Interleukins (Interleukin12, 2,4) and Interferon (gamma interferon) (*definition, general properties, and functions*).

c) Adaptive immunity: Third line of defense- Lymphocytes - B cells & T cells, Role of B and

T-lymphocytes in Humoral immunity and cell-mediated immunity, Acquired immunity.

UNIT 2 : Antigens, Antibodies & reactions

15 Hrs.

- a) **Antigen:** Definition, Types (*exogenous and endogenous*), Structure and properties of antigens- iso- and allo-antigens, antigen specificity, Epitopes(Tcell and B cell epitopes), Essential factors for immunogenicity, Concept of Haptens, Adjuvants, superantigens.
- b) **Antibody:** Basic structure, Immunoglobulin classes (Structure and Biological properties), paratope, antigenic determinates of antibodies (*Isotypes, Idiotypes, and Allotypes*).
- c) **Antigen–antibody reactions:** Concept of specificity, binding forces, affinity, avidity, bonus effect, cross reaction. Precipitation and agglutination reaction.
- d) **Immunochemical techniques:** Principles and applications of RIA, ELISA, Immunocytochemistry, Immunofluorescence. Immunodiffusion reactions: Ouchterlony double diffusion, Immunoelectrophoresis.

UNIT 3: Immunology in Health and Diseases

15 Hrs.

Immune Tolerance: Definition. Factors causing induction. Types of tolerance (Central and peripheral). Mechanism and recovery from tolerance.

B) Hypersensitivity reactions: Definition. Classification of hypersensitivity reactions based on time (*Immediate and Delayed type*) and pathogenesis (*Type I, II, III, IV, and V*).

C) Autoimmune diseases & Immunodeficiency diseases: Definition. Factors causing autoimmune diseases. A brief note on *symptoms, immunological mechanisms, Diagnosis and Treatment* of Systemic lupus erythematosus (SLE), Rheumatoid Arthritis. Immunodeficiency diseases: Definition, Types, a Brief note on AIDS and SCID.

D) Microbial diseases in humans: Mode of infection, symptoms, epidemiology and control measures of diseases caused by Viruses (Hepatitis-B), Bacteria (Typhoid), Fungi (Aspergillosis), Protozoa(Malaria). A brief note on immune evasion strategies by pathogens.

UNIT 4: Applied Immunology

15 Hrs.

A) Tumor: Introduction, factors of predisposition, tumor classification, Mechanism of tumor Evasion, diagnosis (IHC), Treatment {Monoclonal Antibodies, Non-specific Immunotherapies - Oncolytic Virus Therapy, T-cell therapy (CAR-T).

B) Transplantation immunology: Definition. Types of Graft. Immunological mechanism for Graft Acceptance and rejection, Graft Vs Host Disease (GVHD) Immunosuppressive therapies — Induction Therapy and Maintenance therapy

C) Vaccines: Definition, Types: Killed and Live attenuated vaccines, Toxoids, subunit, recombinant (*DNA vaccines*), polyvalent vaccines, mRNA vaccines, and cancer vaccines.

D) Immunization: Definition, Types: Active, passive and subtypes.

E) Immunoinformatics: Computational vaccine design, Tcell & B cell epitope prediction, application of AI in vaccine design.

REFERENCES:

1. Textbook of Immunology, Paul Ajoy, Books and Allied (P) Ltd., 2018.
2. Cellular and Molecular Immunology. 9th edition, Abbas, A.K. et al., Elsevier Saunders Co., 2017.
3. Essential Immunology.13 th edition, Riott, I.M., Wiley-Blackwell Publications, 2017.
4. Kuby, J. (2022). Immunology 8th Edition. WH. Freeman and Company Ltd.
5. Tizard I.R. (1995). Immunology, 4th edition, W.B. Saunders Publisher. Philadelphia.
6. Benjamine, E., Cocoi., Sunshine. (2000). Immunology 4th edition- Wiley-Liss. New York.
7. Roitt, I.M. (2017). Essential Immunology, Thirteenth edition, ELBS, Wiley Blackwell Scientific Publishers, London.
8. Abbas AK, Lichtman AH, and Pillai S. (2019). Basic Immunology- Functions and Disorders of the Immune System. Elsevier.
9. Practical Immunology. Frank C. Hay, Olwyn M. R. Westwood Wiley-Blackwell Scientific Pub., 2008
10. Handbook of Experimental Immunology, Vol. 1 & 2, Weir D.M., Wiley, 1997

BIOTECHNOLOGY PRACTICAL PAPER 7

COURSE TITLE	IMMUNOLOGY
COURSE CODE	21VIBT7 (P)
COURSE CREDITS	02
TOTAL CONTACT HOURS	4 hours/week
DURATION OF ESE	03 hours
CONTINUOUS INTERNAL ASSESSMENT (CIA)	25
END SEMESTER EXAMINATION (ESE)	25

Experiments

1. Isolation of IgY from egg yolk **01 unit**
2. Prediction of T cell & B cell epitope **01unit**
3. Determination of ODD Patterns **01 unit**
4. Differential staining of WBC **01 unit**
5. Agglutination: **03 units**
 - A) RPR/VDRL test
 - B) WIDAL test
 - C) Blood grouping test
6. Immunodiffusion: **03 unit**
 - A) Determination of antibody titer value by Ouchterlony double diffusion method.
 - B) Determination of antibody concentration by Single radial immunodiffusion method.(SRID)
 - C) Determination of antigen concentration in a given sample by Rocket immunoelectrophoresis method
7. Dot ELISA **01 unit**
8. Case studies involving cancer/allergy / autoimmune disorder **04 unit**
9. Industrial visit **05 unit**