

SEMESTER-IV

COURSE 8: IMMUNOLOGY

Theory

Credits: 3

3 hrs/week

COURSE OBJECTIVES:

- To promote critical thinking among students.
- To provide students with a foundation in immunological processes
- To provide students with knowledge on how the immune system works building on their previous knowledge
- To clearly state the role of the immune system.
- To compare and contrast the innate versus adaptive immune systems.
- To provide an overview of the interaction between the immune system and pathogens.

LEARNING OUTCOMES:

The overall course outcome is that the student shall develop deeper understanding of concepts of immunology. This course will provide students with a deep knowledge in immunology by the completion of the course student will be able to –

- Articulate the roles of innate recognition receptors in immune responses
- Compare and contrast humoral versus cell-mediated immune responses
- Distinguish various cell types involved in immune responses and associated functions;
- Distinguish and characterize antibody isotypes, development, and functions
- Understand the role of cytokines in immunity and immune cell activation;
- Understand the significance of the Major Histocompatibility Complex in terms of immune response and transplantation

SYLLABUS:

UNIT – I: Overview of Immune system

- 1.1 Introduction to basic concepts in Immunology
- 1.2 Innate and adaptive immunity
- 1.3 Cells of immune system
- 1.4 Organs of immune system

Activity: *Assignment /Students Seminar/Quiz/Project/Peer teaching/Report writing after watching any video on the above/Model chart preparation of cells/organs of immune system*

Evaluation: *Instructor supposed to prepare a detailed Rubrics for the evaluation of the above activity*

UNIT – II: Antigens

- 2.1 Basic properties of antigens
- 2.2 B and T cell epitopes, paratopes
- 2.3 Haptens and adjuvants
- 2.4 Factors influencing immunogenicity

Activity: *Assignment /Students Seminar/Quiz/Project/Peer teaching/ Model chart preparation of organogenesis*

Evaluation: *Instructor supposed to prepare a detailed Rubrics for the evaluation of the above activity*

UNIT – III: Antibodies

- 3.1 Structure of antibody
- 3.2 Classes of antibodies
- 3.3 Functions of antibodies
- 3.4 Monoclonal antibodies

Activity: *Assignment /Students Seminar/Quiz/Project/Peer teaching/ Model chart preparation of antibodies*

Evaluation: *Instructor supposed to prepare a detailed Rubrics for the evaluation of the above activity*

UNIT – IV: Working of Immune system

- 4.1 Structure and functions of major histocompatibility complexes
- 4.2 Exogenous pathway of antigen presentation and processing
- 4.3 Endogenous pathway of antigen presentation and processing
- 4.4. Basic properties and functions of cytokines

Activity: *Assignment /Students Seminar/Quiz/Project/Peer teaching/ Model chart preparation of MHC*

Evaluation: *Instructor supposed to prepare a detailed Rubrics for the evaluation of the above activity*

UNIT – V: Immune system in health and disease

- 5.1 Gell and Coombs' classification and brief description of various types of hypersensitivities
- 5.2 Introduction to concepts of autoimmunity and immunodeficiency
- 5.3 General introduction to vaccines Types of vaccines, Immunization programme
- 5.4 Organ transplantation- Graft rejection, immune suppressors

Activity: *Assignment /Students Seminar/Quiz/Project/Peer teaching/ Model chart preparation of classification of Hypersensitivity*

Evaluation: *Instructor supposed to prepare a detailed Rubrics for the evaluation of the above activity*

CO-CURRICULAR ACTIVITIES:

- Organizing awareness on immunization importance in local village in association with NCC and NSS teams
- Charts on types of cells and organs of immune system
- Student study projects on aspects such as – identification of allergies among students (hypersensitivity), blood groups in the class (antigens and antibodies duly reported) etc., as per the creativity and vision of the lecturer and students

REFERENCES BOOKS:

- Judy Owen, Jenni Punt, Sharon Stranford 2013 Kuby Immunology: International Edition W. H. Freeman
- Delves P, Martin S, Burton D, Roitt IM 2011 Roitt's Essential Immunology. 12th Ed. Wiley- Blackwell Scientific Publication, Oxford.
- Murphy K, 2011 Janeway's Immunobiology. 8th Ed. Garland Science Publishers, New York.
- Peakman M, and Vergani D. (2009). Basic and Clinical Immunology. 2nd edition Churchill Livingstone Publishers, Edinberg.
- Richard Coico, Geoffrey Sunshine 2008 Immunology: A Short Course, 6th Edition Wiley-Blackwell
- Sudha Gangal 2013 Textbook of Basic and Clinical Immunology Orient Blackswan Private Limited New Delhi

SEMESTER-IV

COURSE 8: IMMUNOLOGY

Practical

Credits: 1

2 hrs/week

COURSE OBJECTIVES:

- To acquire knowledge on the distribution of lymphoid organs
- To study the histology of lymphoid organs
- To acquaint with the process of blood grouping with kit
- To acquaint with the ELISA test
- To acquaint with the Widal test

SYLLABUS:

1. Demonstration of lymphoid organs (as per UGC guidelines)
2. Histological study of spleen, thymus and lymph nodes (through prepared slides)
3. Blood group determination
4. Demonstration of ELISA
5. Demonstration of Immunoelectrophoresis
6. Testing for Typhoid antigens by Widal test.
7. Differential Leukocyte Count
8. Isolation of monocytes from blood.
9. Rapid Plasma Reagin (RPR) Test

REFERENCE WEB LINKS:

- <https://vlab.amrita.edu/?sub=3&brch=69>
- <https://ivl1-au.vlabs.ac.in/List%20of%20experiments.html>
- <https://ivl2-au.vlabs.ac.in/List%20of%20experiments.html>
- <https://www.medicine.mcgill.ca/physio/vlab/immun/vlabmenuimmun.htm>
- <http://www.zoologyresources.com/uploadfiles/books/dc64b77d8769325515d17c945e461b45.pdf>
- <http://www.lucp.net/books-pdf/Lab%20Manual%20Dr.%20Idris%20Adewale%20Ahmed/15.%20BASIC%20IMMUNOLOGY.pdf>
- https://www.avit.ac.in/lab/immunology_bioprocess_engineering_lab/download/17BTCC89/lab_manual.pdf
- <https://www.urmc.rochester.edu/MediaLibraries/URMCMedia/labs/frelinger-lab/documents/Immunology-Lab-Manual.pdf>
- https://webstor.srmist.edu.in/web_assets/downloads/2021/18BTC106J-lab-manual.pdf

SEMESTER-IV

COURSE 9: ANIMAL BIOTECHNOLOGY

Theory

Credits: 3

3 hrs/week

COURSE OBJECTIVES:

- To provide knowledge on animal cell and tissue culture and their preservation
- To empower students with latest biotechnology techniques like stem cell technology, genetic engineering, hybridoma technology, transgenic technology and their application in medicine and industry for the benefit of living organisms
- To explain *in vitro* fertilization, embryo transfer technology and other reproduction manipulation methodologies.
- To get insight in applications or recombinant DNA technology in agriculture, production of therapeutic proteins.
- To understand principles of animal culture, media preparation.

LEARNING OUTCOMES:

This course will provide students with a deep knowledge in animal biotechnology, by the completion of the course student will able to –

- Get knowledge of the Vectors and Restriction enzymes used in biotechnology
- Describe the gene delivery mechanism and PCR technique
- Acquire basic knowledge on media preparation and cell culture techniques
- Understand the manipulation of reproduction with the application of biotechnology
- Understand the applications of Biotechnology in the fields of industry and agriculture including animal cell/tissue culture, stem cell technology and genetic engineering.

SYLLABUS:

UNIT-I:

- 1.1 Enzymes and Vectors Restriction modification systems: Types I, II and III.
- 1.2 Mode of action, nomenclature, applications of Type II restriction enzymes in genetic engineering
- 1.3 DNA modifying enzymes and their applications: DNA polymerases. Terminal deoxynucleotidyl transferase, kinases and phosphatases, and DNA ligases
- 1.4 Cloning Vectors: Plasmid vectors: pBR and pUC series, Bacteriophage lambda and M13 based vectors, Cosmids, BACs, YACs,

Activity: *Assignment /Students Seminar/Quiz/Project/Peer teaching/Report writing after watching any video on the above/ Preparation of models of Cloning vectors with biodegradable material/*

Evaluation: *Instructor supposed to prepare a detailed Rubrics for the evaluation of the above activity*

UNIT- II:

- 2.1 Gene delivery: Microinjection, electroporation, biolistic method (gene gun), liposome and viral mediated delivery
- 2.2 PCR: Basics of PCR.

2.3 DNA Sequencing: Sanger's method of DNA sequencing- traditional and automated sequencing

2.4 Hybridization techniques: Southern, Northern and Western blotting

Activity: *Assignment /Students Seminar/Quiz/Project/Peer teaching/Report writing after watching any video on the above/ Visit to any clinical testing laboratory for hands on experience of PCR Use*

Evaluation: *Instructor supposed to prepare a detailed Rubrics for the evaluation of the above activity*

UNIT-III:

3.1 Natural and Synthetic Cell cultures: primary culture, secondary culture, continuous cell lines

3.2 Organ culture; Cryopreservation of cultures.

3.3 Hybridoma Technology: Cell fusion, Production of Monoclonal antibodies (mAb), Applications of mAb

3.4 Stem cells: Types of stem cells, applications

Activity: *Assignment /Students Seminar/Quiz/Project/Peer teaching/Report writing after watching any video on the above/ Visit to any clinical testing laboratory for observation of various cultures*

Evaluation: *Instructor supposed to prepare a detailed Rubrics for the evaluation of the above activity*

UNIT-IV:

4.1 Manipulation of reproduction in animals: Artificial Insemination, In vitro fertilization

4.2 Manipulation of reproduction in animals: Super ovulation, Embryo transfer, Embryo cloning

4.3 Transgenic Animals: Strategies of Gene transfer;

4.4 Transgenic - sheep, - fish; applications

Activity: *Assignment /Students Seminar/Quiz/Project/Peer teaching/Report writing after watching any video on the above/ Visit to laboratory for observation of Artificial Insemination, In vitro fertilization/model preparation of transgenic animal*

Evaluation: *Instructor supposed to prepare a detailed Rubrics for the evaluation of the above activity*

UNIT-V:

5.1 DNA fingerprinting

5.2 Application of biotechnology in fisheries – monoculture in fishes, polyploidy in fishes

5.3 Gene therapy-application

5.4 Bio informatics- concept-definition-database types

Activity: *Assignment /Students Seminar/Quiz/Project/Peer teaching/Report writing after watching any video on the above/Case study*

Evaluation: *Instructor supposed to prepare a detailed Rubrics for the evaluation of the above activity*

REFERENCES BOOKS:

- Brown TA. (2010). Gene Cloning and DNA Analysis. 6th edition. Blackwell Publishing, Oxford, U.K.
- Clark DP and Pazdernik NJ. (2009). Biotechnology: Applying the Genetic Revolution. Elsevier
- Academic Press, USA

- Primrose SB and Twyman RM. (2006). Principles of Gene Manipulation and Genomics, 7th edition. Blackwell Publishing, Oxford, U.K.
- Sambrook J and Russell D. (2001). Molecular Cloning-A Laboratory Manual. 3rd edition. Cold Spring Harbor Laboratory Press
- Wiley JM, Sherwood LM and Woolverton CJ. (2008). Prescott, Harley and Klein's Microbiology. McGraw Hill Higher Education
- Brown TA. (2007). Genomes-3. Garland Science Publishers
- Primrose SB and Twyman RM. (2008). Genomics: Applications in human biology. Blackwell Publishing, Oxford, U.K.
- Animal Cells Culture and Media, D.C. Darling and S.J. Morgan, 1994.BIOS Scientific Publishers Limited.
- Methods in Cell Biology, Volume 57, Jennie P. Mathur and David Barnes, 1998.
- Animal Cell Culture Methods Academic Press.
- P.K. Gupta: Biotechnology and Genomics, Rastogi publishers (2003).
- B.D. Singh: Biotechnology, Kalyani publishers, 1998 (Reprint 2001)

SEMESTER-IV

COURSE 9: ANIMAL BIOTECHNOLOGY

Practical

Credits: 1

2 hrs/week

COURSE OBJECTIVES:

This course will provide students with a practical knowledge in animal biotechnology, by the completion of the course student shall able to –

- Acquire knowledge on Cloning vectors widely used in biotechnology
- Empower with the process of DNA quantification and amplification
- Explain purification of biological compounds by paper chromatography
- Get insight maintenance of laboratory apparatus
- Understand principles of animal culture, media preparation

SYLLABUS:

1. Cloning Vectors: Plasmid vectors: pBR and pUC series, Bacteriophage lambda and M13 based vectors, Cosmids, BACs, YACs, (Charts/Images/Models)
2. DNA quantification using DPA Method.
3. Techniques: DNA Fingerprinting
4. Separation, Purification of biological compounds by paper chromatography
5. Cleaning and sterilization of glass and plastic wares for cell culture.
6. Preparation of culture media.
7. Amplification of DNA by PCR

Note: above practical may be demonstrated in the lab or demonstrated by V- lab

REFERENCE WEB LINKS:

- <https://vlab.amrita.edu/>
- <https://www.vlab.co.in/broad-area-biotechnology-and-biomedical-engineering>
- <https://blog.praxilabs.com/2020/06/30/dna-extraction-virtual-lab/>
- <http://mbvi-au.vlabs.ac.in/>
- https://webstor.srmist.edu.in/web_assets/downloads/2021/18BTC203J-lab-manual.pdf
- https://webstor.srmist.edu.in/web_assets/srm_mainsite/files/files/BT%200312%20-%20ANIMAL%20CELL%20AND%20TISSUE%20CULTURE%20LABORATORY.pdf
- <https://davjalandhar.com/dbt/biotechnology/SOP/BSc%20Biotechnology%20Semester%20V%20%26%20VI.pdf>
- https://www.austincc.edu/awheeler/Files/BIOL%201414%20Fall%202011/BIOL1414_Lab%200
- [Manual_Fall%202011.pdf](#)

SEMESTER-IV

COURSE 10: WILDLIFE AND CONSERVATION BIOLOGY

Theory

Credits: 3

3 hrs/week

COURSE OBJECTIVES:

- To Grasp the principles of wildlife ecology, identify key threats to wildlife in India, and evaluate conservation approaches.
- To Recognize the importance and types of protected areas (National Parks, Sanctuaries, Biosphere Reserves) and their components in habitat conservation.
- To Apply wildlife management strategies and legislation to protect and manage endangered species and their habitats.
- To Examine the complexities of human-wildlife interactions and propose effective mitigation strategies.
- To Discuss national and international conservation initiatives, including conventions (CITES, IUCN, CBD, Ramsar) and their role in biodiversity protection.

LEARNING OUTCOMES:

This course will provide students with a deep knowledge in acquiring laboratory skills, by completion of the course the graduate shall able to –

- Know the Concept of wildlife and reasons for their depletion
- Know the wild life management strategies
- Know the Importance of ecologically sensitive areas
- Know the human Impact on environmental resources
- Understand the human wildlife interaction

SYLLABUS:

UNIT I

- 1.1 Wildlife wealth of India & threatened wildlife.
- 1.2 Reasons for wildlife depletion in India. Wildlife conservation approaches and limitations.
- 1.3 National Parks, Sanctuaries and Biosphere Reserves, cores and Buffers, Nodes and corridors. Community Reserve and conservation Reserves

Activity: Assignment /Students Seminar/Quiz/Project/Peer teaching/Report writing after watching any video on the above/Case study

Evaluation: Instructor supposed to prepare a detailed Rubrics for the evaluation of the above activity

UNIT II

- 2.1 Red Data Book and Conservation status (endangered, vulnerable, rare, threatened and near threatened species)-definitions.
- 2.2 Wild life Trade & legislation- Assessment, documentation, Prevention of trade
- 2.3 Policies and laws in Wild life management (national) and ethics.

Activity: *Assignment /Students Seminar/Quiz/Project/Peer teaching/Report writing after watching any video on the above/Case study*

Evaluation: *Instructor supposed to prepare a detailed Rubrics for the evaluation of the above activity*

UNIT III

- 3.1 Biodiversity extinction and conservation approaches- Identification and prioritization of Ecologically sensitive area (ESA).
- 3.2 Regional and National approaches for biodiversity conservation.
- 3.3 Population viability analysis-conceptual foundation, uses of PVA models.

Activity: *Assignment /Students Seminar/Quiz/Project/Peer teaching/Report writing after watching any video on the above/Case study*

Evaluation: *Instructor supposed to prepare a detailed Rubrics for the evaluation of the above activity*

UNIT IV

- 4.1 National and International efforts for conservation- Information on CITES, IUCN, CBD
- 4.2 International agreements for conserving marine life. Convention on wetlands of International Importance (Ramsar convention).
- 4.3 Human impact on Terrestrial and Aquatic resources. Overview of conservation of Forest & Grassland resources

Activity: *Assignment /Students Seminar/Quiz/Project/Peer teaching/Report writing after watching any video on the above/Case study*

Evaluation: *Instructor supposed to prepare a detailed Rubrics for the evaluation of the above activity*

UNIT V

- 5.1 Human – wildlife interactions
- 5.2 Strategies to reduce human-wildlife interactions
- 5.3 Role of Government and NGOs in controlling human-wildlife interactions Socio-economic issues related to human-wildlife interactions

Activity: *Assignment /Students Seminar/Quiz/Project/Peer teaching/Report writing after watching any video on the above/Case study*

Evaluation: *Instructor supposed to prepare a detailed Rubrics for the evaluation of the above activity*

REFERENCE BOOKS

- M.Kato. The Biology of Biodiversity, Springer.
- J.C. Avise. Molecular Markers, Natural History and Evolution, Chapman & Hall, New York.
- E.O. Wilson. Biodiversity, Academic Press, Washington.
- G.G. Simpson. Principle of animal taxonomy, Oxford IBH Publishing Company.
- E. Mayer. Elements of Taxonomy.
- E.O. Wilson. The Diversity of Life (The College Edition), W.W. Northem& Co.
- B.K. Tikadar. Threatened Animals of India, ZSI Publication, Calcutta.

SUGGESTED ACTIVITIES:

- Visit to nearby biosphere reserve
- Visit to local Ramsar site and report preparation with pics

SEMESTER-IV

COURSE 10: WILD LIFE AND CONSERVATION BIOLOGY

Practical

Credits: 1

2 hrs/week

COURSE OBJECTIVES:

To Understand the importance of various biomes

To Understand and gain knowledge of animal architecture

SYLLABUS:

1. Using photographs / paintings / coloured drawings identify and study ecological role of characteristic animal species (major representative species only) of various Biomes.
2. Identify marine and fresh water planktons (preserved water samples may be used).
3. Study of animal architecture (photographs / diagram / abandoned specimen); Hive of honey bee, nest of COURSE wasp, nest of potter wasp, Mount of termite, Nests of Weaver Bird and tailor bird.
4. Using photographs / paintings / coloured drawings identify and study distribution and ecological role of common bivalves and gastropods that occur along a sea-shore.
5. Compare and interpret given sonograms of bird calls (any two e.g. Courtship calls, Alarm calls)
6. On a phytogeographic map of India locate & demarcate major sanctuaries / national parks

WEB RESOURCES FOR LAB:

https://www.naturepl.com/pictures/pdfs/NPL_Architecture.pdf

<https://youtu.be/31PWjb7Do1s>