# ST.JOSEPH’S COLLEGE FOR WOMEN (A), VISAKHAPATNAM

# IVSEMESTER ZOOLOGY TIME:4HRS/WEEK

Z 4504 (3) **IMMUNOLOGY AND ANIMAL BIOTECHNOLOGY** MARKS:100

w.e.f. 2020-2021 (20AH) **SYLLABUS**

# LEARNING OBJECTIVES: To the enable students to

* + - Understand the basics of immunology.
    - Be able to compare and contrast the innate versus adaptive immune systems and humoral versus cell-mediated immuneresponses.
    - Understand the significance of the Major Histo compatibility Complex in terms of immune response andtransplantation.
    - Acquire knowledge about the techniques of recombinant DNA technology, Animal cell culture and applied aspects of biotechnology
    - Empower with the latest biotechnology techniques like stem cell technology, genetic engineering, hyridoma technology, transgenic technology and their application in medicine and industry for the benefit of livingorganisms.
      * Gain insight on in- vitro fertilization, embryo transfer technology and other reproduction manipulationmethodologies.

**COURSE OUTCOMES: By the end of the course, students will be able to**

**CO1** Acquire knowledge of the organs of Immune system, types of immunity, cells and organs ofimmunity.

**CO2** Describe the immunological response as to how it is triggered (antigens) and regulated (antibodies)

**CO3** Understand the applications of Biotechnology in the fields of industry and agriculture including animal cell/tissue culture, stem cell technology and geneticengineering.

**CO4** Get familiar with the tools and techniques of animalbiotechnology andto understand principles of animal culture, media preparation.

**CO5**Realize the importance of complying with ethical issues in biotechnology**.**

**UNIT–I IMMUNOLOGY – I (OVERVIEW OF IMMUNESYSTEM)**

* 1. 1.1 Introduction to basic concepts inImmunology
  2. 1.2 Innate and adaptive immunity, Vaccines and Immunizationprogramme
  3. 1.3 Cells of immunesystem
  4. 1.4 Organs of immunesystem

# UNIT – II IMMUNOLOGY – II (ANTIGENS, ANTIBODIES, MHC AND HYPERSENSITIVITY)

* 1. 2.1 Antigens: Basic properties of antigens, B and T cell epitopes, haptens and adjuvant; Factors influencing immune genicity
  2. 2.2 Antibodies: Structure of antibody, Classes and functions ofantibodies
  3. 2.3 Structure and functions of major histo compatibilitycomplexes
  4. 2.4Exogenous and Endogenous pathways of antigen presentation andprocessing
  5. 2.5 Hypersensitivity – Classification andTypes

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# UNIT – III TECHNIQUES

3.1 Animal Cell, Tissue and Organ culture media: Natural and Synthetic media,

3.2 Cell cultures: Establishment of cell culture (primary culture, secondary culture, types of cell lines; Protocols for Primary Cell Culture); Established Cell lines (common examples such as MRC, HeLa, CHO, BHK, Vero); Organ culture; Cryopreservation of cultures

3.3 Stem cells: Types of stem cells and applications

3.4 Hybridoma Technology: Production & applications of Monoclonal antibodies (mAb)

# UNIT – IV APPLICATIONS OF ANIMAL BIOTECHNOLOGY

* 1. 4.1 Genetic Engineering: Basic concept, Vectors, Restriction Endonucleases andRecombinant DNAtechnology
  2. 4.2 Gene delivery: Microinjection, electroporation, biolistic method (gene gun),liposome and viral-mediated genedelivery
  3. 4.3 Transgenic Animals: Strategies of Gene transfer; Transgenic -, - fish, sheep; applications
  4. 4.4 Manipulation of reproduction in animals: Artificial Insemination, Invitro

fertilization, super ovulation, Embryo transfer, Embryo cloning

# UNIT - V

5.1.PCR: Basics ofPCR and types of PCR.

5.2DNASequencing:Sanger’smethodofDNAsequencing-traditionaland automated sequencing (2hrs)

5.3 Hybridization techniques: Southern, Northern and Westernblotting

5.4 DNA fingerprinting: Procedure andapplications

5.5 Applications in Industry and Agriculture: Fermentation:Differenttypes of Fermentation and Downstream processing; Agriculture: Monoculture in fishes, polyploidy in fishes

# CO-CURRICULAR ACTIVITIES (SUGGESTED):

* 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
* Visit to research laboratory in any University as part of Zoological tour and exposure and/ or hands-on training on animal cell culture.
* Visit to biotechnological laboratory in University or any central/state institutes and create awareness on PCR, DNA finger printing and blot techniques or Visit to a fermentation industry or Visit to a local culture pond and submit report on culture of fishesetc.

# REFERENCE BOOKS

1. Immunology by Ivan M.Riott
2. Immunology byKubey
3. Sreekrishna V. 2005. Biotechnology –I, Cell Biology and Genetics. New Age International Publ.New Delhi,India.

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ST.JOSEPH’S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

IV SEMESTER  **ZOOLOGY**  TIME:2HRS/WEEK

Z4554 (2) **IMMUNOLOGY AND ANIMAL BIOTECHNOLOGY** MAX.MARKS:50

w.e.f. 2020-2021 (20AH) **PRACTICALS**

**LEARNING OBJECTIVES: To enable the students to**

* + Acquaint them with immunological techniques vis-à-vis theory taught in the class room
  + Interconnect the theoretical and practical knowledge of immunity with the outer world for the development of a healthier life.
  + Demonstrate basic laboratory skills necessary for Biotechnology research
  + Promoting application of the lab techniques for taking up research in higher studies

**COURSE OUTCOMES: By the end of the course, students will be able to**

**CO1:**Identify and demonstrate the understanding different lymphoid organs.

**CO2:**Acquire skills in determination of different immunological test like blood group, Rh typing.

**CO3:** Acquire skills in careful handling of glass ware and maintaining laboratory equipments.

**CO4:** Explain the function of autoclave and importance of sterilization.

**CO5:**Able to summarize the separation of compounds using paper chromatography

**CO6:** Apply standardized procedures using safety measures in the laboratory.

# IMMUNOLOGY

* 1. Demonstration of lymphoid organs (as per UGCguidelines)
  2. Histological study of spleen, thymus and lymph nodes (through preparedslides)
  3. Blood group determination
  4. Demonstration of
     1. ELISA
     2. Immuno electro phoresis

# ANIMALBIOTECHNOLOGY

* 1. DNA isolation ,quantification using DPA Method
  2. Techniques: Western Blot, Southern Hybridization, DNA Finger printing
  3. Separation, Purification of biological compounds by paper, Thin-layer and Column chromatography
  4. Cleaning and sterilization of glass and plastic wares for cell culture.
  5. Preparation of culture media.

# REFERENCE BOOKS

1. Immunology Lab Biology 477 Lab Manual; Spring 2016 Dr. JulieJameson
2. Practical Immunology A Laboratory Manual; **LAP LAMBERT Academic Publishing**
3. Manual of laboratory experiments in cell biology by Edward,G
4. Laboratory Techniques by Plummer.

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