

Department of Liberal Education
Era University, Lucknow
Course Outline
Effective From: 2023-24

Name of the Program	B.A. / B.Sc. (LIBERAL EDUCATION)			Year/ Semester:	3rd Year/5th Semester
Course Name	Fundamental Immunology & Biotechnology	Course Code:	BCH302	Type:	Theory
Credits	04			Total Sessions Hours:	60 Hours
Evaluation Spread	Internal Continuous Assessment:	50 Marks		End Term Exam:	50 Marks
Type of Course	<input type="radio"/> Compulsory	<input checked="" type="radio"/> Core	<input type="radio"/> Creative	<input type="radio"/> Life Skill	
Course Objectives	<p>The objective of this course is to focus on how immune system protects us from infection through various lines of defense. It allows the student to learn the functioning of the immune system in physiological and pathological conditions, to understand the underlying mechanisms of the main immune-mediated diseases, and to acquire information about vaccines and immunotherapy.</p> <p>The knowledge of modern technology in studying and solving various biological problems requires knowledge of techniques and its uses. This semester would introduce the students to the concept and principals of biotechnology.</p>				
Course Outcomes(CO): <i>After the successful course completion, learners will develop following attributes:</i>					
Course Outcome (CO)	Attributes				
CO1	The students can elucidate types of immunological factors, response systems and defensive mechanisms.				
CO2	They will be able to identify and understand the working of various antibodies and methodologies to raise them				
CO3	The student would learn about genetic engineering, cloning, PCR, genetic sequencing and its uses				
CO4	After this paper the student would be able to delineate the concept of cell & tissue culture and its requirements				
Pedagogy	Interactive, discussion-bases, student-centered, presentation.				
Internal Evaluation Mode	Mid-term Examination: 20 Marks Activity: 10 Marks Class test: 05 Marks Online Test/Objective Test: 05 Marks Assignments/Presentation: 05 Marks Attendance: 05 Marks				

Session Details	Topic	Hours	Mapped CO
Unit 1	<p>Basics of Immunology:</p> <ul style="list-style-type: none"> • History and scope of Immunology • Types of immunity: innate and acquired immunity, humoral and cell mediated immunity. • Cell and organs of immune responses and their functions, B & T cells. <p>Immune Responses:</p> <ul style="list-style-type: none"> • Antigens: haptens, epitopes and Factors influencing immunogenicity. • Antibodies: Structure, types, production and functions of immunoglobulins, Clonal selection theory. • Antigen processing and presentation <p>Antigen Antibody reaction:</p> <ul style="list-style-type: none"> • Precipitation, • Principles of Immunoelectrophoresis, Haem-agglutination, • RIA and ELISA. <p>Transplantational Immunity:</p> <ul style="list-style-type: none"> • Immunological basis of graft rejection, Clinical manifestations; • Immunosuppressive therapy and privileged sites <p>Activity: Watching animated videos for better understanding/playing game-based animation about immunology</p>	15	CO1
Unit 2	<p>Histocompatibility:</p> <ul style="list-style-type: none"> • Structure of MHC class I, II & III and their mode of antigen presentation • MHC restriction and its application <p>Complement system: Components, Classical and alternate pathways of complement activation.</p> <p>Hypersensitivity: General features of hypersensitivity, Basics of various types of hypersensitivity: Type I, Type II, Type III and Type IV.</p> <p>Autoimmunity:</p> <ul style="list-style-type: none"> • General concept of autoimmunity • Common autoimmune disorders in human: organ-specific autoimmune diseases- Addison's disease, Graves' disease, Hashimoto's thyroiditis, Type 1 diabetes mellitus and Myocardial infarction; • Systemic autoimmune diseases- Rheumatoid Arthritis and Systemic Lupus Erythematus. 	15	CO1, CO2

	<p>Vaccines:</p> <ul style="list-style-type: none"> • Types of vaccines; active, passive immunity • Vaccines against Covid-19 virus: Covaxin and Covishield <p>Activity: Collection of data on various kinds of allergies and immunizations from at least 25 persons in a format and discussing its significance.</p>		
Unit 3	<p>Genetic engineering</p> <ul style="list-style-type: none"> • Introduction to concept Introduction to recombinant DNA technology; • Restriction enzymes: Endo & Exonucleases. • Modifying enzymes- DNA & RNA polymerase, reverse transcriptase, terminal transferase; nucleases (DNases, RNases, S1), T4 polynucleotide kinase, Alkaline Phosphatase and ligase (E.coli & T4). • Ligation (cohesive & blunt end ligation) – linkers & adaptor <p>Cloning:</p> <ul style="list-style-type: none"> • Concept • Introduction to Plasmid- definition, properties and types: Plasmid vectors (pUC19 & pBR322), phage vectors (λ & M13), cosmid vectors, shuttle and expression vectors; • Artificial chromosome vectors (BAC & YAC). <p>Screening and selection of recombinant host cells: Insertion Inactivation, Blue-White Screening and colony hybridization techniques;</p> <p>Gene Libraries: Genomic DNA and cDNA cloning techniques.</p> <p>Polymerase Chain Reaction:</p> <ul style="list-style-type: none"> • Fundamentals of Polymerase Chain reaction (PCR), Reverse Transcription Polymerase Chain Reaction (RT-PCR) and Real-Time polymerase Chain Reaction • Designing primers for PCR • Cloning PCR products. • Applications of PCR, RT-PCR and Real Time PCR <p>DNA sequencing:</p> <ul style="list-style-type: none"> • Principles of Sanger's method • Modifications based on Sanger's method. • Automated DNA sequencing. • Concept of Pyrosequencing. <p>Activity: Participating in DNA extraction, separation of DNA by gel electrophoresis and its visualization</p>	15	CO3
Unit 4	<p>Cell and Tissue Culture:</p> <ul style="list-style-type: none"> • Introduction to Cell and Tissue Culture 	15	CO4

	<ul style="list-style-type: none"> • Nutritional Requirements of Cells and growth media: Basal salt solution (BSS), Minimum Essential Medium • Importance of Serum in media, chemical defined media, serum free media; • Natural conditions for growth of animal cells <p>Basic Techniques of mammalian cell culture:</p> <ul style="list-style-type: none"> • Primary culture: isolation and mechanical and enzymatic disaggregation of animal tissue • Secondary culture: transformed animal cells and continuous cell lines. • Introduction to types of cell cultures: Monolayer, suspension culture • Organ culture, Embryo culture; Maintenance of animal cell culture • Common cell culture contaminants, applications of animal tissue culture <p>Activity: Visit to cell culture laboratory and observing the method of primary culture</p>		
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CO-PO and PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	3	2	2	2	2	2	3	2	2	2	2	2
CO2	3	2	2	2	3	3	2	1	3	2	2	3	3	2
CO3	3	3	3	2	2	2	2	2	3	3	2	2	2	2
CO4	3	3	3	2	2	2	2	3	3	2	2	2	2	3

Strongcontribution-3, Averagecontribution-2, Lowcontribution-1,

Suggested Readings:

Text-Books	<ol style="list-style-type: none"> 1. Kuby Immunology. Goldsby RA, Kindt T J., Osborne BA. McMillan Publishers. 6th Edition 2. Gene Cloning and DNA Analysis: An Introduction. Brown TA. Wiley Blackwell Publishers, 8th Edition 3. Culture of Animal Cells A Manual of Basic Technique and Specialized Applications. Freshney R I. Wiley Blackwell Publishers 7th Edidition. 4. Molecular Biology of the Cell, Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, and Peter Walter. 4th edition
Reference Books	<ol style="list-style-type: none"> 1. Roitt's Essential Immunology. Wiley Publishers. 13th Edition 2. Fundamental Immunology. Lippincott Williams & Wilkins Edited by William E. Paul, Wolters Kluwer Health Publication, 6th Edition 3. Basic and Clinical Immunology. Mark Peakman, Diego Vergani. Elsevier Publication, 2nd Edition. 4. Genetic Engineering. Verma P.S. & Agarwal V.K.S. Chand Publishing, 2009

Para Text	<ul style="list-style-type: none"> • Basic Immunology: https://youtu.be/mFNxXfwlP3A • Understanding immunity when we are infected with SARS-CoV-2 virus: https://www.who.int/emergencies/diseases/novel-coronavirus-2019/media-resources/science-in-5/episode-67---understanding-immunity • Game based: https://melanieanns.itch.io/immune-defense • ELISA: https://youtu.be/RVYV1R8ywXM • RIA: https://youtu.be/szJX5U9-POA, https://youtu.be/cDhKjx_i2eA • Sanger sequencing: https://youtu.be/szJX5U9-POA • Pyrosequencing: https://youtu.be/WdTX1yykLks
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Recapitulation & Examination Pattern

Component	Marks	Pattern
Mid Semester	20	Section A: Contains 10 MCQs/Fill in the blanks/One Word Answer/ True-False type of questions. Each question carries 0.5Marks . Section B: Contains 07 descriptive questions out of which 05 questions are to be attempted. Each question carries 03 Marks .
Activity	10	Will be decided by subject teacher
Class Test	05	Contains 05 descriptive questions . Each question carries 01 Mark.
Online Test/ Objective Test	05	Contains 10 multiple choice questions . Each question carries 0.5Marks .
Assignment/ Presentation	05	Assignment to be made on topics and instruction given by subject teacher.
Attendance	05	As per policy.
Total Marks	50	

Course created by: Dr. Ghazala Zaidi

Signature:

Approved by: Prof. Sudhir Mehrotra

Signature: