Integral University, Lucknow

Effective from Session: 2023-24							
Course Code	B100301T/ BS207	**Title of the Course**	Molecular Biology	**L**	**T**	**P**	**C**
Year	II	**Semester**	III	**4**	**2**	**0**	**4**
Pre-Requisite	10+2 Biology	**Co-requisite**					
Course Objectives	The objective of this course is to enable students to understand the concept of different types of genes, DNA replication, Transcription, Translation, regulation of Gene expression in prokaryotes and eukaryotes.						

Course Outcomes	
CO1	The students will be able to evaluate genome organization and synthesize functional models for its biological significance.
CO2	The students will be able to analyse the mechanisms of DNA replication in prokaryotes and eukaryotes, and propose strategies for its regulation
CO3	The students will be able to critically evaluate different types of DNA damages and Repair systems and formulate approaches to prevent/combat DNA damage.
CO4	The students will be able to critically evaluate translation mechanisms in prokaryotes and eukaryotes and propose approaches for their regulation.
CO5	The students will be able to Integrate knowledge of DNA sequence classes, post-transcriptional and post-translational modifications, and construct strategies for regulating gene expression.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Basic Concepts of genome and its organization	Importance of Molecular Biology, Nucleic acid as the genetic material, Central Dogma of Molecular Biology, Model organisms for studying Molecular Biology, Genome and its organization in prokaryotes and Eukaryotes: Gene, Genome, Exon, Intron, regulatory sequence, Nucleosome structure and packaging of DNA into higher order structures.	**8**	CO1
2	DNA Replication	Semiconservative mode of replication. Mechanism of Replication in prokaryotes and eukaryotes. Enzymes and proteins involved in replication, Theta model and Rolling circle model, Inhibitors of Replication.	**8**	CO2
3	DNA Damage, Repair and Mutation	Causes and types of DNA damage, Mechanism of DNA repair, Molecular basis and types of mutation. Ames test.	**6**	CO3
4	Transcription	Transcription process in prokaryotes and eukaryotes. Enzymes, promoter, and transcription factors. Inhibitors of transcription Actinomycin D and α- Amanitin.	**8**	CO4
5	Translation	Components of Protein synthesis machinery: Messenger RNA, tRNA structure and function, Charging of tRNA, aminoacyl tRNA synthetases, ribosome structure and assembly, Mechanism of protein synthesis in prokaryotes and Eukaryotes.	**8**	CO4
6	Post-Transcription and Post-Translation Modifications	Post-transcriptional modifications of eukaryotic mRNA (capping, polyadenylation and splicing, post-translational modifications of proteins.	**8**	CO5
7	Gene expression	Principles of gene regulation, negative and positive regulation, concept of operons, Regulation of gene expression in prokaryotes and eukaryotes; Lac operon and Trp operon concept	**8**	CO5
8	Classes of DNA sequences	Satellite DNA, Split genes, Pseudogenes, Transposable elements, Retroelements, LINEs, SINEs.	**6**	CO5

Reference Books:

1. Lewin B. (2000). Genes VII. Oxford University press.
2. Watson JD, Hopkins NH, Roberts JW, Steitz JA, Weiner AM. (1987). Molecular biology of the gene.
3. Lodish H, Baltimore D, Berk A, Zipursky SL, Darnell J. (1995). Molecular cell biology.
4. Brown, TA Genomes (2020).
1. Lewin B. (2000). Genes VII. Oxford University press.

e-Learning Source:

https://www.coursera.org/learn/dna-decoded#modules

https://www.udemy.com/course/dna-repair-concepts/?srsltid=AfmBOoq-Pm_T0Ly302rWBdh4jKd0TbeHoV_kEfvHIzFiIfa6u_aUUZP_

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3	1					2	3	2	1	
CO2	3	1					2	3	2	2	
CO3	3	1	2		1	1	2	3	2	3	
CO4	3	1					2	3	2	3	
CO5	3	1					2	3	2	3	

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2023-24							
Course Code	B110301T/BS245	**Title of the Course**	Tools and Techniques in Biochemistry	**L**	**T**	**P**	**C**
Year	II	**Semester**	III	**4**	**2**	**0**	**4**
Pre-Requisite	10+2 Biology	**Co-requisite**					
Course Objectives	The objective of this course is to develop the understanding of basic principles, working and application of commonly used biophysical techniques like Chromatography, Centrifugation, Electrophoresis, Microscopy, Spectroscopy and Radioactivity including GM counters and Scintillation counting.						

Course Outcomes	
CO1	The students will be able to critically evaluate differences between different types of chemical bonding.
CO2	The students will be able to formulate experiments using Chromatography and Centrifugation.
CO3	The students will be able to design studies based on Electrophoresis and Microscopy.
CO4	The students will be able to compare various Spectroscopy techniques.
CO5	The students will be able to critically evaluate the applications of radioactivity in biological studies, GM counters and Scintillation counting.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Basics of Biophysics**	Chemical bonding – Ionic bond, Covalent bond, Hydrogen bond and Vander-Waals force	**6**	**CO1**
2	**Chromatography**	Introduction & principle of Chromatography, Paper, Thin-layer, HPLC, GLC, Molecular sieving, Ion exchange chromatography, Affinity chromatography	**8**	**CO2**
3	**Centrifugation**	Principle of centrifugation, Basic rules of sedimentation, Sedimentation coefficient, Various types of centrifuges, Low speed centrifuge, High speed centrifuge and Ultracentrifuge, Types of rotors, Application of centrifugation, Differential centrifugation, Density gradient centrifugation- Zonal and Isopycnic.	**8**	**CO2**
4	**Electrophoresis**	Basic principle, Instrumentation and types of Electrophoresis, Agarose gel electrophoresis, PAGE, SDS-PAGE	**6**	**CO3**
5	**Microscopy**	Principle of Light microscopy, Phase contrast microscopy, Fluorescence microscopy, Electron microscopy, TEM and SEM, Permanent and temporary slide preparation	**8**	**CO3**
6	**Spectroscopic techniques I**	Colorimetry, UV-Visible spectrophotometry and Beer-Lambert law, Fluorescence spectroscopy, Infra-Red spectroscopy.	**8**	**CO4**
7	**Spectroscopic techniques II**	Circular Dichroism, Nuclear Magnetic Resonance spectrometry, Atomic absorption, Emission spectrometry, X Ray diffraction, Mass spectrometry	**8**	**CO4**
8	**Radioactivity**	Radioactivity, Types, their importance in biological studies, Measure of radioactivity, GM counters, Scintillation counting.	**8**	**CO5**

Reference Books:

1. Narayanan, P: Essentials of Biophysics, New Age Int. Pub. New Delhi.
2. Keith Wilson & John Walker: Principles and Techniques of Biochemistry and Molecular Biology.
3. Upadhyay, Upadhyay and Nath: Biophysical Chemistry: Principle and Techniques.
4. David Sheehan: Physical Biochemistry Principle and Applications.
5. Sabari Ghosal & A. K. Srivastava: Fundamentals of Bioanalytical techniques and Instrumentation.

e-Learning Source:

https://www.biophysics.org/education-careers/education-resources/selected-topics-in-biophysics/biophysical-techniques

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3	1					1	3		1	
CO2	3	1					1	2		2	
CO3	3	1					1	3		3	
CO4	3	1					1	2		3	
CO5	3	1					1	3	3	3	

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2023-24							
Course Code	B190302P/BS209	**Title of the Course**	Molecular Biology Lab	**L**	**T**	**P**	**C**
Year	**II**	**Semester**	III	**0**	**0**	**4**	**2**
Pre-Requisite	10+2	**Co-requisite**					
Course Objectives	The course is designed to train the students in basic and some advanced techniques of Molecular biology.						

Course Outcomes	
CO1	The students will be able to formulate genomic DNA isolation strategies from bacteria.
CO2	The students will be able to plan experiments for genomic DNA extraction from plant or animal tissues.
CO3	The students will be able to design studies for isolation of plasmid DNA (*E. coli*).
CO4	The students will be able to evaluate the process of restriction digestion of DNA.
CO5	The students will be able to perform experiments to analyze the size of DNA using Agarose Gel Electrophoresis.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Exp-01	Isolation of genomic DNA from bacteria (*E. coli)*	4	**CO1**
2	Exp-02	Isolation of genomic DNA from plant tissue	6	**CO2**
3	Exp-03	Isolation of genomic DNA from animal tissue	6	**CO2**
4	Exp-04	Isolation of plasmid DNA (*E. coli*)	4	**CO3**
5	Exp-05	Restriction digestion of DNA	2	**CO4**
6	Exp-06	Agarose Gel Electrophoresis	2	**CO5**

Reference Books:

1. Gene Cloning and DNA Analysis: An Introduction, 6th Edition by T. A. Brown

2. Sambrook J, Russell D (2001) Molecular Cloning: A Laboratory Manual, 3rd Ed. Cold Spring Harbor, NY: Cold Spring Harbor Laboratory Press.

e-Learning Source:

https://vlab.amrita.edu/

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3	1					2	3		3	
CO2	3	1					2	3	2	3	
CO3	3	1					1	1		3	
CO4	3	1					1				3
CO5	3	1					1				3

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2023-24							
Course Code	B110302P/ BS246	**Title of the Course**	Biochemical Tools and Techniques	**L**	**T**	**P**	**C**
Year	II	**Semester**	III	**0**	**0**	**4**	**2**
Pre-Requisite	10+2 Biology	**Co-requisite**					
Course Objectives	This course is designed to enable the students to develop the understanding of Beer's law, methods of protein estimation, chromatography and electrophoresis techniques.						

Course Outcomes	
CO1	The students will be able to develop the understanding of Beer's Law and formulate experiments for estimation of proteins.
CO2	The students will be able to plan studies for detection of Amino acids by TLC/ Paper chromatography.
CO3	The students will be able to evaluate the size of DNA and proteins using Agarose Gel Electrophoresis and SDS PAGE.
CO4	The students will be able to evaluate methods for isolating mitochondria.
CO5	The students will be able to judge how to visualize different cells by methylene blue staining

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Exp. 1**	Verification of Beer's Law	**6**	**CO1**
2	**Exp. 2**	Estimation of proteins by Biuret/Lowry method	**6**	**CO1**
3	**Exp. 3**	Separation of amino acid acids by TLC/paper chromatography	**6**	**CO2**
4	**Exp. 4**	To perform agarose gel electrophoresis	**6**	**CO3**
5	**Exp. 5**	To perform agarose SDS PAGE	**6**	**CO3**
6	**Exp. 6**	To isolate mitochondria by differential centrifugation	**6**	**CO4**
7	**Exp. 7**	Visualization of cells by methylene blue	**6**	**CO5**

Reference Books:

1. Narayanan, P (2000) Essentials of Biophysics, New Age Int. Pub. New Delhi.
2. Roy R.N. (1999) A Text Book of Biophysics New Central Book Agency.
3. Plummer D. T., An Introduction to Practical Biochemistry 3rd ed., Tata McGraw Hill Education Pvt. Ltd. 1998,
4. Wilson K. and Walker J., Principles and Techniques of Biochemistry and Molecular Biology, 7th ed., Cambridge University Press, 2010.

e-Learning Source:

https://mas-iiith.vlabs.ac.in/exp/uv-visible-spectroscopy/procedure.html

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3	1					2	3	2		
CO2	3	1					2	3	2		
CO3	3	1	1				2	3	2		
CO4	3	1	1				2	3	2		
CO5	3	1					2	3	2		

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2023-24							
Course Code	B100305V/ BS247	**Title of the Course**	Molecular Diagnostics	**L**	**T**	**P**	**C**
Year	II	**Semester**	III	**3**	**0**	**0**	**3**
Pre-Requisite	10+2	**Co-requisite**					
Course Objectives	The objective of this course is to develop an understanding of the basic principle and application of molecular techniques employed in diagnosis of diseases.						

Course Outcomes	
CO1	The student will be able to evaluate the mechanisms of the human genome and critique their association with the pathogenesis of common diseases using evidence-based analysis.
CO2	The student will be able to critically evaluate types of infectious diseases (bacterial, viral, fungal, protozoan, helminthic), their transmission modes, and propose diagnostic strategies.
CO3	The student will be able to critically evaluate genetic disorders and propose techniques for their diagnosis.
CO4	The student will be able to evaluate different types of cancers and their genetic underpinnings, and analyse the applications of molecular diagnostics in human cancer detection and treatment.
CO5	The student will be able to critically evaluate molecular diagnostic tools, and propose their applications in clinical diagnostics and research.

Unit No.	Title of the Unit	Content of Unit	**Contact Hrs.**	**Mapped CO**
1	Introduction to Human Genome & common diseases	Introduction and mechanism related to the human genome, such as gene expression, replication and genome maintenance. Consequences of mutations and polymorphisms, and impacts of genes and environment on major common diseases, such as cancer, diabetes, vascular, and coronary disease **Virtual Lab:** Demonstration of Extraction of DNA from Animal Sample	10	CO1
2	Infectious Diseases and History of Diagnostics	Types of infectious diseases- bacterial, viral, fungal, protozoan, and other parasites. Infection mode of transmission in infections, factors predisposing to microbial pathogenicity. Diagnosis of infectious diseases caused by bacteria, fungi, viruses, protozoa, and helminths. **Virtual Lab:** Demonstration of Gram staining to identify bacteria	10	CO2
3	Major Genetic disorders, its causes & Diagnosis.	Genetic disorders: Sickle cell anaemia, Duchenne muscular Dystrophy, Retinoblastoma, Cystic Fibrosis, and Sex – linked inherited disorders **Case Study:** A case study on any one of the genetic diseases. (Sickle cell anaemia, Duchene muscular Dystrophy, Retinoblastoma, Cystic Fibrosis or Sex – linked inherited disorders)	10	CO3
4	Cancer Biology and Diagnostics	Different types of cancers, genetics of cancer- oncogenes, tumour suppressor genes, Applications of Molecular Diagnostics for Human Cancers. **Case Study:** A case study on any type of cancer	8	CO4
5	Molecular Diagnostics Tools	RT- PCR, Animal cell culture, DNA Sequencing, Microarray, Techniques of Nucleic acid Extraction, Real time PCR, Fluorescence In Situ Hybridization. **Virtual Lab:** Demonstration of Polymerase Chain Reaction	7	CO5

Reference Books:

"Murray's Medical Microbiology" by Patrick R. Murray, Ken S. Rosenthal, Michael A. Pfaller

"Medical Microbiology" by David Greenwood, Richard C. B. Slack, Michael R. Barer, Will L. Irving

"Kuby Immunology" by Judy Owen, Jenni Punt, Sharon Stranford

"Basic Immunology: Functions and Disorders of the Immune System" by Abul K. Abbas, Andrew H. Lichtman

e-Learning Source:

Vlab.amrita.edu

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)										
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3	1					2	3	2	2	1
CO2	3	1					2	2	2	2	1
CO3	3	1	2				1	3	1	3	
CO4	3	1	2				1	2	1	3	
CO5	3	1					2	3	3	3	1

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2023-24							
Course Code	B100403T/BS256	**Title of the Course**	Infection and immunity	**L**	**T**	**P**	**C**
Year	II year	**Semester**	IV	**3**	**1**	**0**	**4**
Pre-Requisite	10+2	**Co-requisite**					
Course Objectives	**The objective of this course is to develop an understanding of the basics of infection and immunity**						

Course Outcomes	
CO1	The students will be able to analyze and compare the characteristics of various infectious diseases and examine their modes of transmission.
CO2	The students will be able to evaluate and compare various laboratory diagnostic methods for identifying infectious agents
CO3	The students will be able to analyze and compare the structures and functions of antigens, examine the organization of the immune system.
CO4	The students will be able to analyze and compare the structures and functions of MHC molecules and examine the mechanisms of complement activation.
CO5	The students will be able to evaluate and critique various immunological techniques, assess immune response mechanisms, and justify vaccination strategies.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	History and transmission of infectious diseases	Definition and Historical perspectives of infectious diseases, Modes of Transmission and Pathogenesis of Infectious Diseases: Adherence and invasion mechanisms, toxigenesis and virulence factors, Host-pathogen interactions	8	CO1
2	Laboratory Diagnosis of Infectious Agents	Laboratory Diagnosis of Infectious Agents: Sample collection and handling, microscopic examination and staining techniques, Culture, biochemical tests, and serological assays; Infection Control Measures: Standard precautions and isolation techniques, Sterilization, disinfection, and decontamination, Surveillance and outbreak investigation	8	CO2
3	Immune system organization	History of Immune system, Types of immunity Humoral & Cell Mediated. The cells and organs of the immune system. Innate immunity. Anatomical barriers, cell types of innate immunity, connection between innate and adaptive immunity	8	CO3
4	Types of Immunity and antigenic determinants	Adaptive immunity: Antigens and haptens. Structure and distribution of classes and substances of immunoglobulins (Ig), Ig fold, effector functions of antibody, antigenic determinants on Ig and Ig super family. Generation of antibody diversity	8	CO3
5	Structure and functions of MHC molecules	Structure and functions of MHC molecules (MHC I and II), Endogenous and exogenous pathways of antigen processing and presentation	6	CO4
6	Complement and its activation	Complement and its activation by classical, alternate and lectin pathway; biological consequences of complement activation; regulation of complement activity	6	CO4
7	Immunological techniques	Immunological methods-Antigen-antibody interactions. Agglutination, hemagglutination. Precipitin reactions in solution and in gels; immunoassays. Selection, Antigen presentation, Activation of T and B cells. Cytokines	8	CO5
8	Immune response and Vaccination	Immunological tolerance-Primary and secondary. Hypersensitivity and its types. Immune response against major classes of pathogens. Vaccines: Live attenuated, Inactivated, Toxoid, subunit/conjugate vaccine. Monoclonal Antibody	8	CO5

Reference Books:

"Murray's Medical Microbiology" by Patrick R. Murray, Ken S. Rosenthal, Michael A. Pfaller

"Medical Microbiology" by David Greenwood, Richard C. B. Slack, Michael R. Barer, Will L. Irving

"Kuby Immunology" by Judy Owen, Jenni Punt, Sharon Stranford

"Basic Immunology: Functions and Disorders of the Immune System" by Abul K. Abbas, Andrew H. Lichtman

e-Learning Source:

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)										
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3	1					1	3			
CO2	3	1			1		3	2		2	1
CO3	3	1					1	3			
CO4	3	1					1	2			
CO5	3	1			1		3	3		2	1

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2023-24							
Course Code	B110401T/BS254	**Title of the Course**	Enzymes and hormones	**L**	**T**	**P**	**C**
Year	II	**Semester**	IV	**3**	**1**	**0**	**4**
Pre-Requisite	UG in Biological Sciences	**Co-requisite**					
Course Objectives	This course has been designed to teach the student majoring in science all the major aspects of the study of enzymes. The course focuses on the theories of enzyme kinetics, the mechanisms of enzyme catalysis, and immobilization of enzyme.						

Course Outcomes	
CO1	The students will be able to evaluate general properties of enzymes and their classification & nomenclature.
CO2	The students will be able to measure enzyme kinetics.
CO3	The students will be able to analyze mechanisms of enzyme catalysis and enzyme inhibition & activation.
CO4	The students will be able to evaluate multisubstrate enzyme kinetics and enzyme Immobilization and its clinical & industrial use.
CO5	The students will be able to critically evaluate the functions of plant and animal hormones

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Classification and nomenclature of enzymes	General properties of enzymes. Mechanism of enzyme action: Chymotrypsin, ribonuclease, activation of transition metal cation, activation by alkaline earth metal cation, nicotinamide nucleotide, flavin nucleotide and adenosine phosphate.	8	CO1
2	Enzyme kinetics	Michaelis-Menten initial rate equation based on equilibrium assumption, Briggs Haldane steady state approach, integrated form of the Michaelis equation, methods for the determination of Km and Vmax normalized initial rate equation and normalized curves, Haldane relationship.	8	CO2
3	Effect of factors and inhibitors on enzyme kinetics	Effect of enzymes concentration, pH and temperature on kinetics of enzyme reactions. Enzyme inhibition and activation: Types of reversible inhibitors, qualitative analysis of data, derivation of equations for different types of inhibitions, determination of inhibitor constant, determination of activator constant.	8	CO3
4	Multisubstrate enzyme kinetics	Multisubstrate enzyme kinetics: random bi-bi, and ping pong reactions. Intracellular localization of enzymes, purification of enzymes and tests for homogeneity.	6	CO4
5	Applied Enzymology	Immobilization; kinetics of immobilized systems. Isozymes. Allosteric enzymes. Industrial and clinical scope of enzymes.	6	CO4
6	Plant Hormones	Classification, structural features & functions in Plants: Auxins, gibberellins, Cytokinins, ethylene, and abscisic acid	8	CO5
7	Animal Hormones I	Classification, structural features &Functions of hormones secreted by endocrine glands: Hypothalamus, pituitary gland- anterior pituitary and posterior pituitary, thyroid gland	8	CO5
8	Animal Hormones II	Classification, structural features &Functions of hormones secreted by endocrine glands: adrenal gland, Pancreas, gonads	8	CO5

Reference Books:

1. Enzymes Biochemistry, Biotechnology, Clinical Chemistry Authors: T Palmer, P L Bonner; Woodhead Publishing
2. Biochemistry – Lubert Stryer Freeman International Edition.
3. Lehninger: Principles of Biochemistry (2017) by Nelson and Cox Seventh edition, WH Freman and Co.
4. Enzyme Structure and Mechanism; Publisher W H Freeman & Co, New York; Alan Fersht
5. Enzymes: Authors: Malcolm Dixon, Edwin C. Webb; Academic Press

e-Learning Source:

https://onlinecourses.swayam2.ac.in/cec20_bt20/preview

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)										
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3	1					2	3			
CO2	3	1					2	3			
CO3	3	1					2	3			
CO4	3	1					2	3			
CO5	3	1					2	3			

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2023-24							
Course Code	B110402P/BS257	Immunological Techniques Lab	Enzymes and hormones lab	**L**	**T**	**P**	**C**
Year	II	**Semester**	IV	**0**	**0**	**4**	**2**
Pre-Requisite	10+2 Biology	**Co-requisite**					
Course Objectives	The objective of this course is to enable students learn about basics of enzymes and hormones						

Course Outcomes	
CO1	The students will be able to design experiments for isolating enzymes.
CO2	The students will be able to test enzyme activity.
CO3	The students will be able judge the effect of varying substrate and inhibitor concentration on the enzyme activity.
CO4	The students will be able to critically evaluate the effect of pH and temperature on the enzyme activity.
CO5	The students will be able to critically evaluate the roles of plant growth hormones.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Exp. 1**	Isolation of enzyme crude extract and determination of enzyme activity	**6**	**CO1**
2	**Exp. 2**	Study of the effect of pH on the enzyme activity.	**6**	**CO2**
3	**Exp. 3**	Study of the effect of varying substrate concentration on the enzyme activity and determination of Km and Vmax.	**6**	**CO3**
4	**Exp. 4**	Study of the effect of temperature on the enzyme activity.	**6**	**CO4**
5	**Exp. 5**	Study of the effect of inhibitors on the enzyme activity.	**6**	**CO4**
6	**Exp. 6**	Study the effect of any plant growth hormone	**6**	**CO5**

Reference Books:

1. Asim Roy Kumar, IMMUNOLOGY THEORY & PRACTICAL, 5TH SEM. (KALYANI PUB.) 2. Talwar Gupta A Handbook of Practical & Clinical Immunology 3. A.K. Abbas and A.H. Lichtman, Saunders, Basic Immunology, W.B. Company

e-Learning Source:

https://www.ucl.ac.uk/~ucbcdab/enzass/enzymass.htm

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3	1					2	3	2		
CO2	3	1					2	3	2		
CO3	3	1					2	3	2		
CO4	3	1					2	3	2		
CO5	3	1					2	3	2		

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2023-24							
Course Code	B100404P/ BS258	Immunological Techniques Lab	Immunological Techniques Lab	**L**	**T**	**P**	**C**
Year	II	**Semester**	IV	**0**	**0**	**4**	**2**
Pre-Requisite	10+2 Biology	**Co-requisite**					
Course Objectives	The objective of this course is to enable students learn about basics of immunology, types of Blood grouping, cell counts, ELISA, Ouchterlony Double diffusion (ODD) and Separation of serum from blood & precipitation of Immunoglobulins						

Course Outcomes	
CO1	Student will be able to Critically Evaluate the blood groups and the variations in differential WBC counts.
CO2	Student will be able to Evaluate the effects of detergents and concentrations on RBC membrane.
CO3	Student will be able to Evaluate the applications of ELISA and Dot ELISA, interpreting the relevance of these assays.
CO4	Student will be able to Analyze the antigen-antibody interaction pattern by Ouchterlony Double diffusion assay.
CO5	Student will be able to Analyze the separation of serum from blood & precipitation of Immunoglobulin.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Exp. 1**	Blood grouping	**6**	**CO1**
2	**Exp. 2**	Differential Count of WBC	**6**	**CO1**
3	**Exp. 3**	Detergent lysis of RBC	**6**	**CO2**
4	**Exp. 4**	Dot Elisa	**6**	**CO3**
5	**Exp. 5**	ELISA – Demonstration	**6**	**CO3**
6	**Exp. 6**	Ouchterlony Double diffusion (ODD)	**6**	**CO4**
7	**Exp. 7**	Separation of serum from blood & precipitation of Immunoglobulins	**6**	**CO5**

Reference Books:

1. Asim Roy Kumar, 2. Talwar Gupta A Handbook of Practical & Clinical Immunology 3. A.K. Abbas and A.H. Lichtman, Saunders, Basic Immunology, W.B. Company

e-Learning Source:

https://onlinecourses.nptel.ac.in/

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3	1					3	3	2		
CO2	3	1					3	3	2		
CO3	3	1					2	3	2		
CO4	3	1					1	3	2		
CO5	3	1					1	3	2		

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**