

ERA UNIVERSITY, LUCKNOW
STUDY & EVALUATION SCHEME (Effective from Session 2025-26)
M. Sc. BIOTECHNOLOGY
YEAR I, SEMESTER – II

	Course category	Course code	Course title	Hours/week			EVALUATION SCHEME				CT	C	Attributes						
							Mid Sem Exam	TA	Total	End Sem Exam			Employability	Entrepreneurship	Skill Development	Gender	Environment Sustainability	Human values	Professional Ethics
				L	T	P													
THEORY																			
1.	Major Own Faculty	MBT0201T	Enzymology	3	1	0	20	20	40	60	100	4	✓		✓		✓		
2.	Major Own Faculty	MBT0202T	IPR, Biosafety & Ethical issues	3	1	0	20	20	40	60	100	4	✓				✓		✓
3.	Major Own Faculty	MBT0203T	Immunology	3	1	0	20	20	40	60	100	4	✓	✓	✓		✓		
4.	Major Own Faculty	MBT0204T	Genetics	3	1	0	20	20	40	60	100	4	✓	✓	✓		✓		
5.	Elective	MBT0205E	Biostatistics	3	1	0	20	20	40	60	100	4	✓		✓		✓		
	Elective	MBT0206E	Plant & Animal Physiology										✓			✓			
	Elective	MBT0207E	Nanobiotechnology										✓	✓		✓			
PRACTICALS																			
6.	Major Own Faculty	MBT0208P	Laboratory Course II (Enzymology + Immunology + Genetics)	0	0	6	20	20	40	60	100	3	✓	✓	✓		✓		
Total											600	23							

L- Lecture T- Tutorial P- Practical C- Credit TA- Teacher Assessment
 Electives: Any one out of three. CT- Course Total

Sangeeta

Ben *Ujj* *Sch*

[Signature] *[Signature]* *[Signature]*

[Signature] *[Signature]*

Era University
Department of Biotechnology
Course Outline
Academic Year: 2025-2026

Course Name: Enzymology	Course Code: MBT0201T	Year: I	Semester: II
Core Course			
Credits: 4	Total No. of Lectures: 60 Lecture-Tutorial-Practical (In hours/week) L-T-P: 3-1-0		
Evaluation Spread	Internal Continuous	40	End Term Exam 60
Course Objective	The objective is to offer detailed knowledge about enzymes, which catalyze the entire repertoire of biochemical reactions in life processes, providing basic concepts of their mechanism of action, kinetics, regulation, inhibition, purification and diverse applications.		
Course Outcome	CO1: Students will acquire insight into enzyme assays, kinetics, structure, and regulation, mechanism of action and reaction intermediates and inhibition. CO2: Students will learn various theories for enzyme action and regulation and experimental evidences thereof. CO3: Students will learn about the various applications of enzymology in research, medicine, biotechnology, agriculture field.		
Pedagogy	Interactive, Discussion Based Sessions, Presentations, Seminars		
Internal Evaluation Mode	Sessional Test: 20 Quiz: 5 Assignments: 5 Attendance: 5 Presentations: 5		
Unit	Topic		No. of Lectures Total = 60
I	Enzymology an Introduction: Enzymes as biocatalysts, Classification and nomenclature of enzymes, Theories & Mechanism of enzyme action, specificity of enzyme action (lock and key and induced fit model), turnover number, energy of activation. Types of Enzymes (A. Simple enzymes B. Complex enzymes, multienzyme complex, allosteric enzymes, isozymes; multi-substrate enzymes; Order reaction. Experimental Measures of Enzyme Activity, Enzyme induction, active site determination; Initial velocity measurements, detection methods, separation methods in enzyme assays, factors affecting the velocity of enzymatic reactions.		12
II	Enzyme Kinetics and Inhibition: Michaelis-Menten kinetics (pre-steady state, Steady state, Derivation of M-M equation) Determination and significance of Vmax and Km; Linear plots for enzyme kinetic studies, Enzyme inhibition: -competitive inhibition, uncompetitive inhibition, noncompetitive inhibition, mixed inhibition, partial inhibition, substrate inhibition, Allosteric inhibition, irreversible inhibition.		12
III	Enzyme catalysis: Mechanisms of enzyme catalysis-acid-base catalysis, electrostatic catalysis, covalent catalysis, metal ion catalysis and enzyme catalysis; tapping the enzyme-substrate complex, use of substrate analogues, enzyme modification by chemical procedures affecting amino acid chain, treatment with proteases, site directed mutagenesis		12

27

	Mechanism of reactions catalyzed by enzymes: chymotrypsin, lysozyme, ribonuclease and carboxypeptidase.	
IV	Enzyme Immobilization: Introduction; aim of Enzyme Immobilization; effect of immobilization on [a] Physical properties [b] Chemical properties [c] Stability [d] activity of enzyme; Advantages of Immobilization; Limitations of immobilized enzyme; Methods of immobilizations Carrier matrices, Adsorption of enzymes, Covalent coupling (Functional groups that affects the covalent coupling, use of cyanogen bromide Ethyl chloroformate, Carbodiimide, Glutaraldehyde, 3-aminopropyltriethoxysilane) Entrapment and Encapsulation of Enzymes Crosslinking Application of immobilized enzymes in the industries.	12
V	Applied Enzymology Use of enzymes in industries, textile, leather, food, industries. Purification strategies Use of purified enzymes in biosensors, Enzyme sensors for clinical diagnosis, environmental analysis, and other applications of biosensors. Effect of organic solvents on enzyme catalysis, denaturation.	12

Suggested Readings

1. Trevor Palmer & Philip Bonner. Enzymes: Biochemistry, Biotechnology, Clinical chemistry. 2nd Ed., Affiliated East-West Press
2. T. Devasena. Enzymology, 2010, Oxford University Press
3. M.Y. Khan. Principles of enzyme technology, 1st Ed, S. Chand Company
4. Dr. S.M. Bhatt. Enzymology & Enzyme technology, 1st Ed., PHI Learning Press
5. Price Nicholas & Lewis Stevens. Fundamentals of Enzymology: cell & molecular biology of catalytic proteins. 3rd Ed., Oxford University Press.

UNIT	MAPPED CO
I	CO1, CO2, CO3
II	CO1, CO2, CO3
III	CO1, CO2, CO3
IV	CO1, CO2, CO3
V	CO1, CO3

MAPPED CO's WITH PO's & PSO's

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4
CO1	√	√	√			√	√	√	
CO2	√	√	√				√	√	
CO3	√	√	√			√	√	√	

Course Created by:
Dr. Amit Mani Tiwari

Approved by:

Eu

[Signature]

Era University
Department of Biotechnology
Course Outline
Academic Year: 2025-2026

Course Name: IPR, Biosafety & Ethical Issues		Course Code: MBT0202T		Year: I	Semester: II
Core Course					
Credits: 4	Total No. of Lectures: 60	Lecture-Tutorial-Practical (In hours/week) L-T-P: 3-1-0			
Evaluation Spread	Internal Continuous	40	End Term Exam	60	
Course Objective	<ul style="list-style-type: none"> To introduce biosafety regulations and ethical practices in biotechnology To emphasize on IPR issues and need for knowledge about patents in biotechnology. 				
Course Outcome	CO1: Explain the ethical issues in biotechnology CO2: Outline the biosafety guidelines & national regulations. CO3: Apply the knowledge on IPR and infer IPR in the era to globalization. CO4: Summarize awareness on the Biosafety, Bioethics, and Intellectual Property Rights.				
Pedagogy	Interactive, Discussion Based Sessions, Presentations, Seminars				
Internal Evaluation Mode	Sessional Test: 20 Quiz: 5 Assignments: 5 Attendance: 5 Presentations: 5				
Unit	Topic				No. of Lectures Total = 60
I	General principles for the laboratory and environmental biosafety; Health aspects; toxicology, allergenicity, antibiotic resistance, etc; Impact on environment: gene flow in natural and artificial ecologies; Sources of gene escape, tolerance of target organisms, creation of superweeds/superviruses, etc.				12
II	Biosafety and risk assessment issues; Regulatory framework; National biosafety policies and law, The Cartagena protocol on biosafety, WTO and other international agreements related to biosafety, Cross border movement of germplasm; Risk management issues - containment.				12
III	Ecological aspects of GMOs and impact on biodiversity; Monitoring strategies and methods for detecting transgenics; Radiation safety and nonradio isotopic procedure; Benefits of transgenics to human health, society and the environment.				12
IV	The WTO and other international agreements; Intellectual properties, copyrights, trademarks, trade secrets, patents, geographical indications, etc.				12
V	Protection of plant variety and farmers right act; Indian patent act and amendments, patent filing; Convention on biological diversity; Implications of intellectual property rights on the commercialization of biotechnology products.				12

Suggested Readings

1. Sasson A, Biotechnologies and Development, UNESCO Publications, 1988.
2. Sasson A. Biotechnologies in developing countries present and future, UNESCO publishers, 1993.
3. Singh K. Intellectual Property Rights on Biotechnology, BCII, New Delhi.

UNIT	MAPPED CO
I	CO1
II	CO1
III	CO1
IV	CO2 & CO3
V	CO2, CO3 & CO4

MAPPED CO's WITH PO's & PSO's

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4
CO1	√						√		
CO2	√	√	√				√	√	
CO3	√	√	√				√	√	
CO4	√	√	√				√		

DR MANMUKH ZATHEGA
Course Created by:

Approved by:

Sangeeta
ay
su
ay *ay*
ay *ay*

Era University
Department of Biotechnology
Course Outline
Academic Year: 2025-2026

Course Name: Immunology	Course Code: MBT0203T	Year: I	Semester: II
Core Course			
Credits: 4	Total No. of Lectures: 60 Lecture-Tutorial-Practical (In hours/week) L-T-P: 3-1-0		
Evaluation Spread	Internal Continuous	40	End Term Exam 60
Course Objective	This course attempts to teach host defense system, essential concepts of immune system, host-microbial interaction, immune-diagnosis and emerging advancement of immunology. Layering a problem-oriented approach to learning will lead to understanding the fundamental concepts of immunity and an advanced understanding and applied knowledge in the theory and practice of immunology.		
Course Outcome	CO1 Students should be able to demonstrate a significant knowledge on fundamental and advanced aspects of Immunology. CO2: Should be capable of displaying the contribution of organs and cells in the development of immune response. CO3: Should gain insight into the various aspects of immunogenetics, molecular immunology and clinical immunology.		
Pedagogy	Interactive, Discussion Based Sessions, Presentations, Seminars		
Internal Evaluation Mode	Sessional Test: 20 Quiz: 5 Assignments: 5 Attendance: 5 Presentations: 5		
Unit	Topic		No. of Lectures Total = 60
I	Fundamentals of Immunology: Primary and secondary lymphoid organs: Structure and functions of Bone marrow, Thymus, Lymph nodes, tonsils, spleen. Cells of immune system: Origin and differentiation of Progenitor cells in lymphoid, myeloid and erythroid lineages. Granulocytes: Functions of Neutrophils, eosinophils, and basophils. Monocytes, macrophages, Dendritic cells, Mast cells, T cells, B cells, Natural killer cells. Immune privileged sites and their importance		12
II	Innate and Acquired Immunity General introduction to innate immunity and acquired immunity. Barriers of innate immunity. Antigens, Immunogenicity, Adjuvants and haptens. Immunoglobulin: Structure and classification. Immunoglobulin super family.		12
III	Antigen presentation and Transplantation immunology Antigen presenting cells - professional and nonprofessional cells. MHC molecules: Types, Structure and function. MHC peptide interaction: cytoplasmic and endocytic pathway of antigen presentation. Grafting and types of grafts, Graft Rejection.		12
IV	Complement System and Hypersensitivity Activation of T cells, T cell dependent and independent B cell activation.		12

31

Era University
Department of Biotechnology
Course Outline
Academic Year: 2025-2026

Course Name: Genetics	Course Code: MBT0204T	Year: I	Semester: II
Core Course			
Credits: 4	Total No. of Lectures: 60 Lecture-Tutorial-Practical (In hours/week) L-T-P: 3-1-0		
Evaluation Spread	Internal Continuous	40	End Term Exam 60
Course Objective	The aim of the course is to provide students with an understanding of both classical and modern concepts in genetics with special emphasis on the areas of chromosome structure and function, Molecular Genetics, Gene Mapping Methods, and Population Genetics. The course will also provide in-depth knowledge of Evolutionary Genetics, and Human Genome Project.		
Course Outcome	CO1: Students will understand and explain the concept of genetics including genome organization and DNA packaging including Chromosome structure and function in both prokaryotes and eukaryotes. CO2: Students would understand the principles of Mendelian genetics, extensions and concepts of Human genetics. CO3: Understand Gene Mapping Methods. CO4: Students will be able to understand concepts related to Population Genetics. CO5: Students will be able to understand concepts of Quantitative Genetics, Multifactorial Traits and Evolutionary Genetics.		
Pedagogy	Interactive, Discussion Based Sessions, Presentations, Seminars		
Internal Evaluation Mode	Sessional Test: 20, Quiz: 5, Assignments: 5, Attendance: 5, Presentations: 5		
Unit	Topic	No. of Lectures Total = 60	
I	Genes, Chromosomes, and Heredity: Introduction to Genetics, Mendelian Genetics, Extension of Mendelian Genetics, Molecular Structure of chromosomes, Chromosomal Aberrations, Mutations, Polymorphisms, Recombination, Extranuclear Inheritance.	14	
II	Gene Mapping Methods: Linkage Maps, Two point cross, Three point cross, Coefficient of Coincidence and interference, Tetrad Analysis, Mapping with Molecular Markers, Mapping by using Somatic Cell Hybrids, Development of Mapping Population in Plants.	14	
III	Human Genetics: Human Genome Project, Genetic Disorders. Pedigree Analysis, LOD scores for linkage testing, Karyotypes	12	
IV	Population genetics: Theory of Allele Frequencies, Linkage equilibrium and linkage disequilibrium, Natural Selection, Random Genetic Drift, Genetic Equilibrium/Hardy-Weinberg equilibrium	10	
V	Genetics of Organisms: Quantitative Genetics and Multifactorial Traits, Heritability-narrow sense and broad sense heritability, Evolutionary Genetics.	10	

33

Sangeeta

Vij

S

M

S

Suggested Readings

1. Human Molecular Genetics by Tom Strachan and Andrew Read. Taylor & Francis Group, LLC.
2. Principles of Genetics by Snustad & Simmons. John Wiley & Sons, Inc.
3. Concepts of Genetics by K. W. S.
4. Genetics: A Conceptual Approach by Benjamin A. Pierce

UNIT	MAPPED CO
I	CO1, CO2
II	CO1, CO3
III	CO2
IV	CO4
V	CO5

MAPPED CO's WITH PO's & PSO's

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4
CO1	√	√	√			√		√	
CO2	√	√	√			√	√	√	
CO3	√	√	√			√	√	√	
CO4	√	√	√			√	√		
CO5	√	√	√			√	√	√	

Course Created by:
~~Dr. S. P. D. D. D.~~
~~Dr. S. P. D. D. D.~~
 Prof. M. K. S.

Approved by:

[Handwritten signatures and initials]
 Sangeeta
 Prof. M. K. S.
 [Signature]
 [Signature]
 [Signature]
 [Signature]
 [Signature]
 [Signature]

Era University
Department of Biotechnology
Course Outline
Academic Year: 2025-2026

Course Name: Biostatistics		Course Code: MBT0205E		Year: I	Semester: II
Elective Course					
Credits: 4	Total No. of Lectures: 60 Lecture-Tutorial-Practical (In hours/week) L-T-P: 3-1-0				
Evaluation Spread	Internal Continuous	40	End Term Exam	60	
Course Objective	<p>The study of Sampling Methods & Testing of Hypothesis is important as it provides evidence-based information for decision making and helps to identify issues and opportunities, develop options and recommendations, evaluate outcomes and understand the real-world phenomena.</p> <p>Students will also work with examples and apply the various sampling methods, estimation & Testing of Hypothesis to various problems in data analysis. It will cover topics such as various sampling techniques, estimation & testing of hypothesis.</p>				
Course Outcome	<p>On successful completion of this course the students will be able to</p> <p>CO1: Describe the various methods of sample selection.</p> <p>CO2: Apply the sample survey methodology in real life applications.</p> <p>CO3: Describe the techniques of statistical data analysis.</p> <p>CO4: Performing test based on Z, t, χ^2, F distributions.</p> <p>CO5: Apply various statistical tests in the real-life applications.</p>				
Pedagogy	Interactive, Discussion Based Sessions, Presentations, Seminars				
Internal Evaluation Mode	Sessional Test: 20 Quiz: 5 Assignments: 5 Attendance: 5 Presentations: 5				
Unit	Topic				No. of Lectures Total = 60
I	Introduction: Concepts of population, sample, parameter and statistic, sampling versus census, sampling units and frame, advantages of sampling methods, homogeneity of population, bias, precision and accuracy, sampling and non-sampling errors.				12
II	Probability sampling: Basic concepts of Simple random sampling (SRS) with and without replacement Stratified random sampling, Systematic sampling and Cluster sampling. Non probability sampling: Introduction to Convenience Sampling, Consecutive Sampling, Quota Sampling, Judgmental Sampling, Snowball Sampling.				12
III	Estimation: Definitions of Point and Interval estimations, Estimator and Estimate. Characteristics of a good estimator: Unbiasedness, Consistency, Sufficiency and Efficiency (Only concept).				12
IV	Statistical Hypothesis: Hypothesis, null and alternative hypothesis, Simple				12

	and composite hypothesis, Critical Regions, One tailed & Two tailed test, P value, Type I & Type II errors, Level of Significance, Degrees of freedom, Confidence level & Confidence interval.	
V	Significance test: large sample and small sample tests, Z- test for mean, variance, and proportion. Small sample tests based on t-distribution, Chi – square distribution and F test for variance Analysis of variance: One-way and two-way classifications.	12

Suggested Readings

1. Fundamental of Biostatistics, By Irfan A. Khan.
2. Sampling techniques: W.G. Cochran, Wiley
3. Sampling methodologies and applications: P.S.R.S. Rao, Chapman and Hall/CRC 2000
4. Hogg, R.V. and Craig, A.T. (1978) Introduction to Mathematical Statistics, Fourth Edition Collier Macmillian Publishers.
5. Mood, A.M., Graybill, F. a., and Bies, D.C. (1974), Introduction to the Theory of Statistics. Third Edition, McGraw Hill.
6. Lehmann, F.L. (1986), Testing of Statistical Hypothesis (Student edition).

UNIT	MAPPED CO
I	CO1, CO2
II	CO2, CO3
III	CO4
IV	CO4, CO5
V	CO5

MAPPED CO's WITH PO's & PSO's

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4
CO1	√	√	√			√	√		√
CO2	√	√	√			√	√		√
CO3	√	√	√			√	√		√
CO4	√	√	√			√	√		√
CO5	√	√	√			√	√		√

Dr. Abdul Quddoos

Course Created by:

Approved by:

Sal
Sangeeta
[Signature]
[Signature]
[Signature]
[Signature]
[Signature]
[Signature]
[Signature]

Era University
Department of Biotechnology
Course Outline
Academic Year: 2025-2026

Course Name: Plant & Animal Physiology		Course Code: MBT0206E		Year: I	Semester: II
Elective Course					
Credits: 4	Total No. of Lectures: 60	Lecture-Tutorial-Practical (In hours/week) L-T-P: 3-1-0			
Evaluation Spread	Internal Continuous	40	End Term Exam		60
Course Objective	To develop the concept of classification of animal and plant with their cellular organization. To give the brief knowledge of animal and plant kingdom as well as physiology.				
Course Outcome	CO1: To develop the concept of classification and structural organization of plant at cellular level. CO2: To provide the detail knowledge about plant kingdom. CO3: To provide the detail knowledge about animal kingdom. CO4: To provide brief knowledge about plant physiology in phytohormones, photosynthesis and photomorphogenesis.				
Pedagogy	Interactive, Discussion Based Sessions, Presentations, Seminars				
Internal Evaluation Mode	Sessional Test: 20 Quiz: 5 Assignments: 5 Attendance: 5 Presentations: 5				
Unit	Topic				No. of Lectures Total = 60
I	Plant-water relations: Importance of water to plant life, physical properties of water, diffusion and osmosis, Ascent of sap, Absorption of water and minerals, Translocation of photoassimilates, Transpiration, Physiology of stomata. Mineral nutrition: essential macro and micro-elements and their role, mineral uptake, deficiency and toxicity symptoms.				12
II	Growth, development and physiology in plants. Definitions, phases of growth and development, seed dormancy, seed germination and factors of their regulation, plant movements, the concept of photoperiodism, physiology of flowering, florigen concept, physiology of senescence, Photosynthesis: Light harvesting complexes, CO ₂ fixation- C ₃ , C ₄ and CAM pathways; Plant growth hormones, their physiological effects and mode of action, Photomorphogenesis- Structure, function and mechanisms of action of phytochromes, cryptochromes and phototropins.				12
III	General and cellular basis of animal physiology. Digestion and absorption of food-in stomach and small intestine; circulation of body fluid, blood vessels, blood flow and blood cells, ABO blood groups and Rh factor, mechanism of blood clotting.				12
IV	Respiration, Excretion and Nerve Physiology – mechanism of respiration; vital capacity of lungs; transport of gases; dissociation curve of oxyhaemoglobin and control of respiration. Excretion – Formation of ammonia, urea and uric acid; structure and functions of nephron; control of renal functions – role of kidney in the regulation of water and salt. Muscle and movement – ultrastructure and physiology of muscle contraction. Nerve physiology – ultrastructure of a neuron.				12

	synapse, and propagation of nerve impulse.	
V	Endocrinology and Reproductive physiology- Pituitary, adrenal, thyroid and parathyroid glands- structure and hormonal action. Neuro-endocrine regulation, secondary messenger concept. Reproductive physiology- reproductive mechanisms, functional morphology of reproductive organs, gametogenesis, reproductive cycle, hormonal control.	12

Suggested Readings

1. Guyton, A.C. and Hall, J.E. A Text Book of Medical Physiology (10th Edition). W.B. Saunders Company.
2. Ganong, H. Review of Medical physiology. McGraw Hill.
3. Fluer, S. Physiology (a regular system approach). McMillan Pub. Co.
4. Shier, Jakie, Butler and Lewis. Human Anatomy and Physiology. WCB, USA.
5. Berry, A.K. Animal physiology.

UNIT	MAPPED CO
I	CO1, CO2, CO4
II	CO1, CO2, CO4
III	CO3
IV	CO3
V	CO3

MAPPED CO's WITH PO's & PSO's

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4
CO1	√				√		√		
CO2	√				√		√		
CO3	√	√			√		√		
CO4	√				√		√		

DR. SATIABJADA

Course Created by:

Sahbya

Approved by:

Sangeeta

get

Beh

[Signature]

[Signature]

[Signature]

[Signature]

[Signature]

[Signature]

[Signature]

Era University
Department of Biotechnology
Course outline
Academic Year: 2023-2024

Course Name: Nanobiotechnology

Course Code: MBT0207E

Year: I

Semester: II

Unit	Topics	No. of Lectures Total = 60
Unit I	Basic of Nano-biotechnology Introduction to Nanotechnology and Nano-biotechnology, Scope of Nanotechnology and Nano-biotechnology, Properties of Nanomaterials, Classification of Nanomaterials, Biophysical characterization of Nanomaterials, Bio-mineralized Inorganic Nanomaterials.	12
Unit II	Instrumentation in Nano-biotechnology Optical (UV-Vis/Fluorescence), X-ray diffraction, Imaging and size (Electron microscopy, light scattering, Zeta potential), Surface and composition (EDSA, EDAX, AFM/STM etc), Vibrational (FT-IR and RAMAN), SERS.	12
Unit III	Nanomaterials and Diagnostics/Drug Delivery and Therapeutics Nanoparticles in Diagnostics, Nanoparticles for Drug Delivery Surface Modified Nanoparticles, Peptide/DNA Coupled Nanoparticles, Lipid Nanoparticles in Drug Delivery and Diagnostics, Inorganic Nanoparticles for Drug Delivery and Diagnostics, Metal/Metal Oxide Nanoparticles.	12
Unit IV	Basics of Nanotechnology in Tissue Engineering Stem Cell and Tissue Engineering, Biomaterials for Stem Cell and Tissue Engineering (Synthetic and Natural), Biodegradable materials: synthesis and characterization, Biocompatibility (Factors determining it), Application of Tissue Engineering, Application in stem cell tissue engineering (Cardiac cells engineering, Neural cell engineering), Nanotechnology-based approaches in the treatment of injuries.	12
Unit V	Nanoparticles and Toxicity Evaluation Nanotoxicology Fundamentals, Methods for Nanotoxicology Evaluation, <i>In vitro</i> methods: (Cytotoxic Assays (MTT, LDH, Alamar Blue), Genotoxicity Assays (Const. Assay, Micronuclease assay), Immunotoxicity Assay/Cytokines Assays/Flow Cytometry). <i>In vivo</i> methods: (Acute Toxicity Studies), (Sub-chronic Toxicity Studies), (Chronic Toxicity Studies).	12

Suggested Readings

1. Challa S.S.R. Kumar (Ed) Biological and pharmaceutical nanomaterials: Wiley - VCH Verlag GmbH & Co, KgaA.
2. Ninmeyer C.M, Mirkin C.A (Eds) 2005. Nanobiotechnology
3. H.S. Nalwa (Ed) Handbook of Nanostructured Biomaterials and their applications in nanobiotechnology, American Scientific Publishers.2005

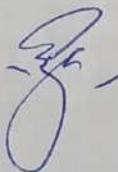
UNIT	MAPPED CO
I	CO1
II	CO2
III	CO3
IV	CO4
V	CO5

MAPPED CO's WITH PO's & PSO's

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4
CO1	√				√		√		
CO2	√				√		√		
CO3	√	√						√	
CO4		√	√				√	√	
CO5		√	√				√	√	

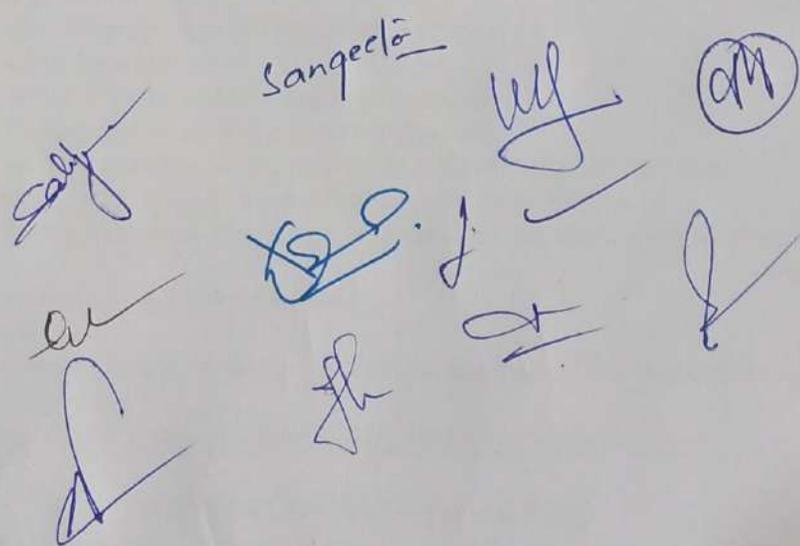
DR SHADAB RAZA

Course Created by:



Approved by:

Sangeeta



Era University
Department of Biotechnology
Course Outline
Academic Year: 2025-2026

Course Name: Laboratory Course II (Enzymology + Immunology + Genetics)	Course Code: MBT0208P	Year: I	Semester: II
Core Course			
Credits: 3	Total No. of Lectures: NIL Lecture-Tutorial-Practical (In hours/week) L-T-P: 0-0-6		
Evaluation Spread	Internal Continuous	40	End Term Exam 60
Course Objective	The objective of this laboratory course is to introduce students to experiments in Enzymology, Genetic and Immunology. The course is designed to teach students the utility of set of experimental methods in biotechnology in a problem-oriented manner.		
Course Outcome	CO1: Student should be able to understand fundamental aspects of basic tools and techniques in enzymology, genetics and immunology. CO2: Ability to apply these practical knowledge and experience in biotech industries. CO3: Ability to fundamental and applied research in the field of biology.		
Pedagogy	Interactive, Discussion Based Sessions, Practical's		
Internal Evaluation Mode	Sessional Test: 20 Viva: 10 Attendance: 5 Lab Record: 5		

Topic

ENZYMOLOGY:

(30HRS)

1. Isolation of enzyme and determination of enzyme activity.
2. Study of the effect of pH on the enzyme activity.
3. Study of the effect of varying substrate concentration on the enzyme activity and determination of Km.
4. Study of the effect of temperature on the enzyme activity.
5. Study of the effect of inhibitors on the enzyme activity.
6. Enzyme immobilization.

IMMUNOLOGY:

(30HRS)

7. Identification of blood group by simple agglutination method.
8. To collect the serum from blood.
9. To enumerate the total number of RBCs in the blood sample.
10. To enumerate the total number of WBCs in the blood sample.
11. Estimation of specific antibodies present in serum by rapid slide test (WIDAL test).
12. To learn the techniques of Radial immune-diffusion-precipitation reaction.
13. To determine the presence of specific antigen by sandwich ELISA method (Dot ELISA).

GENETICS:

(30HRS)

14. Demonstration of Sex chromatin in buccal smear.
15. Karyotype preparation.
16. Genetics problems based on: (i) Mendel's law (ii) Gene mapping and (iii) Transposable elements
17. Ames test for mutagenesis
18. Preparation of polytene chromosomes from salivary gland of Chironomous larvae

MAPPED CO's WITH PO's & PSO's

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4
CO1	√	√	√			√	√	√	
CO2	√	√	√			√	√	√	
CO3	√	√	√			√	√	√	

Course Created by:

Dr. AMIT MANGI
 Dr. SACHIN KISHOR
 Dr. MUSKANTH KARAN
 Sangeeta

Approved by:

(Handwritten signatures and initials)