Program and Course Structure

School of Engineering Technology

M Sc Genetic Engineering

Program code: SET0206

Batch: 2020-22

1.1 Vision, Mission and Core Values of the University

Vision of the University

To serve the society by being a global University of higher learning in pursuit of academic excellence, innovation and nurturing entrepreneurship.

Mission of the University

1. Transformative educational experience
2. Enrichment by educational initiatives that encourage global outlook
3. Develop research, support disruptive innovations and accelerate entrepreneurship
4. Seeking beyond boundaries

Core Values

- Integrity
- Leadership
- Diversity
- Community

Vision of the School

To become a globally acclaimed institution of higher learning in engineering and technology promoting excellence in research, innovation and entrepreneurship to provide sustainable solution to the needs of the society

Mission of the School

1. To impart quality education with strong industry & academic connectivity in the expanding fields of Engineering and Technology in a conducive and enriching learning environment.
2. To produce technocrats equipped with technical & soft skills and experiential learning required to stay current with the modern tools in emerging technologies to fulfill professional responsibilities and uphold ethical values.
3. To inculcate a culture of interdisciplinary research, innovation and entrepreneurship to provide sustainable solutions to meet the growing challenges and societal needs.
4. To foster collaborative learning and to play adaptive leadership role in professional career and pursuit of higher education through effective mentoring and counseling.

Core Values

- Integrity
- Leadership
- Diversity
- Community

1.2.1Vision and Mission of the Department

Vision of the Department

To serve the society by being a global centre of higher learning in pursuit of academic excellence, innovation and nurturing entrepreneurship to cater to the needs of biotechnology in health, agriculture and environment sectors.

Mission of the Department

M1: To conduct cutting-edge multidisciplinary original research in plant, animal, medical, industrial and environmental biotechnology.

M2: To train and transform students into thinking bioengineers, and scientists who are able to integrate theoretical knowledge with practical applications in diverse areas of Biotechnology

M3: To adapt and update with rapidly changing technologies through self-improvement with continuous learning and education, without compromising with moral and professional ethics.

M4: To provide opportunities for collaborative-learning beyond classrooms, in the broader community- across the diverse spectrum of disciplines**.**

Core Values

- Integrity
- Leadership
- Diversity
- Community

1.3 Program Educational Objectives (PEO)

PEO1: Graduates will be able to integrate the physical, biological and mathematical sciences with engineering principles for the study of biological systems and medical health related problems.

PEO2: Graduates will demonstrate the applications of biotechnology and Genetic Engineering principles through development of processes related to crop improvement and health care.

PEO3: Graduates will adapt to and update with rapidly changing biotechnologies through self-improvement with continuous learning about the impact of technology and engineering solutions on the society and environment.

PEO4: Graduates will develop research oriented approach towards various biological areas and develop solutions to various problems related to environment and society.

PEO5: Graduates will develop leadership skills at levels appropriate to their experience and perform ethically and professionally in business, academia, industry and society.

1.3.3 Program Outcomes (PO's)

PO1: **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO2: **Knowledge and Skill Set**: Students will become proficient in understanding various biological systems and processes. The student will be skilled in latest interdisciplinary biological techniques that will beneficial for their future research/ employment.

PO3: **Research:** Students will be able to independently think and identify a research problem, design experimental protocols to address that problem and analyse the results or solutions emanating out of his/ her work.

PO4: **Biotechnology, Environment and Society:** Students will be able to develop and use genetically engineered organisms for betterment of environment and society after thorough evaluation of their side-effects/ negative impacts.

PO5: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PSO1: To create postgraduates with successful career as professional or a researcher through lifelong learning in the field of biotechnology.

PSO2: Hands-on training and mandatory research projects will help our students by providing knowledge and technical experience of problem-solving in a research environment.

PSO3: An ability to apply fundamental knowledge related to pure sciences in an interdisciplinary manner for providing innovative solutions to need based problems for global impact.

1.3.5 The components of the curriculum

Course Component	Curriculum Content (% of total number of credits of the program)	Total number of contact hours	Total number of credits
Basic Sciences	2.38%	2	2
Engineering Sciences	26.19%	25	22
Humanities and Social sciences	2.38%	4	2
Program Core	57.14%	51	48
Project	11.9%	20	10

School of Engineering and Technology
M Sc Genetic Engineering
Batch: 2020-2022
TERM: I

S. No.	Course Code	Course	Teaching Load			Credits	Type of course 1. CC 2. AECC 3. SEC 4. DSE
			L	T	P		
THEORY CLASSES							
1.	MGE101	Advanced Cell Biology	4	0	0	4	CC
2.	MGE102	Structure and Function of Biomolecules	4	0	0	4	AECC
3.	MGE103	Molecular Biology	4	0	0	4	AECC
4.	MGE104	Molecular Cloning	4	0	0	4	AECC
5.	MST111	Biostatistics	2	0	0	2	SEC
PRACTICALS							
6	MGP101	Advanced Cell Biology lab	0	0	3	2	SEC
7	MGP102	Macromolecule's lab	0	0	3	2	SEC
8	MGP103	Molecular Biology Lab	0	0	3	2	SEC
9		Community connects	0	0	4	2	SEC
TOTAL CREDITS						**26**	

School of Engineering and Technology
M Sc Genetic Engineering
Batch: 2020-2022
TERM: II

S. No.	Course Code	Course	Teaching Load			Credits	Type of Course
			L	T	P		
THEORY SUBJECTS							
1.	MGE105	Advances in Immunology	4	0	0	4	AECC
2.	MGE106	Metabolic Pathways	4	0	0	4	AECC
3.	MGE107	Techniques in Biology	4	0	0	4	SEC
4.	MGE108	Bioinformatics	4	0	0	4	SEC
5.	MGE109	Transgenic Organisms	4	0	0	4	AECC
PRACTICAL							
6	MGP104	Techniques in Biology Lab	0	0	3	2	CC
7	MGP105	Bioinformatics lab	0	0	3	2	SEC
TOTAL CREDITS						**24**	

School of Engineering and Technology
M Sc Genetic Engineering
Batch: 2020-2022
TERM: III

S. No.	Course Code	Course	Teaching Load			Credits	Type of Course
			L	T	P		
THEORY SUBJECTS							
1.	MGE201	Industrial Microbiology	4	0	0	4	AECC
2.	MGE202	Genomics and Proteomics	4	0	0	4	AECC
3.	MGE203	Cancer and Stem Cell Biology	4	0	0	4	CC
4.	MGE204	Clinical Biotechnology	4	0	0	4	CC
5.	MGE205	Enzyme Technology	4	0	0	4	CC
PRACTICAL							
6.	MGP201	Industrial Microbiology lab	0	0	3	2	SEC
7.	MGP202	Genomics and Proteomics lab	0	0	3	2	SEC
TOTAL CREDITS						**24**	

School of Engineering and Technology
M Sc Genetic Engineering
Batch: 2020-2022
TERM: IV

S. No.	Course Code	Course	Teaching Load			Credits	Type of Course
			L	T	P		
THEORY SUBJECTS							
1.	MGP203	NPTEL/MOOC	0	0	0		CC
PRACTICAL							
2.	MGP204	Project	0	0	20	10	CC
TOTAL CREDITS						**10**	

Syllabus

MGE101 Advanced Cell Biology

School: SET		**Batch : 2020-22**
Program: MSc		**Current Academic Year: 2020-21**
Branch: Genetic Engineering		**Semester:1**
1	Course Code	MGE101
2	Course Title	**Advance Cell Biology**
3	Credits	4
4	Contact Hours (L-T-P)	4-0-0
	Course Status	Core
5	Course Objective	(1) Many of the advancements in modern science are the result of a better understanding of cellular components and their functions. (2) At the end of the course, the students can gain in-depth knowledge of cell biology, which provides information about the composition, structure and function of organelles and other cellular components and their biological activities.
6	Course Outcomes	After successfully completion of this course students will be able to: CO1: Understanding the structure, function of plasma membrane, cytoplasm and its composition. CO2:Illustrate the structure and function of various intracellular organelles CO3: Understanding the concept of cytoskeleton and its regulatory function. CO4: Describe the structure of chromatin and chromosomes CO5:Explain the general principles of cell communication, cell adhesion and roles of different adhesion molecules CO6: Gained the in-depth knowledge of cell biology, various cellular organelles, their structure and function
7	Course Description	The focus of cell biology is the study of the structure and function of the cell. In this course, we will cover topics such as plasma membrane structure and composition, transport, cell organelles, cytoskeleton and cell movement, structure of chromatin, chromosome, and general principle of cell communication, cell adhesion and roles of different adhesion molecules.
8	Outline syllabus	
	Unit 1	Cellular organization
	A	Plasma Membrane and its Functions in Transport
	B	Exocytosis and Endocytosis
	C	Cytoplasm and its Composition, electrical properties of membranes

	Unit 2	Intracellular organelles		
	A	Structure and function of Cell wall, nucleus, mitochondria		
	B	Structure and function of Golgi bodies, lysosomes, endoplasmic reticulum,		
	C	Structure and function of peroxisomes, plastids, vacuoles, chloroplast		
	Unit 3	Cytoskeleton and Cell Dynamics		
	A	Structures and assembly of Cytoskeleton and its Regulation		
	B	Molecular Motors, microfilaments and microtubules		
	C	Role of cytoskeleton in motility		
	Unit 4	Organization of Gene and chromosome		
	A	Structure of chromatin and chromosomes, Heterochromatin, Euchromatin, transposons		
	B	Gene concept, Structural and numerical alterations of chromosomes.		
	C	Cell cycle; mitosis and meiosis and their regulation		
	Unit 5	Cellular communication		
	A	General principles of cell communication, cell adhesion and roles of different adhesion molecules		
	B	Gap junctions, extracellular matrix, integrins		
	C	Neurotransmission and its regulation		
	Mode of examination	Theory		
	Weightage Distribution	CA	MTE	ETE
		30%	20%	50%
	Text book/s*	1.Devasena.T, Cell Biology. Oxford University Press India; First edition (2012). 2.Rastogi . S.C, Cell Biology. newagepublishers (2008).		
	Other References	3.David L Nelson & Michael M Cox, Lehninger -Principles of biochemistry.W.H. Freeman company New York 4th edition 2007. 4.Garrett Grisham, Biochemistry. International student's edition. 3'rd edition 5.Karp G, Cell and Molecular Biology: Concepts and Experiments. John Wiley & Sons. Inc. 6th Edition.2010 6.De Robertis E.D.P & De Robertis E.M.F. Cell and Molecular Biology.2006. 7.Cooper, G.M. and Hausman, R.E. The Cell: A Molecular Approach. Sinauer Associates, Inc.; 6 edition, 2013.		

MGE102: Structure and Function of Biomolecules

School: SET		**Batch : 2020-22**
Program: MSc		**Current Academic Year: 2020-21**
Branch: Genetic Engineering		**Semester:1**
1	Course Code	MGE102
2	Course Title	**Structure and Function of Biomolecules**
3	Credits	4
4	Contact Hours (L-T-P)	4-0-0
	Course Status	Core
5	Course Objective	(1)This paper trains students to appreciate the salient features of biomolecules in the organization of life. (2)It helps the students in understanding the classification, functions and application aspects of biomolecules.
6	Course Outcomes	After successfully completion of this course students will be able to: CO1: Understand the principles of biochemistry CO2:Explain the structure, classifications and function of carbohydrates. CO3: Explore the structure, types and functions of lipids. CO4: Understand structure, classifications and function of proteins. CO5:Understand structure, classifications and function of nucleotides and nucleic acids CO6:Gained the in-depth knowledge about structure and function of various biomolecules
7	Course Description	The focus of this subject is to understand the structure and function of various biomolecules namely carbohydrates, lipids, proteins and nucleic acids.
8	Outline syllabus	
	Unit 1	**Principles of biochemistry**
	A	Structure of atoms, molecules and chemical bonds, Van der Waals, electrostatic interaction
	B	Hydrogen bonding, Hydrophobic interaction, pH, buffer
	C	Reaction kinetics, thermodynamics, colligative properties
	Unit 2	**Carbohydrates**
	A	Classification of carbohydrates, Composition, structure and function of Monosaccharides, oligosaccharides and polysaccharides
	B	Structure and functions of polysaccharides such as starch, cellulose, glycogen and chitin, Glycation and glycosylation of proteins,
	C	Physical and chemical properties of carbohydrates, Gycosoaminoglycans and proteoglycans.

	Unit 3	**Lipids**		
	A	Classification, structure and function of lipids, fatty acids and triglycerides, phospholipids and their types, Sterols and steroid hormones		
	B	Sphingolipids, eicosanoids, vitamins. Action of pain killers, Chemical nature of blood groups		
	C	Disease related to lipid metabolism. Purification and characterization of lipids.		
	Unit 4	**Amino acids and proteins**		
	A	Structure and classification of amino acids, chemical and physical properties of amino acids		
	B	Levels of protein structure-primary, secondary (Ramachandran plot, secondary structure, domains, motif and folds), tertiary and quaternary		
	C	Chemical synthesis of peptides. Methods of sequencing of peptide and proteins. Structure of hemoglobin, myoglobin, collagen and keratin.		
	Unit 5	**Nucleotides and Nucleic acids**		
	A	Structure of Purines and Pyrimidines, nucleosides and nucleotides. Structure and function of DNA and its different forms, RNA and their types		
	B	Denaturation and renaturation of DNA, DNA methylation and its role.		
	C	Nucleotides as energy molecules, enzyme cofactors and regulatory molecules.		
	Mode of examination			
	Weightage Distribution	CA	MTE	ETE
		30%	20%	50%
	Text book/s*	1. Albert L. Lehninger Principles of Biochemistry CBS Publishers & Distributors, New Delhi, 4th edition 2004.		
	Other References	2. J.L.Jain et al. Fundamentals of Biochemistry by S.Chand and Company 4th edition, 1994. 3. M.N.Chatterjea and Ranashinde Text book of Medical biochemistry Jaypee Brothers Medical Publisher (P) Ltd, 6th edition 2005 4. Lippincott's illustrated biochemistry – Champe and Harvey; 6th edition 2007. 5. D.Voet and J.G. Voet, Biochemistry, John Wiley & Sons, USA 2004.		

MGE103 Molecular Biology

School: SET		**Batch : 2020-2022**
Program: MSc		**Current Academic Year: 2020-21**
Branch: Genetic Engineering		**Semester: 1**
1	Course Code	MGE103
2	Course Title	**MOLECULAR BIOLOGY**
3	Credits	4
4	Contact Hours (L-T-P)	4-0-0
	Course Status	**Compulsory**
5	Course Objective	1. To acquire a fundamental knowledge of central dogma of life relating processes of replication, transcription and translation. 2. To understand the different theories of recombination. 3. To learn about the fundamental concept of regulatory RNA.
6	Course Outcomes	CO1: Differentiate between prokaryotic and eukaryotic replication, compare prokaryotic and eukaryotic transcription and examine the functions of different types of RNA polymerases. CO2: Demonstrate the regulation of transcription and identify post-transcriptional modifications. CO3: Experimentally demonstrate the process of translation in prokaryotes and eukaryotes and presence of post translational modification CO4: Recognize the process of recombination and formation of Holliday junction. CO5: Investigate the role of viral oncogenes, cellular oncogenes and tumour suppressor genes and proteins in cancer. CO6: Discuss the various aspects of central dogma and DNA repair mechanisms.
7	Course Description	Molecular biology is a course to acquire a fundamental knowledge of central dogma of life relating processes of replication, transcription and translation. To understand the different theories of recombination. To learn about the fundamental concept of regulatory RNA.
8	Outline syllabus	
	Unit 1	**DNA replication, repair and recombination**
	A	Unit of replication, enzymes involved, replication origin and replication fork, fidelity of replication
	B	Extrachromosomal replicons, DNA damage and repair mechanism
	C	homologous and site-specific recombination

	Unit 2	**RNA synthesis and processing**		
	A	Transcription factors and machinery, formation of initiation complex, transcription activator and repressor, RNA polymerases, capping, elongation, and termination		
	B	RNA processing, RNA editing, splicing, and polyadenylation.		
	C	Structure and function of different types of RNA, RNA transport		
	Unit 3	**Protein synthesis and processing**		
	A	Ribosome, formation of initiation complex, initiation factors and their regulation, elongation and elongation factors, termination, genetic code, aminoacylation of tRNA		
	B	tRNA-identity, aminoacyl tRNA synthetase, and translational proof-reading		
	C	translational inhibitors, Post- translational modification of proteins		
	Unit 4	**Control of gene expression**		
	A	Regulating the expression of phages, viruses, prokaryotic and eukaryotic genes, role of chromatin in gene expression and gene silencing.		
	B	Operons and their regulation		
	C	Histone modifications and their effects on gene expression, acetylation and methylation.		
	Unit 5	**REGULATORY RNAs**		
	A	Riboswitches, RNAs as defense agents		
	B	CRISPR system in bacteria, CRISPR-Cas9 for genome editing, CRISPRi and CRISPRa for gene regulation.		
	C	Synthesis and function of miRNA molecules, silencing of gene expression by small RNAs, RNAi, long noncoding RNAs and X-inactivation		
	Mode of examination	Theory		
	Weightage Distribution	CA	MTE	ETE
		30%	20%	50%
	Text book/s*	1. Molecular Biology Lab Fax. T.A. Brown (Ed.), bios Scientific Publishers Ltds., Oxford, 1991		
	Other References	1. Molecular biology of the Gene (4th Edition),J .D. Watson, N. H. Hopkins, J. W. Roberts,J.A. Steitz and A.M. 2. Molecular Cell biology (2nd Edition) J. Darnell, H. Lodish and D. Baltimore, Scientific American Books, USA, 1994. 3. Molecular Biology of the Cell (2nd Edition) B. Alberts, D.Bray, J.Lewis, M.Raff, K. Roberts, and J.D. Watson, Garland publishing. Inc., New York, 1994.		

MGE 104 Molecular Cloning

School: SET		**Batch : 2020-2022**
Program: MSc		**Current Academic Year: 2020-21**
Branch: Genetic Engineering		**Semester: 01**
1	Course Code	MGE104
2	Course Title	**Molecular Cloning**
3	Credits	4
4	Contact Hours (L-T-P)	4-0-0
	Course Status	Compulsory
5	Course Objective	1. To understand the basic principles of cloning. 2. To learn about applications of PCR 3. To analyse different strategies of gene cloning 4. To elaborate different concepts of protein expression
6	Course Outcomes	CO1: Test the ability of restriction endonucleases and other modification enzymes used in genetic engineering CO2: Correlate between different vectors used in plants, bacteria and animal cells. CO3: Perform gene amplification using polymerase chain reaction. CO4: Use different types of cloning and expression vectors for genetic transformation. CO5:Construct genomic and cDNA libraries. CO6: Understanding of different methods of molecular cloning and protein expression.
7	Course Description	This course covers various enzymes used in Genetic manipulation, Cloning Vectors and expression vectors, PCR amplification, cDNA cloning and genomic libraries. It also gives conceptual idea about protein expression.
8	Outline syllabus	
	Unit 1	**Enzymes and vectors used in gene cloning**
	A	Restriction enzymes, DNA polymerases, reverse transcriptase, terminal transferase, alkaline phosphatase
	B	Polynucleotide kinase, ligase, DNases, RNases, and topoisomerase.
	C	Plasmid vectors, phage vectors, BAC vectors and plasmid incompatibility, and vectors for cloning in yeast, and mammalian cells

	Unit 2	**Strategies of Gene cloning**		
	A	Cohesive end cloning, blunt end cloning, checking the direction of cloning by PCR and restriction digestion,		
	B	Cloning using adapters. TA cloning, TOPO-TA cloning		
	C	Screening methods-complementation, insertional inactivation.		
	Unit 3	**Polymerase chain reaction**		
	A	PCR, factors affecting PCR, primer designing, Reverse transcriptase-PCR,		
	B	Real-time PCR, Nested PCR and TaqMan probe, site directed mutagenesis by PCR,		
	C	Screening by PCR, LAMP PCR.		
	Unit 4	**cDNA and Genomic library**		
	A	Construction of cDNA library, genomic DNA library		
	B	Vectors used in the construction of cDNA and genomic DNA libraries		
	C	Screening the libraries using heterologous probes, Reporter genes and assay.		
	Unit 5	**Expression of proteins**		
	A	Components of an expression plasmid vector, strategies for codon optimization, optimization of induction of protein expression, inclusion body formation		
	B	Factors affecting protein folding, solubilizing recombinant protein in inclusion bodies		
	C	Purification of recombinant proteins with and without purification ligands.		
	Mode of examination	**Theory**		
	Weightage Distribution	CA	MTE	ETE
		30%	20%	50%
	Text book/s*	Griffiths J. F. “Introduction to Genetic Analysis”, W. H. Freeman, 2010.		
	Other References	1. J. Sambrook. E. F. Fritsch and T. Maniatis, "Molecular Cloning: a Laboratory Manual" Cold Spring Harbor Laboratory Press, New York, 2000.		

MGE105 Advances in Immunology

School: SET		**Batch : 2020-22**
Program: MSc		**Current Academic Year: 2020-21**
Branch: Genetic Engineering		**Semester:1I**
1	Course Code	MGE105
2	Course Title	**Advances in Immunology**
3	Credits	4
4	Contact Hours (L-T-P)	4-0-0
	Course Status	Core
5	Course Objective	1. This course is designed to impart the students the importance of immunology and its theoretical aspects and on the principles of immunology and Immunotechnology. 2. It also explains the various antigen-antibody reactions involved in vaccine development.
6	Course Outcomes	After successfully completion of this course students will be able to: CO1: Get a deep foundation on host pathogen relationship for generation of immune response. CO2: Get a deep foundation of Immune response. CO3: Demonstrate functions of cells and organs of the immune system CO4: Elaborate how MHC recognizes self and non-self-molecules and helps in generation of immune response. CO5: Examine the genetic and molecular mechanisms associated with autoimmunity and graft rejection and review clinical interventions required in organ transplantation. CO6: Students will gain knowledge on how the immune system works and also on the immune system network and interactions during a disease or pathogen invasion.
7	Course Description	This course will cover the major topics in cellular immunology, including antigen recognition, antigen processing and presentation to B and T cells, the events leading to the generation of antibody and T cell receptor diversity, antibody effector functions, the role of CD4 and CD8 T cell subsets and NK cells in immune responses, self-tolerance and autoimmunity, the inflammatory response and the role of immunity in protection against pathogens and cancer.
8	Outline syllabus	
	Unit 1	**Microbes and parasites**
	A	Classification of pathogens-Bacteria, Fungi, Viruses, Protozoa, Helminths, Arthropods and Prions;
	B	Host-parasite relationship, modes of transmission, factors predisposing to microbial pathogenicity

	C	stages, pathological patterns, virulence and infectivity		
	Unit 2	**Humoral and cell mediated immunity**		
	A	Cell mediated cytotoxicity: Mechanism of T cell and NK Cell mediated lysis, Antibody dependent cell mediated cytotoxicity and macrophage mediated cytotoxicity.		
	B	Cytokines and their role in immune regulation,		
	C	Biology of Complement system, Complement fixation test and assessment of immune complexes in tissues. Immune suppression and immune tolerance.		
	Unit 3	**Cells of the immune system**		
	A	Macrophages, B and T lymphocytes, Dendritic cells, Natural killer cells, Eosinophils, neutrophils and Mast cells.		
	B	Organs of the immune system: Bone marrow, Spleen, lymph nodes, MALT.		
	C	Haematopoiesis and differentiation, lymphocyte trafficking.		
	Unit 4	**Antibody and Antigen**		
	A	Antibody- biology, structure and functions in different classes of immunoglobulin. Antigens, Biology of superantigens.		
	B	MHC structure and types, antigen recognition and presentation, activation of B and T lymphocytes.		
	C	Design of different kinds of vaccines.		
	Unit 5	**Hyper sensitivity reactions, Autoimmune disorders, Transplantation immunology**		
	A	Hypersensitivities and their types		
	B	Autoimmunity and autoimmune disorders		
	C	MLR, HLA Typing, Bone marrow transplantation, Organ transplants.		
	Mode of examination	Theory		
	Weightage Distribution	CA	MTE	ETE
		30%	20%	50%
	Text book/s*	Goldsby R A “Kuby Immunology”, Freeman, 2006.		
	Other References	Roitt, I. M. Essentials of Immunology”, Blackwell Scientific publishers, London 1998.		

MGE106 Metabolic Pathways

School: SET		**Batch : 2020-22**
Program: MSc		**Current Academic Year: 2020-21**
Branch: Genetic Engineering		**Semester: II**
1	Course Code	MGE106
2	Course Title	**Metabolic Pathways**
3	Credits	4
4	Contact Hours (L-T-P)	4-0-0
	Course Status	Core
5	Course Objective	1. Understand the overall organization of the biochemical metabolism. 2. Describe the structure and function of various biomolecules in maintaining balance in body.
6	Course Outcomes	After successfully completion of this course students will be able to: CO1: To understand the basic metabolic pathways of carbohydrates CO2: Elaborate different types of lipids and their metabolism CO3: Discuss the metabolism of amino acids, and demonstrate how they are responsible for protein building. CO4: Elaborate nucleotide metabolism and synthesis of energy compounds. CO5: Examine the various mechanisms responsible for the generation of ATP in plants and animals. CO6: Understanding of metabolic pathways (catabolism and anabolism), their diversity and how these are specifically regulated and interrelated in different cells
7	Course Description	The Biochemistry is designed to equip students with a broad understanding of the chemical and molecular events involved in biological processes. It helps students in understanding of structural and functional aspects of different biomolecules. The Biochemistry provides a foundation for careers in medicine, biotechnology, or research in all branches of the biological sciences.
8	Outline syllabus	
	Unit 1	**Metabolism of carbohydrates**
	A	Photosynthesis, Biosynthesis of starch, glycogen and glucose,
	B	Glycolysis, TCA cycle, Gluconeogenesis, Pentose Phosphate pathway,
	C	Glycogen metabolism-Glycogenesis, glycogenolysis
	Unit 2	**Lipid Metabolism**
	A	Lipid profile, degradation and biosynthesis and regulation of fatty acids
	B	Metabolism and regulation of membrane lipids, Ketone bodies.
	C	Metabolism, regulation and fate of cholesterol.

	Unit 3	**Amino acid and Protein metabolism**		
	A	Digestion and absorption, Biosynthesis and degradation of amino acid.		
	B	Metabolism and regulation of ammonia as well as urea cycle.		
	C	Metabolic network-Interrelationship of metabolisms Krebs cycle, amino acid synthesis.		
	Unit 4	**Metabolism of Nucleotides**		
	A	Biosynthesis, degradation and regulation of nucleotides and related molecules.		
	B	Energy compounds and its biosynthesis		
	C	ATP, NAD, NADP, FAD, Creatin phosphates		
	Unit 5	**Photophosphorylation and Oxidative phosphorylation**		
	A	Redox reactions, standard oxidation reduction potential, mitochondrial electron transport chain,		
	B	Oxidative phosphorylation, structure of ATP synthase, chemiosmotic hypothesis, coupled reaction, group transfer		
	C	biological energy transducers.		
	Mode of examination	Theory		
	Weightage Distribution	CA	MTE	ETE
		30%	20%	50%
	Text book/s*	David L Nelson, Michael M Cox, "Principles of Biochemistry" W. H. Freeman; Seventh edition Jan, 2017.		
	Other References	Biochemistry by Voet and Voet, Wiley New York, April 2012.		

MGE107 Techniques in Biology

School: SET		**Batch : 2020-22**
Program: MSc		**Current Academic Year: 2020-21**
Branch: Genetic Engineering		**Semester: II**
1	Course Code	MGE107
2	Course Title	**Techniques in Biology**
3	Credits	4
4	Contact Hours (L-T-P)	4-0-0
	Course Status	Core
5	Course Objective	1.To develop and understanding of the principle, instrumentation, operation and applications of different analytical, separation 2. Diagnostic techniques used in the fields of Biochemistry, Molecular Biology and Biotechnology.
6	Course Outcomes	After successfully completion of this course students will be able to: CO1: Apply microscopic techniques to identify differences between cells, cell organelles and intracellular localization of proteins. CO2: Apply chromatographic techniques for separating pigments, drugs, amino acids and hormones. CO3: Apply the spectroscopy techniques (Absorption and fluorescence, atomic and circular dichroism) to characterize physio-chemical properties of biological molecules. CO4: Elaborate various ways to study Ag-Ab interactions. CO5: Examine the various techniques to study various interactions of biomolecules at molecular level. CO6: To develop and understanding of applications of different analytical, separation techniques used in the field of Biotechnology.
7	Course Description	Allow students to familiarize themselves with the specific requirements of biomedical instrumentation and biotechnology tools and to enable them to use and apply these techniques and equipment's to solve experimental problems.
8	Outline syllabus	
	Unit 1	**Microscopic and Radiolabelling techniques**
	A	Visualization of cells and subcellular components by light microscopy, resolving power, microscopy of living cells,
	B	scanning and transmission microscopes, different fixation and staining techniques for EM,

	C	Detection and measurement of different types of radioisotopes normally used in biology, incorporation of radioisotopes in biological tissues and cells, molecular imaging of radioactive material		
	Unit 2	**Chromatographic techniques**		
	A	Classification of Chromatography, Column and Ion-exchange chromatography		
	B	Adsorption and Partition chromatography, Paper Chromatography, TLC, Liquid Chromatography, Gel permeation chromatography		
	C	HPLC and GC		
	Unit 3	**Biophysical Techniques**		
	A	Molecular analysis using UV/visible, fluorescence, circular dichroism		
	B	NMR and ESR spectroscopy		
	C	Surface plasma resonance methods.		
	Unit 4	**Histochemical and Immuno techniques**		
	A	Antibody generation, Detection of molecules using ELISA, RIA, immunoprecipitation		
	B	flowcytometry and immunofluorescence microscopy		
	C	detection of molecules in living cells, in situ localization by techniques such as FISH and GISH.		
	Unit 5	**Techniques in Molecular Biology**		
	A	Template challenge assay, Filter binding assay, Primer extension assay,		
	B	DNA Helicase Assay, Biochemical Fractionation and Biochemical Complementation, DNA finger Printing		
	C	SDS PAGE, 2D GE, western blot and Northern blotting		
	Mode of examination	Theory		
	Weightage Distribution	CA	MTE	ETE
		30%	20%	50%
	Text book/s*	Wilson K. and Walker J., "Principles and Techniques of Biochemistry and Molecular Biology", Cambridge University Press, 2010.		
	Other References	Ninfa A.J., Ballou D.P. and Benore M., "Fundamental Laboratory Approaches for Biochemistry and Biotechnology", Wiley, 2009.		

MGE 108 Bioinformatics

School: SET		**Batch : 2020-22**
Program: MSc		**Current Academic Year: 2020-21**
Branch: Genetic Engineering		**Semester: II**
1	Course Code	MGE108
2	Course Title	**Bioinformatics**
3	Credits	4
4	Contact Hours (L-T-P)	4-0-0
	Course Status	Core
5	Course Objective	1. 2.
6	Course Outcomes	After successfully completion of this course students will be able to: CO1:Understand the basics, branches, and various applications of Bioinformatics CO2:Explore the importance, concepts and applications of various biological databases CO3: Understand the concepts, types, and uses of sequence alignment and explore the various methods and advantages for phylogenetic analysis CO4: Acquire the knowledge about structure predictions and their importance. CO5: Understand the basics, types and various applications of computer aided drug designing and discovery process. CO6: Overall understanding the concept, branches, tools, and various applications for Bioinformatics
7	Course Description	This syllabus will cover the important areas in Bioinformatics namely sequence analysis, molecular phylogenetic analysis, structure predictions, computer aided drug designing and discovery process.
8	Outline syllabus	
	Unit 1	**Basics of Bioinformatics**
	A	Introduction to Bioinformatics, Scope of Bioinformatics, Importance of Bioinformatics.
	B	Different branches of Bioinformatics, Applications of Bioinformatics
	C	PERL/Bio-PERL, Python/Bio-Python. Importance of Computers in Bioinformatics.

	Unit 2	**Biological Databases**		
	A	Introduction to Databases and Biological Databases, Primary Databases, Secondary Databases and Composite Databases.		
	B	Nucleic acid sequence databases (GenBank, EMBL and DDBJ), Protein Sequence Databases (UniProt, PIR, TrEMBL, MIPS).		
	C	Secondary Protein Sequence Databases (Prosite, PFAM, BLOCKS), Structural Databases: PubChem, Drug Bank, ZINC, PDB, PDBSUM. Sequence/structure Submission		
	Unit 3	**Sequence alignment and Phylogenetic analysis**		
	A	Sequence Identity, Sequence similarity, Pairwise Sequence alignment, Methods in Pair-wise sequence alignment (DOTPLOT, Dynamic Programming, BLAST & FASTA), Multiple sequence alignment,		
	B	Methods in Multiple sequence alignment (Dynamic Programming, Progressive approach and Iterative Approach).		
	C	Concepts of Phylogenetic analysis, Distance and Character based methods.		
	Unit 4	**Structural Bioinformatics**		
	A	Protein structures, Experimental methods for protein structure determination (X-ray Crystallography, Nuclear Magnetic Resonance and Cryo electron microscopy),		
	B	In silico structure prediction methods: Homology modeling, Threading and Ab initio.		
	C	Importance and limitation of in silico structure prediction methods. Visualization Tools.		
	Unit 5	**Drug designing and discovery**		
	A	History, Concept of Molecular docking, Structure Based Virtual Screening, Ligand Based Virtual Screening, Pharmacophore modeling,		
	B	Quantitative Structure Activity Relationship (QSAR), Drug repurposing.		
	C	Molecular docking tools, Concept and applications of Molecular dynamics Simulations.		
	Mode of examination	Theory		
	Weightage Distribution	CA	MTE	ETE
		30%	20%	50%
	Text book/s*	Jin X., "Essential Bioinformatics", Cambridge University Press, 2006.		
	Other References	Baxevanis A., Ouellette F.B.F., "Bioinformatics: A practical guide to the analysis of genes and proteins", Wiley-Interscience, 2004.		

MGE109 Transgenic Organisms

School: SET		**Batch : 2020-22**
Program: MSc		**Current Academic Year: 2020-21**
Branch: Genetic Engineering		**Semester: II**
1	Course Code	MGE109
2	Course Title	**Transgenic Organisms**
3	Credits	4
4	Contact Hours (L-T-P)	4-0-0
	Course Status	Core
5	Course Objective	1. To learn *in vitro* regeneration, transformation, and gene editing of plants for the purpose of generating genetically modified plants for basic and applied research. 2. To learn *in vitro* techniques of animal cell and tissue culture for the purpose of generating genetically modified animals for basic and applied research. 3. To understand the mechanism of genetic engineering of microbes.
6	Course Outcomes	After successfully completion of this course students will be able to: CO1:Understand *in vitro* regeneration of plants from different explants CO2:Gain knowledge on the production of transgenic plants CO3: Elaborate to the various culture techniques employed in animal systems. CO4: Acquire the knowledge about application of genetically modified animals in the various fields of science. CO5: Illustrate use of microbes and techniques for manipulation and analysis of microbial cells for the production of economically important products. CO6: Acquaint the students to the versatile tools and techniques employed in genetic engineering and transgenic organisms.
7	Course Description	The student will achieve a sound knowledge on methodological repertoire which allows them to innovatively apply these techniques in in basic and applied fields of life science researches related to transgenic organisms.
8	Outline syllabus	
	Unit 1	**In Vitro Propagation of Plants**
	A	History of plant tissue culture, types of media and their preparation, plant hormones, direct and indirect organogenesis
	B	meristem, callus and suspension cell culture, micropropagation, somatic embryogenesis

	C	protoplast fusion, somaclonal variation, and artificial seeds		
	Unit 2	Transgenic Plants		
	A	Difference between transgenic plants and genetically edited plants. Transgenic crops for tolerance to abiotic stress, engineering crops for male sterility and modification of flower colour, flowering, fruit ripening and senescence.		
	B	Modern approaches for disease resistance. Cloning plant genes, Comparative genomics positional cloning-RNAi-mediated crop improvement.		
	C	Examples of transgenic Plants		
	Unit 3	**Animal Cell Culture**		
	A	Different types of cell culture media, growth supplements, serum free media, balanced salt solution, Conditions required for culturing animal cells,		
	B	Behaviour of cells in culture conditions, division, their growth pattern, Estimation of cell number, Culture of mammalian cells, tissues and organs, primary culture, secondary culture,		
	C	Continuous cell lines, suspension cultures and cryopreservation.		
	Unit 4	**Applications of Animal Cell culture**		
	A	Animal cell culture for in vitro testing of drugs, testing of toxicity of environmental pollutants in cell culture,		
	B	cell culture technology in production of human and animal viral vaccines and pharmaceutical proteins,		
	C	Cloning of different animals, Cloning for conservation of endangered species.		
	Unit 5	**Applications of Transgenic Microbes**		
	A	Significance of transgenic microbes, Overexpression and tagging of recombinant proteins in *E. coli*. Overexpression systems in *S. cerevisiae*, Baculovirus overexpression system		
	B	yeast one-hybrid assay, Yeast two hybrids system,		
	C	Production of antibiotics, drugs, vitamins and therapeutic peptides using microbes.		
	Mode of examination	Theory		
	Weightage Distribution	CA	MTE	ETE
		30%	20%	50%
	Text book/s*	S.B. Primrose, "Molecular Biotechnology" Blackwell Scientific Publishers, Oxford, 1994.		
	Other References	Sambrook. E. F. Fritsch and T. Maniatis, "Molecular Cloning: a Laboratory Manual" Cold Spring Harbor Laboratory Press, New York, 2000.		

MGE201 Industrial Microbiology

School: SET		**Batch : 2020-22**
Program: MSc		**Current Academic Year: 2020-21**
Branch: Genetic Engineering		**Semester: III**
1	Course Code	MGE201
2	Course Title	**Industrial Microbiology**
3	Credits	4
4	Contact Hours (L-T-P)	4-0-0
	Course Status	Core
5	Course Objective	1. To enable students bridge the gap between theoretical concepts and practical aspects in industrial microbiology. 2. To have In-depth knowledge and hands-on laboratory/industrial skills required for employment or for creation of employment in desired product processing.
6	Course Outcomes	After successfully completion of this course students will be able to: CO1: Illustrate design and functioning of bioreactors. CO2: Elaborate the Kinetics of fermentation process. CO3: Describes various steps and methods of recovery and purification of product. CO4: Discuss the methods and challenges for production of metabolites. CO5: Elucidate the various methods of production of enzymes, biofertilizers, SCP and recombinant proteins. CO6: Overall understanding of industrial application of Biotechnology.
7	Course Description	The challenge for biochemical engineers is to design compact and clean processes to make and efficiently separate instable products, such as recombinant proteins, from dilute complex fermentation broths to the required pharmaceutical degree of purity. Therefore, the quantitative systematic design of integrated downstream processes is the general theme of this course and will help students in quantitatively and systematically design an integrated industrial process.
8	Outline syllabus	
	Unit 1	**Bioreactor Design**
	A	Fermenter structure-Construction material, Basic components – Agitator, aerator, valves and steam traps, seals, stirrer glands.
	B	Measurement and control of parameters (on-line and off line sensors) – temperature, flow rate, pressure, pH, DO, gas analysis, computer control pathways.
	C	Types of Fermenters Air-lift, stirred tank, tower, fluidized bed, packed bed, pulsed, photo bioreactors, PFR.

	Unit 2	**Kinetics of fermentation**		
	A	Kinetics of Batch, fed-batch and continuous process;		
	B	Sterilization methods - batch sterilization, continuous sterilization of medium and air. Solid state and submerged; aerobic and anaerobic fermentation.		
	C	Development of inoculum for yeast, bacterial, mycelial and vegetative fungal processes. Transport phenomena - Mass transfer, heat transfer, oxygen transfer. Applications of fermentation technology		
	Unit 3	**Downstream Processing**		
	A	Biomass separation by centrifugation, filtration, flocculation and other recent developments		
	B	Cell disintegration: Physical, chemical and enzymatic methods. Extraction: Solvent, two phase, liquid extraction, whole broth, aqueous multiphase extraction.		
	C	Purification by different methods. Concentration by precipitation, ultra-filtration, reverse osmosis. Drying and crystallization		
	Unit 4	**Production of primary and secondary metabolites**		
	A	A brief outline of processes for the production of some commercially important primary metabolites		
	B	Production of citric acid, lactic acid, acetic acid, glutamic acid, aspartic acid		
	C	Production processes for various classes of secondary metabolites such as beta-lactams (penicillin, cephalosporin), aminoglycosides (streptomycin) macrolides (erythromycin)		
	Unit 5	**Production of enzymes and other bioproducts**		
	A	Production of industrial enzymes such as proteases, amylases, lipases		
	B	Production of biopesticides, biofertilizers, Single cell protein		
	C	Production of recombinant proteins with therapeutic and diagnostic applications		
	Mode of examination	Theory		
	Weightage Distribution	CA	MTE	ETE
		30%	20%	50%
	Text book/s*	Principles of Fermentation Technology by Stanbury, P.F., Whitekar A. and Hall. 2017		
	Other References	Bioreaction Engineering Principles by Nielsen, J. and Villadsen, plenum Press, N.Y.		

MGE202 Genomics and Proteomics

School: SET		**Batch : 2020-22**
Program: MSc		**Current Academic Year: 2021-22**
Branch: Genetic Engineering		**Semester: III**
1	Course Code	MGE202
2	Course Title	**Genomics and Proteomics**
3	Credits	4
4	Contact Hours (L-T-P)	4-0-0
	Course Status	Core
5	Course Objective	1. The aim of this course is to teach genomics, proteomics using model organisms representing plants and animals. The course will cover recent developments in genomics, gene expression and small RNAs. 2.The course imparts advanced knowledge on proteins through a detailed study of protein Structure, its characteristics property and significance in biological systems .
6	Course Outcomes	After successfully completion of this course students will be able to: CO1: Explain about various techniques and instrumentations used for nucleotide sequencing, genome sequencing and NGS CO2: Elaborate the concept of microarray, TILLING, and advances in genome analysis. CO3: Describes various steps and methods of protein purification and analysis. CO4: Discuss the methods and challenges for protein engineering. CO5: Elucidate the various applications of genomics and proteomics in human diseases, drug development and in food industry. CO6: Explain Genomics and Proteomics including fundamentals, current techniques and applications.
7	Course Description	The objectives of this course include understanding the various aspects the diversity and complexity of eukaryotic genomes, the historical and evolutionary perspective of genomic content, techniques commonly employed in studies of genomics and transcriptomics and applications derived from the knowledge provided by this science.
8	Outline syllabus	
	Unit 1	**Genome Sequencing**
	A	Overview of conventional and new sequencing technologies, Strategies used in whole genome sequencing, NGS technologies, RNAseq,
	B	Genome annotation, Candidate gene discover and data mining, Transcription factor, Genome mapping by genetic and physical technique.

	C	Evolution and phylogenetic relationships of genomes in prokaryotes and eukaryotes.		
	Unit 2	**Structural and Functional Genomics**		
	A	Advances in research related to human genome, Arabidopsis genome, rice genome, wheat genome, Comparative genomics and SNP analysis.		
	B	Microarray technology introduction, Types of DNA-microarrays-cDNAs and Oligonucleotides spotted chips.		
	C	TILLING as a functional genomics tool. In silico genomics and metabolomics.		
	Unit 3	**Scope of Proteomics**		
	A	Introduction and scope of proteomics; Protein separation techniques: ion-exchange, size- exclusion and affinity chromatography techniques, SDA-PAGE, Isoelectric focusing (IEF), 2D PAGE for proteome analysis; Image analysis of 2D gels		
	B	Protein chips and functional proteomics; Clinical and biomedical application of proteomics		
	C	Proteome database; Proteomics industry.		
	Unit 4	**Protein Engineering**		
	A	Protein engineering methods, Rational design and site directed mutagenesis, directed mutation, Receptor-based QSAR methods, Phage display, cell free translation		
	B	Protein scaffold, stability of enzymes, chemical modification of proteins, incorporation of unnatural amino acids into proteins,		
	C	Use of ribosomal frameshift-suppressor tRNAs and editing-defective aminoacyl-tRNA synthetases, in vitro evolution of proteins		
	Unit 5	**Applications of Genomics and Proteomics**		
	A	Genomics of human diseases, nutritional genomics, epigenomics and methods of epigenomics		
	B	Proteomics in bio-marker technology, Drug discovery,		
	C	Proteomics in biopolymer industry and food industry.		
	Mode of examination	Theory		
	Weightage Distribution	CA	MTE	ETE
		30%	20%	50%
	Text book/s*	Concepts and Techniques in Genomics and Proteomics, N Saraswathy, P Ramalingam, Woodhead Publishing 2011		
	Other References	1. Twyman, R.M. Principles of Proteomics. Bios Scientific Publisher, Oxford, 2004		

MGE203 Cancer and Stem Cell Biology

School: SET		**Batch : 2020-22**
Program: MSc		**Current Academic Year: 2021-22**
Branch: Genetic Engineering		**Semester: III**
1	Course Code	MGE203
2	Course Title	**Cancer and Stem Cell Biology**
3	Credits	4
4	Contact Hours (L-T-P)	4-0-0
	Course Status	Core
5	Course Objective	1. To learn the biology and genetics of cancer and the genetic basis of cancer therapy. 2.To learn the basics of stem cell biology and its application in healthcare
6	Course Outcomes	After successfully completion of this course students will be able to: CO1:Gain knowledge on biology and genetics of cancer CO2:Understand the signaling pathways and therapeutic resistance involved in cancer CO3:Discuss various mechanism of angiogenesis and metastasis CO4: Illustrate knowledge about stem cells and their characteristics, embryonic stem cells and stem cell niche . CO5:Elaborate about the applications of stem cells in tissue engineering and treatment of human diseases CO6:Overall understanding about the Cancer biology and Stem cell applications.
7	Course Description	This course provides understanding about the causes and mechanism of cancer and its spread and therapeutics. It also elaborates about the stem cells, their types and application in tissue engineering and diseases treatment.
8	Outline syllabus	
	Unit 1	**Introduction to Cancer**
	A	Definition of cancer, history of cancer research, DNA stability and its role in cancer development
	B	Growth factors and their role in cancer, Overview of the hallmarks of cancer.
	C	Physical and chemical carcinogens.
	Unit 2	**Gene Expression and Cancer**
	A	Proto-oncogenes, oncogenes and tumor suppressor genes, Mechanisms of oncogene activation, Role of growth factors and receptors in carcinogenesis,
	B	Signaling in cancer, role of Ras, p53, myc, Rb, mTor pathways,

	C	Telomeres, cellular immortalization, and Apoptosis		
	Unit 3	**Metastasis and Angiogenesis**		
	A	Metastasis; Migration & Invasion, Metastasis steps, Epithelial to Mesenchymal Transition		
	B	Angiogenesis; Hypoxia and VEGF, Stroma interaction; Impact of Tumor-Stroma Interaction on Tumor Development,		
	C	Angiogenesis- factors and process, Prevention and treatments for cancer		
	Unit 4	**Stem Cells and Their Types**		
	A	Properties of Stem cells, proliferation, medical applications of stem cells		
	B	Types of stem cells- embryonic stem cell, Adult stem cell,		
	C	Cancer Stem cells		
	Unit 5	**Therapeutic Applications of Stem Cells**		
	A	Cell replacement therapy, application of stem cells in Neurological diseases, Immunotherapy		
	B	drug screening and toxicology, tissue remodelling, cancer treatment and development of scaffolds.		
	C	Ethical and legal issues in use of stem cells.		
	Mode of examination	Theory		
	Weightage Distribution	CA	MTE	ETE
		30%	20%	50%
	Text book/s*	Bunz F. "Principles of Cancer Genetics", Springer Science, Second Edition (2016).		
	Other References	Sell S. "Stem Cells Handbook", Humana Press, Second Edition (2004).		

MGE204 Clinical Biotechnology

School: SET		**Batch : 2020-22**
Program: MSc		**Current Academic Year: 2021-22**
Branch: Genetic Engineering		**Semester: III**
1	Course Code	MGE204
2	Course Title	**Clinical Biotechnology**
3	Credits	4
4	Contact Hours (L-T-P)	4-0-0
	Course Status	Core
5	Course Objective	1. To acquire knowledge about the molecular pathology and pathogenesis. 2. To acquire knowledge about the diagnostic methods of infectious disease.
6	Course Outcomes	After successfully completion of this course students will be able to: CO1: Explain various clinical aspects of infectious diseases. CO2: Illustrate various factors involved in host pathogen relationship. CO3: Describe the pathogenesis of various infectious diseases. CO4: Understand the mode of actions of antibiotics, antimicrobial agents CO5: Elaborate different aspects and phases of clinical research. CO6: Discuss overall mechanism of infectious diseases and their treatment.
7	Course Description	This course provides understanding of molecular pathology, host defense mechanism against pathogens, pathogenesis, virulence factors of pathogens, diagnostic methods and treatment of infectious diseases.
8	Outline syllabus	
	Unit 1	**Clinical Aspects of Infectious Diseases**
	A	Bacterial, Viral and Parasitic diseases, Disease pathology and clinical spectrum, Clinical diagnosis of diseases;
	B	Molecular genetics of the host and the pathogen,
	C	Assays for the Diagnosis of bacterial, viral and parasitic diseases by using ELISA, RT-PCR and Western blot
	Unit 2	**Host Pathogen Interaction**
	A	Different reservoirs and epidemiology of pathogenic diseases, Different micro flora of skin, respiratory and excretory tract and other parts of body, Factors responsible for infection
	B	Colonization of pathogens inside body, Transmission via vector and without vectors,
	C	Toxins produced by pathogens, their types and their mode of action. Nosocomial infections.

	Unit 3	**Pathogenesis of Infectious Diseases**		
	A	Clinical features, diagnosis and treatment of Malaria, Leishmaniasis, Tetanus, Botulism		
	B	Cholera, Plague, Tuberculosis, Measles, Mumps,		
	C	HIV, HBV, Corona viruses, HPV, Dengue		
	Unit 4	**Antimicrobial Agents**		
	A	Antimicrobial drugs, antibiotics and their types,		
	B	narrow spectrum and broad spectrum antibiotics, mode of action of antibiotics		
	C	antiviral and antifungal agents. Antibiotic resistance		
	Unit 5	**Clinical Research**		
	A	Origin and history of drug development and clinical research		
	B	types and phases of clinical research, clinical trials in India- the national perspective,		
	C	ethical consideration and guidelines of clinical research, clinical trial management.		
	Mode of examination	Theory		
	Weightage Distribution	CA	MTE	ETE
		30%	20%	50%
	Text book/s*	Pommerville J.C. “Guide to Infectious Diseases by Body System”, Jones & Bartlett Learning”, Second Edition (2012).		
	Other References	Kasper D and Fauci A. “Harrison's Infectious Diseases” McGraw-Hill Education, Third Edition (2017).		

MGE205 Enzyme Technology

School: SET		**Batch : 2020-22**
Program: MSc		**Current Academic Year: 2021-22**
Branch: Genetic Engineering		**Semester: III**
1	Course Code	MGE205
2	Course Title	**Enzyme Technology**
3	Credits	4
4	Contact Hours (L-T-P)	4-0-0
	Course Status	Core
5	Course Objective	This course will result in understanding of 1. The importance and role of Enzymes in biological processes 2. Kinetics, Mechanism & Regulation of enzymes 3. Applications of enzymes in Medical, Biotechnological, industrial and Agricultural fields.
6	Course Outcomes	After successfully completion of this course students will be able to: CO1: Explain the nature, power and purification of enzymes. CO2: Illustrate steady state and pre-steady state kinetics and mechanism of enzyme action. CO3: Describe and appreciate the intricate mechanism of enzyme regulation and inhibition. CO4: Understand and appreciate the application of enzymes and immobilized enzymes CO5: Elaborate different applications of enzymes in different areas of health, industry and in food industry. CO6: Discuss all the basic information necessary to understand, appreciate and utilize enzymes in their higher studies and research in biotechnology.
7	Course Description	This course will provide the basic understanding of the nature and properties of Enzymes. The students will learn, isolation, purification of enzymes and would also learn about the mechanism and kinetics. The students will be able to appreciate the application of enzymes in various sectors including Biotechnology.
8	Outline syllabus	
	Unit 1	**Introduction to Enzymes**
	A	Enzyme as biocatalysts, classification, nomenclature of enzymes
	B	extraction, isolation and large scale production and purification of enzymes.
	C	Cofactors and their role in enzyme activity

	Unit 2	**Mechanism of Enzyme Action**		
	A	Concept of active site and energetics of enzyme-substrate complex formation, specificity of enzyme action; kinetics of enzyme action		
	B	estimation of Michaelis-Menten's parameters;		
	C	multi-substrate reactions-mechanisms & Kinetics, Hill's Plot, Scatchard Plot		
	Unit 3	**Regulation of Enzymes and their inhibition**		
	A	Enzyme inhibition, Enzyme Inhibitors, Competitive, uncompetitive and non-competitive inhibition.		
	B	Mechanism, general principles, theories with examples of Chymotrypsin and Lysozyme, Feedback inhibition, allosteric and cooperativity, Isoenzymes, Covalent and non-covalent modification:		
	C	Examples of Glycogen phosphorylase, Aspartate transcarbamoylase.		
	Unit 4	**Immobilized Enzymes**		
	A	Immobilization of enzyme and whole cells; Methods of immobilization – ionic bonding, adsorption, covalent bonding (based on R groups of amino acids), microencapsulation and gel entrapment.		
	B	Process design and operation strategies for immobilized enzyme reactors, Immobilization of multiple enzyme system and immobilized enzymes in industrial processes.		
	C	Enzymes modification and site directed mutagenesis.		
	Unit 5	**Applications of Enzymes**		
	A	Importance of enzymes in diagnostics, Enzyme pattern in diseases like Myocardial infarctions (SGOT, SGPT & LDH).		
	B	Use of isozymes as markers in cancer and other diseases. Enzymes in immunoassay techniques.		
	C	Enzymes used in detergents, use of proteases in food, leather and wool industries, starch hydrolyzing enzymes, uses of lactase in dairy industry, glucose oxidase and catalase in food industry.		
	Mode of examination	Theory		
	Weightage Distribution	CA	MTE	ETE
		30%	20%	50%
	Text book/s*	Price and Stevenson– 2009 Fundamentals Of Enzymology, 3rd Edition, Oxford University Press.		
	Other References	L. Nelson, Michael M. Cox, Lehninger Principles of Biochemistry/Edition 7, Publisher: Freeman, W.H.& Company, 2017		