

Department of Biochemistry
Faculty of Science
The M. S. University of Baroda

Papers for M. Sc. (Medical Biotechnology) Semester syllabus

	THEORY SEMESTER - I	CREDITS	Course Code
PAPER I	Basic Biochemistry	03	MBT2101C01
PAPER II	Protein Structure and Function & Basic Enzymology	03	MBT2102C02
PAPER III	Cell Biology	03	MBT2103C03
PAPER IV	Biophysical Techniques and Biostatistics	04	MBT2109C09
PAPER V	Basic Molecular Biology	03	MBT2108C08
	Practical-I	09	MBT2106C06
	Viva (Internal)	01	MBT2107C07
	Total Credits	26	
	THEORY SEMESTER - II	CREDITS	Course Code
PAPER I	Mammalian Biochemistry	03	MBT2201C08
PAPER II	Advance Cell Biology	03	MBT2202C09
PAPER III	Enzymology	02	MBT2209C16
PAPER IV	Basic Physiology	03	MBT2204C11
	Practical-II	09	MBT2206C13
	Viva (Internal)	01	MBT2207C14
	Seminar	01	MBT2208C15
	TOTAL CREDITS	22	

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Papers for M. Sc. (Medical Biotechnology) Semester syllabus

	THEORY SEMESTER - III	CREDITS	Course Code
PAPER I	Infection and Immunity	03	MBT2301C01
PAPER II	Clinical Biochemistry and Ethical Aspects	03	MBT2302C02
PAPER III	Gene Expression and Modulation	03	MBT2309C09
PAPER IV	Hormone Regulation and Diseases	03	MBT2304C04
PAPER V	Medical Microbiology	03	MBT2305C05
	Practical-III	09	MBT2306C06
	Viva (Internal)	01	MBT2307C07
	Seminar	01	MBT2308C08
	Total Credits	26	
	THEORY SEMESTER - IV	CREDITS	Course Code
PAPER I	Human Genetics, Stem Cell and Regenerative Biology	03	MBT2401C09
PAPER II	Recombinant DNA Technology and Information Biology	03	MBT2409C16
PAPER III	Molecular Medicine	03	MBT2403C11
PAPER IV	Neurobiology and Neurological Disorders (Optional Paper- I)	03	MBT2407C15
PAPER IV	Medicinal Drug Discovery and Design (Optional Paper- I)	03	MBT2408C15
	Practical- IV	04	MBT2404C12
	Viva (External)	01	MBT2405C13
	Project Work	06	MBT2406C14
	Total Credits	23	

Bloom's Taxonomy Levels: 1. Remember 2. Understand 3. Application 4. Analysis 5. Evaluation 6. Creation
Programme Name: MSc. (Medical Biotechnology) Higher Payment Program

Programme Specific Outcome (PSO)

Biotechnology was long heralded as the science which would answer all problems associated with life. Growth of biotechnology due to an immense contribution from molecular biology techniques has lead to its compartmentation into plant, animal, microbial and medical biotechnology. The department of Medical Biotechnology set up in 1955 had been in the forefront of clinical and nutritional research and its staff decided to put their collective expertise to initiate the Medical biotechnology course in 2007 with a view of catering to the need of Pharma and health sectors. The Master's in Medical Biotechnology program aims to train students with in depth knowledge in clinical sciences. The papers are designed such that the students have a grasp of the human physiology along with greater understanding of proteins and enzymes, immunology, genetics, molecular biology, medical microbiology, biophysical techniques, cell biology, biostatistics. At the end of the course students can go for PhD or can find job in clinical set-up, pharmaceutical industry or academia.

Syllabus of Courses

		The Maharaja Sayajirao University of Baroda Faculty of Science Department of Biochemistry		Academic Year		2025-2026					
M.Sc. (Medical Biotechnology): Higher Payment Program											
Year	1	Core. Basic Biochemistry MBT2101C01		Credits / Hours per week		03/03					
Semester	I	Year of Introduction: 2016 Year of Syllabus Revision: 2019		Maximum Marks / Grade		100 each					
Mode of Transaction		Lectures									
Course Outcome (CO) MBT2101C01											
CO1 Understanding the importance of water properties											
CO2 Learn about thermodynamic principles underlying life processes.											
CO3 Solving the riddle of apparent entropic violations in life forms.											
CO4 Understand the efficiency of operations in life processes.											
CO5 Understand structure-function relationships.											
CO6 Applications of thermodynamic logic in Medical Biotechnology.											
Unit No.	Topic/Unit			Contact Hours	Weightage (%)	BT Level	CO	PSO	Elements of Employ	Relevance to Local	Relation to Gender

							ability (Emp)/ Entrepre- neurship (Ent)/ Skill Develop- ment (SD)	(L)/ National (N)/ Regiona l(R)/Glo bal (G) develop- mental needs	(G), Environ- ment and Sustaina- bility (ES), Human Values (HV) and Professi- onal Ethics (PE)
1	Relevance of properties of water for life. Diffusion rates, viscosity; Thermodynamic principles in metabolism. techniques to study metabolic pathways. Carbohydrate Chemistry: Monomers. Structure-function correlation and diversity in various organisms	15	33	1,2,3,4	CO1 to CO6				
2	Carbohydrate Chemistry: Polymers & Modifications and their structure-function correlation; diversity in various organisms; Amino acids Chemistry: structure-function correlation	15	33	1,2,3,4	CO1to CO6				
3	Chemistry of Lipids & Nucleotides: structure-function correlation & Modifications; Chemistry of Vitamin and their functions.	15	34	1,2,3,4	CO3 toCO6				
Reference Books									
1.	D. Voet (2010) Medical Biotechnology , 4th edition, John Wiley & Sons (ISBN: 978-0-470-57095-1).								
2.	D. L. Nelson and M. M. Cox (2007) Lehninger Principles of Medical Biotechnology , Fourth Edition.								
3.	R. H. Garrett and C. M. Grisham (2008) Medical Biotechnology_ 4th Edn., Brooks/cole Cengage Learning								
4.	Haynie, D. T. (2008) Biological Thermodynamics, 2 nd Edn., Cambridge Univ. Press.								
5.	Nelson P. (2004) Biological Physics, W. H. Freeman & Co., NY, USA.								
6.	D. E. Metzler, (2003) Medical Biotechnology , Vol. 1 & II, 2 nd Edn., Academic Press.								
7.	R. R. Crichton (2008) Biological Inorganic Chemistry : An Introduction, Elsevier.								

MBT2102C02 Protein Structure and Function & Basic Enzymology**Programme Specific Outcome (PSO)**

Proteins being workhorses of a cell understanding their structure is absolutely essential for students of Medical Biotechnology and medical biotechnology. The activity of a protein is determined by its structure and protein structure is a consequence of its sequence. Errors in primary structure of a protein forms the basis for many diseases.

The students are taught about the various levels of proteins structure, in vitro synthesis of proteins, artificially and the influence of various factors on protein structure. Proteins play many important roles in the cell. The coursework focuses on enzymatic activity of proteins, as enzymes are biocatalysts and enzymatic activity is fundamental to all biological reactions. Students are introduced to enzymes, their classification and enzyme kinetics.

The influence of various environmental factors on enzyme activity is taught here. Knowledge in this area will help the students in optimizing chemical reactions for industrial applications. Further, enzyme inhibition and its mechanisms are taught, as most drugs act as inhibitors to enzyme activity. Studies on Enzyme inhibition is of great importance in pharmaceutical industry.

These are basic compulsory subjects. Students will opt for Research, teaching and R and D placements.

Syllabus of Courses

	The Maharaja Sayajirao University of Baroda Faculty of Science Department of Biochemistry		Academic Year		2025-2026					
M.Sc. (Medical Biotechnology): Higher Payment Program										
Year	I	Core: MBT2102C02 Protein Structure and Function & Basic Enzymology	Credits / Hours per week				03/03			
Semester	I	Year of Introduction: 2016 Year of Syllabus Revision: 2019	Maximum Marks / Grade				100			
Mode of Transaction		Lectures and Tutorials								
Course Outcome (CO) MBT2102C02 CO1: Learning about primary structure of proteins and artificial synthesis of proteins CO2: Learning higher orders of structure in proteins & basics of enzymology CO3: Learning effect of various factors on enzyme activity										
Unit No.	Topic/Unit		Contact Hours	Weightage (%)	BT Level	CO	PSO	Elements of Employability (Emp)/Entrepre	Relevance to Local (L)/ National (N)/	Relation to Gender (G), Environment

							neurship (Ent)/ Skill Develop ment (SD)	Regiona l(R)/Glo bal (G) develop mental needs	and Sustaina bility (ES), Human Values (HV)an d Professi onal Ethics (PE)
1	Primary Structure of Proteins and artificial synthesis of proteins: Proteins: Primary structure and determination; artificial peptide synthesis; restrictions on primary structure (recognition sequences for protein modifications and targeting); Chemical modification of side chains of amino acid residues	15	34	1,2,3,4	CO1				
2	Higher orders of structure in proteins & Basics of Enzymology: Forces and interactions responsible for protein structure; Secondary and tertiary structure including prediction; quaternary structure. Scope of enzymology, classification and nomenclature. Kinetics: chemical kinetics; Variations of velocity with [E], [S].	15	33	1,2,3	CO2				
3	Effect of various factors on enzyme activity: Variations of velocity with pH and temperature; enzyme inhibition; bi-substrate reaction kinetics; uses of kinetic studies in determining enzyme mechanism; scope for increasing enzyme efficiency; enzyme specificity.	15	33	1,2,3	CO3				
Reference Books									
1.	Gray (2010) Enzymes Biotechnology, Cbs.								
2.	J. Poliana and A. P MacCabe (2007) Industrial Enzymes – Structure, Function and Applications, Springer.								
3.	W. Aehle (2007) Enzymes in Industry, Wiley-VCH.								
4.	D. Whitford (2005) Proteins: Structure and Function. Wiley Publication.								
5.	G. A. Petsko and D. Ringe (2003) Protein Structure and Function, New Science Press, Ltd.								
6.	Metzler, D. E. (2003) Medical Biotechnology , Vol. 1 & II, 2 nd Edn., Academic Press.								

7.	S. P. Trevor (2001) Enzymes, Harwood.
8.	Voet, D., Voet, J. and Pratt, C. W. (1999) Fundamentals of Medical Biotechnology .
9.	Price, N. C. & L. Stevens, (1999) Fundamentals of Enzymology, 3 rd Edn., Oxford University Press.
10.	H. Uhlig, E. M L. Bednar (1998) Industrial Enzymes and their Applications, Wiley.
11.	Creighton, T. E. (1995) Proteins : Structure and Molecular Properties.
12.	Fersht, A. R. (1985) Enzyme structure and function, 2 nd Edition, W. H. Freeman & Co. NY.
13.	Dixon and Webb, (1979) Enzymes.
14.	Bayer, Lardy and Myrback, The Enzymes, Academic Press.

Bloom's Taxonomy Levels: 1. Remember 2. Understand 3. Application 4. Analysis 5. Evaluation 6. Creation

Programme Name: MSC Medical Biotechnology **Course:** Cell Biology

Programme Specific Outcome (PSO)

Cell Biology help incoming student to understand the basic principles of Cell Biology. Cell evolution and theories to understand modern cell biology is one of the essential outcome of this paper. It also involves with the introduction of emerging tools and techniques in Cell Biology. Further different cellular organelles and the biochemical principles governing their functions.

Syllabus of Course

 सत्यं शिवं सुन्दरम्		The Maharaja Sayajirao University of Baroda Faculty of Science Department of Biochemistry	Academic Year	2025-2026
M.Sc. Medical Biotechnology -Higher Payment Program				
Year	I	Core: MBT2103C03 Cell Biology	Credits / Hours per week	03/03
Semester	I	Year of Introduction: 2012 Year of Syllabus Revision: 2019	Maximum Marks / Grade	100
Mode of Transaction		Lectures and Tutorials		
Course Outcome (CO) MBT2103C03 CO1- Learn about different techniques of Cell Biology, human cell culture CO2- Cell membrane, cell cell interaction, cells interaction with extracellular matrix CO3- Cell organelles and their role in cellular homeostasis				

Unit No.	Topic/Unit	Contact Hours	Weightage (%)	BT Level	CO	PSO	Elements of Employability (Emp)/Entrepreneurship (Ent)/Skill Development (SD)	Relevance to Local (L)/National (N)/Regional(R)/Global (G) developmental needs	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV) and Professional Ethics (PE)
1	Introduction to cell; evolution of cell; comparative aspects of prokaryotes and eukaryote, Cell and tissue culture techniques, cell lines and cell cloning. Cell Biology techniques—Freeze fracture; cell fractionation.	15	33.33	1, 2,3	CO1,			National and Global Research	
2	Structure and function of Biomembranes, Types of membrane transport. Cell-cell and Cell-Extracellular matrix interactions Cytoskeleton, Intracellular transport.	15	33.33	1,2,3	CO2				
3	Cellular organelles like Endoplasmic reticulum, Golgi, Mitochondria. Lysosomes. Mechanism of protein translocation, Membrane trafficking, Vesicular transport.	15	33.33	1,2,3	CO3				

Reference Books

1. B. Alberts et al. (2010) Essential Cell Biology, 3rd Edn., Garland Science.
2. S. Tompkins (2010) Cell Biology, Appleacademics.
3. T. D. Pollard & W. C. Earnshaw (2008) Cell Biology 2nd Edn., Saunders Elsevier.
4. H. Lodish et al., (2008) Molecular Cell Biology, 6th Edn., W. H. Freeman & Co. NY. USA.
5. K. Roberts, J. Lewis, B. Alberts, P. et al. (2008) Molecular Biology of the Cell, 5th Edn., Garland Publishing Inc New York
6. Kreitzer, G., F. Jaulin and C. Espenel (2009) Cell Biology Assays: Essential Methods, Academic Press.
7. K. Gerald (2007) Cell and Molecular Biology, Concept and Experiment, 5th Edn., Wiley.

Bloom's Taxonomy Levels: 1. Remember 2. Understand 3. Application 4. Analysis 5. Evaluation 6. Creation

Programme Name: MSC Medical Biotechnology **Course-** Biophysical Techniques and Biostatistics

Programme Specific Outcome (PSO)

Biophysical techniques are pivotal to any kind of research work in any branch of life sciences. It is impossible to do any research work in this field without using biophysical techniques, as they are used to study the structure and function of macromolecules.

The course will teach students purification of molecules, studying the properties like molecular weight, structure, activity, interactions with other molecules. Hence, it is central to conducting research, analysing data and implementing in a laboratory. It will give a deeper insight into life sciences. Apart from learning about basic aspects of molecules biophysical studies help in understanding the cause and finding the right medicine. These are basic compulsory subjects irrespective of whether the students will choose Research, teaching and R and D placements.

Syllabus of Courses

	The Maharaja Sayajirao University of Baroda Faculty of Science Department of Biochemistry		Academic Year				2025-2026				
M.Sc. (Medical Biotechnology): Higher Payment Program											
Year	I	Core / Elective / Foundation MBT2109C09 Biophysical Techniques and Biostatistics		Credits / Hours per week				04/04			
Semester	I	Year of Introduction: 2016 Year of Syllabus Revision: 2023		Maximum Marks / Grade				100			
Mode of Transaction		Lectures and Tutorials									
Course Outcome (CO) MBT2109C09 CO1: Learning about macromolecular structure and the role of inter and intramolecular interactions, Radiotracer techniques and centrifugation. CO2: Learning Methods employed for the separation, characterization and molecular weight determination of macromolecules CO3: Learning Spectroscopic techniques and their applications in understanding of structure and function, and structural transitions in Biomolecules. CO4: Introduction to Statistics in biology											
Unit No.	Topic/Unit			Contact Hours	Weightage (%)	BT Level	CO	PSO	Elements of Employability (Emp)/ Entrepreneurship	Relevance to Local (L)/ National (N)/ Regional	Relation to Gender (G), Environment and

							(Ent)/ Skill Develop ment (SD)	l(R)/Glo bal (G) develop mental needs	Sustaina bility (ES), Human Values (HV)an d Professi onal Ethics (PE)
1	Inter and intramolecular interactions, their role in determining protein structure and function, radioactivity, tracer techniques, radioactivity counters, Centrifugation	18	30	1,2,3,4	CO1				
2	Methods employed for separation, characterization and molecular weight determination of macromolecules such as uotrafiltration, equilibrium dialysis, solvent extraction, preipitation, electrophoresis and chromatography and their principles and applications.	15	25	1,2,3	CO2				
3	Spectroscopy theory, UV-visible, IR, Raman, Resonance Raman, CD, ORD, Fluoresecence, NMR, ESR, Atomic absorption spectroscopic techniques, Mass spectrometry, X ray diffraction - Principles, instrumentation, applications in the estimation of quantity and characterization of structure and function of molecules..	15	25	1,2,3	CO3				
4	Introduction to biostatstics, Sampling, measures of central tendency and dispersion. Normal distribution, Skewness and Kurtosis, testing of hypothesis, Z-test, t-test, types of errors.Chi-square test. Correlation and regression, Probability, Binomial distribution, Poisson distribution.	12	20	1,2,3,4,5	CO4				
Reference Books									
1.	R. R. Bergethon (2010) The Physical Basis of Medical Biotechnology: The Foundations of Molecular Biophysics, 2nd Edn., Springer, NY.								
2.	P. J. Walla (2009) Modern Biophysical Chemistry, Wiley-VCH.								
3.	D. Sheeham (2009) Physical Medical Biotechnology 2nd Edn., Wiley-Blackwell.								
4.	Wilson, K and Walker, J.M (2005) Principles and techniques of Medical Biotechnology and molecular biology, 6th ed., Cambridge University								

	Press
5.	J. A. Goodrich and J. F. Kugel (2006) Binding and Kinetics for Molecular Biologists. Cold Spring Harbor Press.
6.	van Holde, K. E. (1998) Principles of Physical Medical Biotechnology , Prentice Hall.
7.	Freifelder, D., 1982, Physical Medical Biotechnology : applications to Medical Biotechnology and molecular biology.

Programme Specific Outcome (PSO)

The molecular biology coursework is concerned with the biological activity at the molecular level, studying the genome structure of an organism and its function which includes genetics, proteins and nucleic acids. It will be beneficial in conducting research, analysing data and implementing best practices in a laboratory set up. It will give a deeper understanding of biosciences. Molecular Biology is significant in understanding the origin of diseases and to make changes in an organism to create a potential cure or assist in easing the diseases.

These are basic compulsory subjects. Students will opt for Research, teaching and R and D placements.

Syllabus of Courses

	The Maharaja Sayajirao University of Baroda Faculty of Science Department of Biochemistry		Academic Year		2025-2026					
M.Sc. (Medical Biotechnology): Higher Payment Program										
Year	I	Core / Elective / Foundation MBT2108C08: Basic Molecular Biology	Credits / Hours per week				03/03			
Semester	I	Year of Introduction: Year of Syllabus Revision: 2022	Maximum Marks / Grade				100			
Mode of Transaction		Lectures and Tutorials								
Course Outcome (CO) MBT2108C08 CO1 Understanding nucleic acids and genome. CO2 Learn about chromosomes, genes and transcription in prokaryotes. CO3 Learn about transcription in eukaryotes and posttranscriptional events.										
Unit No.	Topic/Unit		Contact Hours	Weightage (%)	BT Level	CO	PSO	Element s of Employability (Emp)/Entrepre	Relevan ce to Local (L)/ National (N)/	Relation to Gender (G), Environ ment and

							neurship (Ent)/ Skill Develop ment (SD)	Regional (R)/Glob al (G) develop mental needs	Sustaina bility (ES), Human Values (HV)and Professio nal Ethics (PE)
1	Genome organization: Physical and chemical properties of nucleic acids, purification and analysis of Nucleic acids. The central dogma, evidence that DNA is genetic material, Structure of DNA and RNA, physico chemical properties of nucleic acids and genomes-cot plot, kinetic and chemical complexity, Tm, buoyant density, satellite DNA, Organization of the <i>E.coli</i> and human genomes, Chromosome, structure of chromatin-nucleosomes, solenoids, scaffolds. Chromatin domains and isochores, structure and functional organization of centromeres and telomeres	15	34	1,2,3	CO1				
2	Replication: Replication in prokaryotes and eukaryotes, models, DNA dependent and RNA dependent polymerases, mode of action, DNA amplification and polytenization, telomere replication, Basis of epigenetic changes. – Principles and applications of DNA polymerases; PCR and applications in Biotechnology, Anthropology and Forensic Science	15	33	1,2,3	CO2				
3	Recombination and repair: mutation and recombination in bacteria, eukaryotes, Recombination: homologous, site specific and non-homologous or illegitimate recombination. DNA damage and repair. Transposition, Basics of CRISPR-Cas system of gene manipulation	15	33	1,2,3	CO3				
Reference Books									
1.	B. Lewin, J. E. Krebs, E. S. Goldstein and S. T. Kilpatrick (2008) Lewin’s Essential Genes, 2 nd Edn., Jones &Barlett Pub., USA.								
2.	R. Weaver (2011) Molecular Biology, 5th Edn., McGraw-Hill.								
3.	J. D. Watson, T. A. Baker, S. P. Bell, A. Gann, M. Levine, R. Losik, CSHLP (2017) Molecular Biology of the Gene, 7 th Edition, Pearson.								
4.	D. Clark (2018) Molecular Biology: Academic Cell, 3 rd Edn. Academic Press.								
5.	J. E. Krebs, E. S. Goldstein and S. T. Kilpatrick (2017) Lewin’s Genes XII, 12th Edn., Jones &Barlett Pub., USA.								
6.	Twyman, R.M. (1998) Advanced Molecular Biology, Bios Scientific Publ.								

Programme Specific Outcome (PSO)

PSO1 Learn basics of techniques in Medical Biotechnology applicable to all areas of life science and contribute to further knowledge

- PSO2 Basic understanding and application of the biochemical techniques through their use in analysis
 PSO3 Learn methods to determine levels of biomolecules, principles of estimation and calculation
 PSO4 Demonstrate latest techniques in estimation with principles involved
 PSO5 Determination of enzymes involved in various processes with their kinetics
 PSO6 Training and exposure to research problems through dissertation

Syllabus course

		The Maharaja Sayajirao University of Baroda Faculty of Science Department of Biochemistry			Academic Year		2025-2026		
M.Sc.(Medical Biotechnology)									
Year	I	Core MBT2106C06: Practical I			Credits / Hours per week		9/18 Hrs		
Semester	I	Year of Introduction: 2016 Year of Syllabus Revision: 2019			Maximum Marks / Grade		100		
Mode of Transaction		Laboratory Experiments, discussion and viva			PSO3 is common for all experiments				
Course Outcome (CO) MBT2106C06									
CO1 Understanding the importance of gravimetric and volumetric measurements, units and interconversions, statistical analysis of biology data.									
CO2 Understanding the concept of molarity, normality, pH and Lambert beer's Law									
CO3 Understanding the principle, methodology, data collection and analysis of different experiments									
No.	Experiment				Contact Hours	Weightage (%)	BT Level	CO	PSO
1	Orientation towards analytical methods in Medical Biotechnology , Basics of laboratory principles, dos and don'ts in a Medical Biotechnology laboratory, BALANCES, PIPETTES; ACCURACY & PRECISION, BEER-LAMBERT'S LAW & COLORIMETERY, BUFFERS AND SOLUTIONS				32	20	1,2,3,4,5	CO1 & CO2	PSO1
2	Clinical estimations like glucose, urea, uric acid, creatinine; A/G Ratio, blood collection, CBC, bleeding and clotting time, ESR, PCV, Blood group, hemoglobin estimation; biochemical analysis of urine, lipid profile, clinically important enzymes in blood				96	35	1,2,3,4,5	CO2 & CO3	PSO1
3	Microbiology: Learning Laboratory techniques in Medical Microbiology				48	25	1,2,3,4,5	CO2 & CO3	PSO1
4	Biochemical analysis: Iron, phosphate, Ascorbic acid and Protein estimation by colorimetry				32	20	1,2,3,4,5	CO2 & CO3	PSO2

SEMESTER II

Syllabus of Courses

	The Maharaja Sayajirao University of Baroda Faculty of Science Department of Biochemistry		Academic Year		2025-2026					
M.Sc.(MEDICAL BIOTECHNOLOGY) : Higher Payment Programs										
Year	I	Core. Mammalian Biochemistry MBT2201C08	Credits / Hours per week				03/03			
Semester	II	Year of Introduction: 2016 Year of Syllabus Revision: 2019	Maximum Marks / Grade				100 each			
Mode of Transaction		Lectures								
Course Outcome (CO) MBT2201C08										
CO1 Understanding organization of carbohydrate metabolism.										
CO2 Learn about uses of various metabolic pathways.										
CO3 Understanding energy yields of various metabolic pathways.										
CO4 Understand the efficiency of operations in metabolic pathways.										
CO5 Understand logic behind selection of metabolic pathways under various physiological circumstances.										
CO6 Applications of principles of metabolic control in cells..										
CO7 Understanding the organization of pathways for Lipid metabolism.										
Unit No.	Topic/Unit		Contact Hours	Weightage (%)	BT Level	CO	PSO	Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill	Relevance to Local (L)/ National (N)/ Regional (R)/ Global (G)	Relation to Gender (G), Environment and Sustainability

							Develop ment (SD)	develop mental needs	(ES), Human Values (HV)an d Professi onal Ethics (PE)
1	Carbohydrate Metabolism (organization, reactions, regulation etc.)- Glycolysis, Glycogenolysis, Glycogenesis & Gluconeogenesis; HMP, E-D, Glyoxylate pathways.	15	34	1,2,3,4	CO1 to CO6				
2	TCA cycle, its central role, interactions, organization, reactions, regulation etc.	15	33	1,2,3,4	CO1 to CO6				
3	Metabolism of Lipids: Triglyceride, cholesterol, phospholipid, lipoproteins and eicosanoids. Even, odd & branched chain fatty acid metabolism.	15	33	1,2,3,4	CO2 to CO7				

Reference Books

1.	D. Voet (2010) Medical Biotechnology , 4th edition, John Wiley & Sons (ISBN: 978-0-470-57095-1).
2.	D. L. Nelson and M. M. Cox (2007) <u>Lehninger Principles of Medical Biotechnology</u> , Fourth Edition.
3.	R. H. Garrett and C. M. Grisham (2008) <u>Medical Biotechnology</u> 4th Edn., Brooks/cole Cengage Learning
4.	Haynie, D. T. (2008) Biological Thermodynamics, 2 nd Edn., Cambridge Univ. Press.
5.	Nelson P. (2004) Biological Physics, W. H. Freeman & Co., NY, USA.
6.	D. E. Metzler, (2003) Medical Biotechnology , Vol. 1 & II, 2 nd Edn., Academic Press.

Programme Specific Outcome (PSO)

This paper is to develop understanding of advanced developments of the cellular processes. The major focus is to keep student abreast metabolism understanding to the students. It deals with advanced concept of Cell Biology: regulation of cell cycle, cell death, its implication in cancer and other chronic disease conditions. Advanced tools of cell biology as well as its implication in understanding the patho-physiological conditions is one of the major goal of the paper.

	The Maharaja Sayajirao University of Baroda Faculty of Science Department of Biochemistry	Academic Year	2025-2026
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M.Sc.(MEDICAL BIOTECHNOLOGY) : Higher Payment Programs										
Year	I	Core: Advance Cell Biology MBT2202C09		Credits / Hours per week				03/03		
Semester	II	Year of Introduction: 2012 Year of Syllabus Revision: 2019		Maximum Marks / Grade				100		
Mode of Transaction		Lectures and Tutorials								
Course Outcome (CO) MBT2202C09 CO1- Learn about advance concepts in cell cycle and its regulation CO2- Learn about Cancer Cell Biology, classification, oncogenes and tumor suppressors CO3- Advance Cell Biology techniques										
Unit No.	Topic/Unit	Contact Hours	Weightage (%)	BT Level	CO	PSO	Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional(R)/Global (G) developmental needs	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV) and Professional Ethics (PE)	
1	Mitosis, Meiosis, Cyclin dependent regulation of cell cycle. Apoptosis and Necrosis. Applications of microscopic techniques.	15	33.33	1, 2,3	CO1			National and Global Research		
2	Cancer biology - Mechanism of carcinogenesis, tumor suppressor genes and oncogenes. Flow cytometry and Immunocytochemical techniques	15	33.33	1,2,3	CO2					
3	Eukaryotic cell signaling, types of receptors, receptor purification and characterization, cell transduction by membrane bound, cytosolic and nuclear receptors via various pathways	15	33.33	1,2,3	CO3					
Reference Books										

1. B. Alberts et al. (2018) The Mol Biology of the Cell, 3rd Edn., Garland Science
2. S. Tompkins (2010) Cell Biology, Apple Academics
3. K. Roberts, J. Lewis, B. Alberts, P. Walter, A. Johnson and M. Raff (2008) Molecular Biology of Cell
4. Harvey Lodish Mol Cell Biology (2016).
5. T. D. Pollard & W. C. Earnshaw (2008) Cell Biology 2nd Edn., Saunders Elsevier.
6. H. Lodish et al., (2008) Molecular Cell Biology, 6th Edn., W. H. Freeman & Co. NY. USA.
7. Kreitzer, G., F. Jaulin and C. Espenel (2009) Cell Biology Assays: Essential Methods, Academic Press.
8. K. Gerald (2007) Cell and Molecular Biology, Concept and Experiment, 5th Edn., Wiley.

Enzyme Mechanism & Regulation (MBT2203C10)

 सत्यं शिवं सुन्दरम्		The Maharaja Sayajirao University of Baroda Faculty of Science Department of Biochemistry				Academic Year		2025-2026			
M.Sc. MEDICAL BIOTECHNOLOGY : Higher Payment Programs											
Year		I	Core: MBT2209C16: Enzymology			Credits / Hours per week			02/02		
Semester		II	Year of Introduction: 2016 Year of Syllabus Revision: 2019			Maximum Marks / Grade			50 each		
Mode of Transaction			Lectures								
Course Outcome (CO) MBT2209C16											
CO1 Understanding the logic of application of chemical kinetics to enzyme kinetics..											
CO2 Learn about proxy indicators & meanings of constants, their limitations and uses.											
CO3 Solving/Deriving the equations of enzyme kinetics.											
CO4 Understand the uses of kinetic constants and their variations with pH, temperature, etc.											
CO5 Understand timescales of enzyme operations and catalytic efficiency.											
CO6 Applications of kinetic parameters to understand enzyme catalytic mechanism.											
Unit No.	Topic/Unit			Contact Hours	Weightage (%)	BT Level	CO	PSO	Elements of Employability	Relevance to Local (L)/	Relation to Gender (G),

[illegible]

Programme Specific Outcome (PSO)

For a good in-depth understanding of Medical Biotechnology the students need to understand how the physiological systems function. The basic physiology course is designed to unravel the basic tenets of Blood, Gastrointestinal, Respiratory, Nephrology which are important for Medical Biotechnology students. The course is basic and is compulsory for all Medical Biotechnology students

This Physiology course will help in understanding the implications of diseases. A good understanding of this course will help students well when they opt for Research or teaching. R and D laboratories would also desire students with a good hold over physiology.

Syllabus of Courses

	The Maharaja Sayajirao University of Baroda Faculty of Science Department of Biochemistry		Academic Year					2025-2026		
M.Sc. (Medical Biotechnology): Higher Payment Programme										
Year	I	Core / Elective / Foundation MBT2204C11: Basic Physiology	Credits / Hours per week					03/03		
Semester	II	Year of Introduction: 2012 Year of Syllabus Revision: 2019	Maximum Marks / Grade					100		
Mode of Transaction		Lectures and Tutorials								
Course Outcome (CO) MBT2204C11 CO1 Blood and its components CO2 Gastrointestinal physiology and Kidney function and its regulation CO3 Respiration and its role in homeostasis										
Unit No.	Topic/Unit		Contact Hours	Weightage (%)	BT Level	CO	PSO	Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional (R)/ Global (G) developmental needs	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV) and

									Professional Ethics (PE)
1	Structure & function of digestive system. .Motility, secretions digestion and absorption and their regulation, diseases related to these systems	15	30	1,2,3	CO1				
2	Structure and function of excretory system and role of kidney in urine formation; fluid electrolyte balance. Blood Chemistry & blood clotting,	15	40	1,2,3	CO2				
3	Function of respiratory system and regulation of respiration, Cardiac cycle, cardiac output, Regulation and diseases	15	30	1,2,3	CO3				
Reference Books									
1.	Guyton, Text book of Medical Physiology, 1998								
2.	Ganong, Review of medical physiology, 1997								
3.	Tortora, G. J. Principles of anatomy and physiology (2006)								
4.	Siegel. Basic Neurochemistry (2008)								
5.	Nerve, Muscle & Synapse. Katz, B. (1994).								
6.	Principles of neuroscience Kandel and Schwartz (2006)								

Programme Name: MSc. (Medical Biotechnology)

Programme Specific Outcome (PSO)

- PSO1 Learn basics of techniques in Medical Biotechnology applicable to all areas of life science and contribute to further knowledge
- PSO2 Basic understanding and application of the biochemical techniques through their use in analysis
- PSO3 Learn methods to determine levels of biomolecules, principles of estimation and calculation
- PSO4 Demonstrate latest techniques in estimation with principles involved
- PSO5 Determination of enzymes involved in various processes with their kinetics
- PSO6 Training and exposure to research problems through dissertation

		The Maharaja Sayajirao University of Baroda Faculty of Science Department of Biochemistry			Academic Year		2025-2026		
M.Sc. (Medical Biotechnology): Higher Payment Programme									
Year	I	Core MBT2206C13 : Practical-II			Credits / Hours per week		09/18		
Semester	II	Year of Introduction: 2007 Year of Syllabus Revision: 2019			Maximum Marks / Grade		100		
Mode of Transaction		Laboratory Experiments, discussion and viva			PSO7 is common for all experiments				
Course Outcome (CO) MBT2206C13 CO1 Determination of enzyme activity and its kinetics CO2 Techniques in protein purification and their principles CO3 Animal handling and its techniques CO4 Basic experiments in immunology CO5 Techniques in molecular biology CO6 Techniques in Human Genetics									
No.	Experiment				Hours	% weightage	BT Level	CO	PSO
1	Enzyme kinetics: Introduction to enzymology; Preparation of sample, Protein estimation, Substrate curve, pH curve, Temperature curve, enzyme curve				48	21	1,2	CO 1	PSO1
2	Protein purification: Understanding techniques of Protein purification and its principles, Expression of proteins in E.coli, purification by size exclusion and affinity chromatography				48	21	2	CO 2	PSO2
3	Animal Experimentation: Introduction to animal Experiments, identification; sexing, tube feed, blood collection, injection, vaginal smear, marking, dissection.				16	7	2,3	CO 3	PSO1, PSO2
4	Immunology: Basic experiments in immunological assays				32	15	3,4	CO 4	PSO4
5	Molecular Biology: DNA isolation purification and Techniques in molecular biology				32	15	2,3	CO 5	PSO1, PSO4
6	Human Genetics: Introduction to Human Genetics, Isolation of genomic DNA from human blood samples, Genotyping by PCR-RFLP, ARMS-PCR, TaqMan assay, HRM methods and				48	21	2,3,4	CO 6	PSO1, PSO2, PSO3

	variable number tandem repeat polymorphism using PCR; Determination of Hardy Weinberg Equilibrium. Isolation of RNA from human blood samples; cDNA synthesis and Gene expression studies using Real-time PCR. Discussion on Pedigree analysis, Autosomal inheritance: Recessive and dominant inheritance, Sex-linked inheritance: X linked and Y linked.					
Reference Books						
1.	Medical Biotechnology by Voet and Voet					
2.	Principles and techniques of Medical Biotechnology and Molecular biology by Wilson and Walker					

SEMESTER III

Bloom's Taxonomy Levels:

1. Remember 2. Understand 3. Application 4. Analysis 5. Evaluation 6. Creation

Programme Specific Outcome (PSO)

This paper is to develop understanding of the basic principle of different pathogen their infection and defense response in different organism. The different types of response generated during infections will be discussed. Further the cell types, evolution of the response will be the major goal. The understanding of connection between innate and adaptive immunity will be discussed . The goal is to prepare student to understand the immune perspective of patho-physiological conditions

	The Maharaja Sayajirao University of Baroda Faculty of Science Department of Biochemistry		Academic Year					2025-2026		
M.Sc. (Medical Biotechnology): Higher Payment Programme										
Year	II	MBT2301C01 Infection And Immunity	Credits / Hours per week					03/03		
Semester	I	Year of Introduction: 2012 Year of Syllabus Revision: 2019	Maximum Marks / Grade					100		
Mode of Transaction		Lectures and Tutorials								
Course Outcome (CO) MBT2301C01 CO1- Learn about advance concepts different type of immunity, cells of the immune system and details of innate immunity CO2- Learn about Nature and type of pathogen associated molecular pattern CO3- Adaptive immunity, cell of adaptive immunity and principle of antigen presentation										
Unit No.	Topic/Unit		Contact Hours	Weightage (%)	BT Level	CO	PSO	Elements of Employ ability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional(R) /Global (G) development al needs	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional Ethics (PE)

1	Bacterial and viral infections in humans. Emerging viral infections and bacterial infections. Pathologies associated with infections. Cells and organs system effected by the common viral and bacterial infections. Basic immunology including morphology and general functions of the proteins, cells and organs of the immune system.	15	33.33	1, 2,3	CO1				
2	Nature of Antigens; Role of Microbial Associated Molecular Patterns (Toll-like receptors & Noll Like Receptors); Complement System, Different types of complement system its role in innate immunity Cells of the adaptive immunity, T and B cells, development of immune cells, Immunoglobulin-structure, types, distribution, biological and chemical properties - Theories of antibody production- its regulation and diversity. Monoclonal and polyclonal antibodies. Complement system – mode of activation- Classical, Alternate and Lectin pathways	15	33.33	1,2,3	CO2			National and Global Research	
3	Structure and function of T cell receptors, Generation of Diversity. T cell differentiation – Positive and Negative selection, Antigen Presentation, Activation of T and B cells. Histocompatibility antigens - HLA and Disease	15	33.33	1,2,3	CO3				
Reference Books									
1.	K. M. Murphy, P. Travers, M. Walport (2016) Janeway's Immunobiology, 9th Edition, Garland Science.								
2.	W. E. Paul (2012) Fundamental Immunology, 7th Edition, Lippincott Williams & Wilkins.								
3.	A. K. Abbas, A. H. Lichtman & S. Pillai (2015) Cellular and Molecular Immunology, 8th Edition, Saunders.								
4.	Owen, J. A., Punt, J., Stranford, S. A. & Jones, P. P. (2013) Kuby Immunology, 7th edition, W. H. Freeman.								
5.	P. J. Delves, S. J. Martin, D. R. Burton and I. M. Roitt (2016) Roitt's Essential Immunology 13th Edn., Blackwell Publ..								
6.	D. Male, J. Brostoff, D. B. Roth & I. Roitt (2012) Immunology, 8th Edn., Mosby-Elsevier.								
7.	T. W. Mak and M. E. Saunders (2014) Primer to the Immune Response – Basic and Clinical Principles, 2nd Edn., Academic Press.								
8.	R. Coico, and G. Sunshine (2015) Immunology - A Short Course, 7th edition, John Wiley & Sons								

Bloom's Taxonomy Levels:

1. Remember 2. Understand 3. Application 4. Analysis 5. Evaluation 6. Creation

Programme Specific Outcome (PSO)

This paper is to develop advanced metabolism understanding to the students. Metabolism II paper deals with how the electron transport chain (ETC) is organized in different living systems starting from bacterial to plants to mitochondria and how it couples oxidative phosphorylation with ATP generation. It further elucidates the thermodynamic considerations for ETC and production of reactive oxygen species (ROS) as its by product. It also deals with defense mechanism to deal with ROS. The paper further deals with nucleotide metabolism, integration of metabolic pathways and in-born errors of metabolism. These papers help students to integrate different metabolic pathways and their regulation and their alteration during many patho-physiological conditions.

 सत्यं शिवं सुन्दरम्		The Maharaja Sayajirao University of Baroda Faculty of Science Department of Biochemistry		Academic Year				2025-2026		
M.Sc. (Medical Biotechnology): Higher Payment Programme										
Year	II	MBT2302C02 Clinical Biochemistry and Ethical Aspects		Credits / Hours per week				03/03		
Semester	I	Year of Introduction: 2012 Year of Syllabus Revision: 2019		Maximum Marks / Grade				100		
Mode of Transaction		Lectures and Tutorials								
Course Outcome (CO) MBT2302C02 CO1: Importance of sampling CO2: Diagnostic techniques CO3: Quality control in diagnosis										
Unit No.	Topic/Unit		Contact Hours	Weightage (%)	BT Level	CO	PSO	Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional(R) /Global (G) developmental needs	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional Ethics (PE)
1.	Introduction to clinical diagnostics, Normal and reference values, Biological sample collection and preservation, Selection of analytical		15	33.33	1, 2,3	CO1, CO2			National and Global	

	methods. With reference to various analytes. Automation and Bedside chemistry.							Research	
2	Diagnostics - Biochemical, Immunological and Molecular Diagnostics in relation to Organ function tests, Prenatal diagnosis .recent advances in diagnostic methods.	15	33.33	1,2,3	CO2				
3	Quality control and GLP, Clinical trials and clearance for application, Patents and copy rights (IPR-, Social and ethical issues.	15	33.33	1,2,3	CO3				
Reference Books									
1.	D. Voet (2010) Biochemistry, 4th edition, John Wiley & Sons (ISBN: 978-0-470-57095-1).								
2.	David L. Nelson Michael M. Cox (2007) Lehninger Principles of Biochemistry.								
3.	Metzler, D. E. Biochemistry, Vol. 1 & II, 2nd Edn., Academic Press, 2003.								
4.	D. Voet, (2008) Fundamentals of Biochemistry, J. Wiley.								
5.	Voet, D. and Voet, J. G. Biochemistry, 3rd Edn., John Wiley & Sons, 2004.								
6.	R. K. Murray, D. K. Granner, P. A. Mayes, V. W. Rodwell Harper's Biochemistry, 27th Edition, McGraw Hill, 2006.								

Programme Specific Outcome (PSO)

The molecular biology coursework is concerned with the biological activity at the molecular level, studying the genome structure of an organism and its function which includes genetics, proteins and nucleic acids. It will be beneficial in conducting research, analysing data and implementing best practices in a laboratory set up. It will give a deeper understanding of biosciences. Molecular Biology is significant in understanding the origin of diseases and to make changes in an organism to create a potential cure or assist in easing the diseases. These are basic compulsory subjects. Students will opt for Research, teaching and R and D placements.

Syllabus of Courses

		The Maharaja Sayajirao University of Baroda Faculty of Science Department of Biochemistry			Academic Year			2025-2026			
M.Sc. (Medical Biotechnology): Higher Payment Programme											
Year	II	Core / Elective / Foundation MBT2309C09: Gene Expression and Modulation			Credits / Hours per week			03/03			
Semester	I	Year of Introduction: 2012 Year of Syllabus Revision: 2022			Maximum Marks / Grade			100			
Mode of Transaction		Lectures and Tutorials									
Course Outcome (CO) MBT2309C09 CO1: Learning DNA replication, repair and transposition CO2: Learning DNA recombination and translation apparatus. CO3: Learning translation and regulation of gene expression in prokaryotes and eukaryotes.											
Unit No.	Topic/Unit			Contact Hours	Weightage (%)	BT Level	CO	PSO	Element s of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional (R)/Global (G) developmental needs	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional Ethics

								(PE)
1	Transcription: Core and regulatory elements in transcription of prokaryotic and eukaryotic genes, Structure and mode of action of prokaryotic and eukaryotic RNA polymerases. Co- and –post transcriptional modifications in prokaryotes and eukaryotes, RNA Processing and Splicing, Catalytic RNA.	15	33	1,2,3	CO1			
2	Translation in Prokaryotes, Eukaryotes and Regulation of Gene Expression: Mechanism of translation in prokaryotes and eukaryotes, Structure of tRNA, rRNA and mRNA, ribosomes. Genetic code, post translational modifications, inhibitors of protein synthesis. Regulation of protein synthesis in prokaryotes and eukaryotes	15	34	1,2,3	CO2			
3	Molecular tools for studying Genes and Gene activity: Analysis of Gene expression, Knock-in, gene knock outs. Techniques used for controlled gene expression: tet systems, antisense oligonucleotides, RNA interference etc. Tools and techniques for mapping and DNA finger printing. Principles and methods of nucleic acid sequencing and synthesis.	15	33	1,2,3	CO3			
Reference Books								
1.	B. Lewin, J. E. Krebs, E. S. Goldstein and S. T. Kilpatrick (2008) Lewin’s Essential Genes, 2 nd Edn., Jones & Barlett Pub., USA.							
2.	R. Weaver (2011) Molecular Biology, 5th Edn., McGraw-Hill.							
3.	J. D. Watson, T. A. Baker, S. P. Bell, A. Gann, M. Levine, R. Losik, CSHLP (2017) Molecular Biology of the Gene, 7 th Edition, Pearson.							
4.	D. Clark (2018) Molecular Biology: Academic Cell, 3 rd Edn. Academic Press.							
5.	J. E. Krebs, E. S. Goldstein and S. T. Kilpatrick (2017) Lewin’s Genes XII, 12th Edn., Jones & Barlett Pub., USA.							
6.	Twyman, R.M. (1998) Advanced Molecular Biology, Bios Scientific Publ.							

Programme Specific Outcome (PSO): MBT2304C04: Hormone Regulation and Diseases

Hormones are master regulators of all biochemical processes in the body. To appreciate and understand the intricacies of biochemical regulation a thorough knowledge of endocrinology is important. This course gives the students a complete understanding of the synthesis, action and consequences of disturbances of each hormone. The course will help in proper understanding of the origin of diseases and to make changes in an organism to create a potential cure or assist in easing the diseases.

It is a basic compulsory subject. Students can easily be absorbed for Research, teaching and in R and D divisions of pharmaceutical companies.

Syllabus of Courses

		The Maharaja Sayajirao University of Baroda Faculty of Science Department of Biochemistry	Academic Year		2025-2026						
M.Sc. (Medical Biotechnology): Higher Payment Programme											
Year	II	Core / Elective / Foundation MBT2304C04: Hormone Regulation and Diseases		Credits / Hours per week				03/03			
Semester	I	Year of Introduction: 2012 Year of Syllabus Revision: 2019		Maximum Marks / Grade				100			
Mode of Transaction		Lectures and Tutorials									
Course Outcome (CO) MBT2304C04 Hormone Regulation and Diseases CO1: Basis of Endocrinology and Neuroendocrinology CO2: Hormones of Thyroid, parathyroid and GIT hormones and their action. CO3: Steroid hormone and synthesis											
Unit No.	Topic/Unit			Contact Hours	Weightage (%)	BT Level	CO	PSO	Element s of Employa bility (Emp)/ Entrepre neurship (Ent)/ Skill Develop	Relevan ce to Local (L)/ National (N)/ Regional (R)/Glob al (G) develop	Relation to Gender (G), Environ ment and Sustaina bility (ES), Human

							ment (SD)	mental needs	Values (HV)and Professio nal Ethics (PE)
1	Overview of endocrine glands, classification of hormones, synthesis, secretion and function; Regulation- negative and positive feedback; neuroendocrinology; Methods of hormone assays, hypothalamus-pituitary and its disorders.	15	40	1,2,3,4	CO1				
2	Thyroid, parathyroid (calcium homeostasis hormones)-hyper and hypo secretions; Goiter, grave disease, Rickets, Osteomalacia, and their diagnosis	15	30	1,2,3	CO2				
3	Steroid hormones of adrenal and reproductive axis. Adrenal medulla. Disorders of adrenal-Cushings syndrome, CAH, Addison's disease, Pheochromocytoma, Hypo- and hypergonadism – pathology and Diagnosis	15	30	1,2,3	CO3				
Reference Books									
1.	Kronenberg, H., Williams, R. H. (2008) Textbook of endocrinology								
2.	Nussey, S. Whitehead, S. A. (2001) Endocrinology: an integrated approach								
3.	Baulieu, E. E. and Paul A. Kelly, P. A. (2009) Hormones: from molecules to disease								
4.	Williams Textbook of Endocrinology (2010) Melmed et al								

Programme Specific Outcome (PSO)

Biostatistics coursework teaches students making a hypothesis for a research problem, collecting data either by experimenting, or from the records or by conducting surveys. It also teaches how to be unbiased and present the data in an assimilable fashion using tables and graphs, use of measures of central tendency and variation. Students are also taught concepts of probability, binomial and Poisson distributions and normal distribution. Testing the hypothesis using various test of statistics. Finally the student learns how to draw inferences from his data. Hence, the course is very essential for conducting research, and analysing data. The understanding of Biostatistics help them in understanding disease transmission patterns, efficacy of drugs and choice of treatment strategies etc. These are basic compulsory subjects, occupying centre stage in Research, teaching and R and D placements.

Syllabus of Courses

		The Maharaja Sayajirao University of Baroda Faculty of Science Department of Biochemistry		Academic Year		2025-2026					
M.Sc. (Medical Biotechnology): Higher Payment Programme											
Year	II	Core. MBT2305C05 Medical Microbiology		Credits / Hours per week		3/3					
Semester	I	Year of Introduction: 2016 Year of Syllabus Revision: 2019		Maximum Marks / Grade		100 each					
Mode of Transaction		Lectures									
Course Outcome (CO) MBT2305C05											
CO1 Understanding of infectious diseases and their epidemiology.											
CO2 Learn about factors affecting pathogenesis and transmission of infectious diseases.											
CO3 Learn about important and emerging infectious diseases.											
CO4 Understand the molecular pathogenic mechanisms used by different pathogens.											
CO5 Understanding of diagnosis, treatment and prevention of infectious diseases.											
Unit No.	Topic/Unit			Contact Hours	Weightage (%)	BT Level	CO	PSO	Element s of Employa bility (Emp)/ Entrepre neurship (Ent)/ Skill	Relevan ce to Local (L)/ National (N)/ Regional (R)/Glob al (G)	Relatio n to Gender (G), Environ ment and Sustaina bility (ES),

[illegible]

Programme Specific Outcome (PSO)

PSO2 introduction to Molecular biology techniques

PSO3 Genetics

 The Maharaja Sayajirao University of Baroda Faculty of Science Department of Biochemistry		Academic Year		2025-2026			
M.Sc. (Medical Biotechnology): Higher Payment Programme							
Year	II	Core / Elective / Foundation Practical-III (MBT2306C06)	Credits / Hours per week		09/18		
Semester	I	Year of Introduction: 2019 Year of Syllabus Revision: 2019	Maximum Marks / Grade		100		
Mode of Transaction		Laboratory Experiments, discussion and viva	PSO7 is common for all experiments				
Course Outcome (CO) Practical-III (MBT2306C06) CO1 Estimation of metabolites for disease diagnosis CO2 Molecular diagnosis by PCR CO3 Genetic manipulations of bacteria C04: Statistical methods							
No.	Experiment		Hours	% weightage	BT Level	CO	PSO
1.	Clinical Chemistry: Introduction to Clinical chemistry, glucose estimation- kit based and colorimetric assay, lipid profile, Hemoglobin content, Alkaline phosphatase, Aminotransferases assay, Creatinine. Molecular based diagnosis- PCR and types of PCR		48	35	1,2	CO1 , CO2	
2	Genetics: Bacterial Transformation, transformation, recombination, mutation analysis		48	35	2	CO3	
3	Research methods: sampling, grouping, T tests, ANOVA		48	30	2	CO4	
Reference books							
1	Clinical Chemistry- Varley						
2	Biochemistry By Voet and Voet						

SEMESTER IV

Programme Specific Outcome (PSO)

The Human Genetics, stem Cell and Regenerative Biology is an upcoming field of biology and deals with how genetic diseases are inherited and how their distribution is studied in an given population and what laws govern the equilibrium. Stem cells are providing a new avenue to treat multiple diseases due to their ability to transform into any given cell type and that is covered under regenerative biology. It will be beneficial in conducting research, analysing data and implementing best practices in a laboratory set up. It will give a deeper understanding of biosciences. Genetics is significant in understanding the origin of diseases and to make changes in an organism to create a potential cure or assist in easing the diseases.

These are basic compulsory subjects. Students will opt for Research, teaching and R and D placements.

Syllabus of Courses

	The Maharaja Sayajirao University of Baroda Faculty of Science Department of Biochemistry		Academic Year			2025-2026				
M.Sc. (Medical Biotechnology): Higher Payment Programme										
Year	II	Core / Elective / Foundation MBT2401C09-: Human Genetics, Stem Cell and Regenerative Biology	Credits / Hours per week			03/03				
Semester	II	Year of Introduction: 2019 Year of Syllabus Revision: 2019	Maximum Marks / Grade			100				
Mode of Transaction		Lectures and Tutorials								
Course Outcome (CO) MBT2401C09 CO1: Learning methods in molecular biology, molecular cloning methods and analysis of cloned genes. CO2: Learning molecular tools for studying genes and gene activity. CO3: Learning heterologous gene expression; protein-protein interactions; cell cycle, cell death, and cancer.										
Unit No.	Topic/Unit		Contact Hours	Weightage (%)	BT Level	CO	PSO	Element s of Employa bility (Emp)/ Entrepre neurship (Ent)/	Relevan ce to Local (L)/ National (N)/ Regional (R)/Glob	Relation to Gender (G), Environ ment and Sustaina bility

							Skill Develop ment (SD)	al (G) develop mental needs	(ES), Human Values (HV)and Professio nal Ethics (PE)
1	Principles of population genetics, Hardy-Weinberg law and its application for autosomal genes. Epigenetics, mitochondrial inheritance. Inherited human diseases, single gene diseases, complex traits, Statistical methods for genetic analysis of complex traits.	15	33.33	1,2,3,4	CO1				
2	Types of stem Cells- Totipotency, pluripotency, multipotency and unipotency. Embryonic stem cells, induced pluripotent stem cells, adult stem cells, hematopoietic stem cells, mesenchymal stem cells. Differentiation: Cellular basis of differentiation, trans-differentiation, and dedifferentiation. Stem cells maintenance of stemness and control of differentiation, characterization, expansion, regeneration, repair and ageing.	15	33.33	1,2,3	CO2				
3	Expression and growth kinetics of different types of stem cells, ES cell technologies, somatic cell cloning and hybridization. Transfection & transformation of cells. Concept of Cell replacement therapy and regenerative medicine. Stem cell Niche. Stem cell applications.	15	33.33	1,2,3	CO3				
Reference Books									
1.	Embryonic Stem cells by E.Notari Anni and MJ Evans								
2.	Stem Cell assays by Mohan C , Vemunri								
3.	Biochemistry of Cell signaling by JM Helmreich								
4.	Population Genetics By Hartel and Clarke								
5.	Hartl, D. L. & E. W. Jones (2005) Genetics: Analysis of Genes and Genomes. 6th Edn., Jones & Bartlett Publishers.								
6.	A. Gardener & T. Davies (2009) Human Genetics, 2nd Edn., Scion Publ., UK.								

Programme Specific Outcome (PSO)

The molecular biology coursework is concerned with the biological activity at the molecular level, studying the genome structure of an organism and its function which includes genetics, proteins and nucleic acids. It will be beneficial in conducting research, analysing data and implementing best practices in a laboratory set up. It will give a deeper understanding of biosciences. Molecular Biology is significant in understanding the origin of diseases and to make changes in an organism to create a potential cure or assist in easing the diseases.

These are basic compulsory subjects. Students will opt for Research, teaching and R and D placements.

Syllabus of Courses

	The Maharaja Sayajirao University of Baroda Faculty of Science Department of Biochemistry		Academic Year		2025-2026					
M.Sc. (Medical Biotechnology): Higher Payment Programme										
Year	II	Core / Elective / Foundation MBT2409C16: Recombinant DNA Technology and Information Biology	Credits / Hours per week				03/03			
Semester	II	Year of Introduction: Year of Syllabus Revision: 2022	Maximum Marks / Grade				100			
Mode of Transaction		Lectures and Tutorials								
Course Outcome (CO) MBT2409C16 CO1: Understanding the tools and techniques for biological data analysis and annotation. CO2: Learning molecular tools for gene cloning and its analysis. CO3: Learn about approaches to study protein-protein interactions and heterologous gene expression. CO4: Learn about molecular tools and techniques for functional genomics and genome analysis.										
Unit No.	Topic/Unit		Contact Hours	Weightage (%)	BT Level	CO	PSO	Element s of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Develop	Relevan ce to Local (L)/ National (N)/ Regional (R)/Glob al (G) develop	Relation to Gender (G), Environ ment and Sustaina bility (ES), Human

[illegible]

1. Remember 2. Understand 3. Application 4. Analysis 5. Evaluation 6. Creation

Programme Specific Outcome (PSO)

		The Maharaja Sayajirao University of Baroda Faculty of Science			Academic Year			2025-2026												
M.Sc. (Medical Biotechnology): Higher Payment Programme																				
Year		II		Core: Optional Paper I MBT 2403C11 Molecular Medicine			Credits / Hours per week			03/03										
Semester		II		Year of Introduction: 2007 Year of Syllabus Revision: 2019			Maximum Marks / Grade			100										
Mode of Transaction				Lectures and Tutorials																
Course Outcome (CO) MBT 2403C11 MOLECULAR MEDICINE CO1- Deals with GIT, Liver and Blood Disorders CO2- Emphasis on The Heart diseases Co3- Life style Disorders																				
<table border="1"> <thead> <tr> <th>Unit No.</th> <th>Topic/Unit</th> <th>Contact Hours</th> <th>Weightage (%)</th> <th>BT Level</th> <th>CO</th> <th>PSO</th> <th>Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)</th> <th>Relevance to Local (L)/ National (N)/ Regional(R) /Global (G) development al needs</th> <th>Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional Ethics (PE)</th> </tr> </thead> </table>											Unit No.	Topic/Unit	Contact Hours	Weightage (%)	BT Level	CO	PSO	Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional(R) /Global (G) development al needs	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional Ethics (PE)
Unit No.	Topic/Unit	Contact Hours	Weightage (%)	BT Level	CO	PSO	Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional(R) /Global (G) development al needs	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional Ethics (PE)											

1	Biochemical and molecular basis of pathogenesis, clinical course, diagnosis and treatment of GIT disorders, Liver diseases like jaundice, hepatitis, fibrosis, necrosis and cirrhosis. Acute and chronic renal failure Glomerular and tubular renal diseases.	15	40	1,2,3	CO1, CO2, CO3				
2	Physiology of heart, Myocardial infarction, Heart Failure, Hypertension. Atherosclerosis, Biochemical and molecular basis of Haemoglobinopathies and other blood disorders.	15	30	1,2,3	CO1, CO2, CO3				
3	Biochemical and molecular basis of metabolic disorders and life style disorders –metabolic syndrome, PCOD, Obesity AND Inflammation; Alzheimer’s Disease, Major Depression.	15	30	1,2,3	CO1, CO2, CO3				

Reference Books

1.	Tietz Textbook of Clinical Chemistry, Third Edition. Carl A. Burtis and Edward R. Ashwood, eds.
2.	Marshall WJ, Bangert SK. (2008) Clinical Chemistry, 6th Edition. Edinburgh, London: Mosby Elsevier.
3.	Kumar, V., Abbas, A. K., Fausto, N. & Aster, J. C. (2010) Robin & Cotron Pathologic basis of Disease. 8 th Edn., Saunders-Elsevier.
4.	J. Vijg (2007) Aging of the Genome, Oxford Univ. Press.
5.	C. A. Burtis, Edward R. Ashwood and D. E. Bruns (2007) Tietz Fundamentals of Clinical Chemistry. 6thEdn., Saunders
6.	B. S. Weeks & I. E. Alcamo (2010) AIDS : The Biological Basis. 5thEdn., Jones & Bartlett Publ., USA.
7.	Clinical Chemistry: Principles, Procedures, Correlations, 5th ed. Michael L. Bishop, Edward P. Fody, & Larry Schoeff. Baltimore, MD: Lippincott Williams & Wilkins, 2005.
8.	Clinical chemistry. William J. Marshall, William J. Marshall (Ph. D.), S. K. Bangert

		The Maharaja Sayajirao University of Baroda Faculty of Science			Academic Year			2025-2026			
M.Sc. (Medical Biotechnology): Higher Payment Programme											
Year	II	Core: Optional Paper I MBT2407C15 Neurobiology and Neurological disorders			Credits / Hours per week			03/03			
Semester	II	Year of Introduction: 2007 Year of Syllabus Revision: 2019			Maximum Marks / Grade			100			
Mode of Transaction		Lectures and Tutorials									
Course Outcome (CO) MBT2407C15 Neurobiology and Neurological disorders CO1- Physiology of the Nervous system CO2- Neurochemistry of neurotransmitters CO3- Neurodegenerative disorders											
Unit No.	Topic/Unit			Contact Hours	Weightage (%)	BT Level	CO	PSO	Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional(R) /Global (G) development al needs	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional Ethics (PE)
1	Nervous system overview –ultra structure and function ; structure of Blood Brain Barrier, compartmentation of function and its correlation with glial cells			15	40	1,2,3	CO1, CO2, CO3				
2	Biochemistry of various neurotransmitters-excitatory and Inhibitory; Neurochemistry of sensory system- Visual, Auditory, Somatosensory, Chemosensory system.			15	30	1,2,3	CO1, CO2, CO3				

3	Neurodegenerative disorders with special emphasis on polyglutamine repeat disorders like Huntington's Disease and Ataxias, Mode of pathogenicity of mutant proteins, learning and memory; Neurobiology of circadian rhythms - cellular rhythms, organismal rhythms-central and peripheral regulation of Circadian rhythm	15	30	1,2,3	CO1, CO2, CO3				
Reference Books									
1.	Eric Kandel, James Schwartz, Thomas Jessell. (2000) Principles of Neural Science. 4 th ed McGraw-Hill, Health Professions Division								
2.	Mark F. Bear, Barry W. Connors, Michael A. Paradiso (2007) Neuroscience 3ed.,Lippincott Williams & Wilkins								
3.	John G. Nicholls, A. Robert Martin, Paul A. Fuchs, David A. Brown, Mathew E. Diamond, and David A. Weisblat (2012). From Neuron to Brain. 5 th Edn.,Sinauer Publ								
4.	Irvin Leritan and Leonard K Acznarck, (2001) The Neuron, Cell and Molecular Biology, 3rd Edn., Oxford University Press, USA.								
5.	W. Wang (2008) Molecular Mechanisms of Neurotransmitter release. Humana Press.								
6.	Dale Purves, George J. Augustine, David Fitzpatrick, William C. Hall, Anthony-Samuel LaMantia, Leonard E. White (2011)Neuroscience, Fifth Edition Sinauer Associates, Inc.								
7.	Larry R. Squire, Darwin Berg, Floyd Bloom, Sascha du Lac, Anirvan Ghosh (2008) Fundamental Neuroscience, Third Edition by Academic Press.								

Programme Specific Outcome (PSO)

The Medicinal Drug Discovery and design coursework is concerned with understanding of drug action and its effect. The course is designed mainly to aim the students that are needed for their entry at pharma industry and academia. It will be beneficial for designing drug discovery research, analysing data and implementing best practices in a laboratory set up. This is an optional paper wherein students opt to cater the current research in pharmacology. This course touches the basic aspects for translational research.

Syllabus of Courses

		The Maharaja Sayajirao University of Baroda Faculty of Science		Academic Year			2025-2026				
M.Sc. (Medical Biotechnology): Higher Payment Programme											
Year	II	Core: Medicinal Drug Discovery and design (Optional Paper I) (MBT2408C15)			Credits / Hours per week			03/03			
Semester	II	Year of Introduction: 2007 Year of Syllabus Revision: 2019			Maximum Marks / Grade			100			
Mode of Transaction		Lectures and Tutorials									
Course Outcome (CO) MBT2408C15 Medicinal Drug Discovery and design C01- helps in understanding what body does to drug. Its implications on various interactions. C02- helps in understanding Drug action and its efficacy C03- Drug discovery research											
Unit No.	Topic/Unit			Contact Hours	Weightage (%)	BT Level	CO	PSO	Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional(R) /Global (G) development al needs	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional Ethics (PE)
1	Basics of pharmacology: What are Drugs, Receptor interactions, Agonist, antagonist, partial agonist &			15	40	1,2,3	CO1, CO2,		This course		

	reverse agonist, administration, absorption, distribution, bioavailability and excretion.				CO3		is very important for jobs in pharma industry .		
2	Basics of medicinal chemistry: Molecular structure, Solubility, Stability, Isomerism, Molecular Recognition, SAR, QSAR, Bioisosteres, Hansch equation, Craig's plot.	15	30	1,2,3	CO1, CO2, CO3				
3	Drug development: Basic aspects of drug development, Screening of Drugs, Hit identification, Lead and candidate development& optimization, IND filing, <i>Denovo</i> and computer based drug design, Preclinical development Mode of action, e.g. antacids, pain killers	15	30	1,2,3	CO1, CO2, CO3				
Reference Books									
1. Dale's Pharmacology. 6th Edition. H.P. Rang James M. Ritter Maureen M. Dale Philip Moore									
2. Goodman & Gilman's The Pharmacological Basis of Therapeutics ed. Laurence Brunton, John Lazo, Keith Parker									
3. Pharmacology and Pharmacotherapeutics, RS Satoskar, SD Bhandarkar									

Programme Specific Outcome (PSO)

PSO1 Learn basics of techniques in biochemistry applicable to all areas of life science and contribute to further knowledge

PSO2 Basic understanding and application of the biochemical techniques through their use in analysis

PSO3 Learn methods to determine levels of biomolecules, principles of estimation and calculation

PSO4 Demonstrate latest techniques in estimation with principles involved

PSO5 Determination of enzymes involved in various processes with their kinetics

PSO6 Training and exposure to research problems through dissertation

		The Maharaja Sayajirao University of Baroda Faculty of Science Department of Biochemistry				Academic Year		2025-2026			
M.Sc. (Medical Biotechnology): Higher Payment Programme											
Year		II		Core MBT2404C12: Practicals IV- Disease Diagnostics			Credits / Hours per week		04/08 Hrs		
Semester		II		Year of Introduction: 2016 Year of Syllabus Revision: 2019			Maximum Marks / Grade		100		
Mode of Transaction			Laboratory Experiments, discussion and viva				PSO3 is common for all experiments				
Course Outcome (CO) MBT2404C12 CO1 Introduction to different disease diagnostic techniques CO2 Practical demonstration of various diagnostic techniques CO3 Understanding the principle, methodology, data collection and analysis of different experiments											
No.	Experiment						Contact Hours	Weightage (%)	BT Level	CO	PSO
1	Introduction to different disease diagnostic techniques						36	20	1, 2	CO1	
2	Practical demonstration of various diagnostic techniques						42	40	2, 3	CO2	
3	Understanding the principle, methodology, data collection and analysis of different experiments						60	40	4, 5	CO3	
Reference books											
1	Clinical Chemistry- Varley										
2	Principles and techniques of Medical Biotechnology and Molecular biology by Wilson and Walker										

Programme Specific Outcome (PSO)

PSO1 Training and exposure to research problems through dissertation

		The Maharaja Sayajirao University of Baroda Faculty of Science Department of Biochemistry			Academic Year		2025-2026			
M.Sc.(Biochemistry)										
Year		II	Core MBT2406C14: Project Work			Credits / Hours per week		06/12 Hrs		
Semester		II	Year of Introduction: 2016 Year of Syllabus Revision: 2019			Maximum Marks / Grade		100		
Mode of Transaction		Laboratory Experiments, Introduction and Result and Discussion seminars				PSO1 is common for all experiments				
Course Outcome (CO) MBT2406C14 CO1 Introduction to research proposal in form of a seminar CO2 Carrying experiments towards achieving proposed objectives CO3 Analyzing data and presenting in Results and Discussion seminar										
No.	Experiment					Contact Hours	Weightage (%)	BT Level	CO	PSO
1	Introduction to research proposal in form of a seminar					23	10	1, 2	CO1	
2	Carrying experiments towards achieving proposed objectives					82	65	2, 3, 6	CO2	
3	Analyzing data and presenting in Results and Discussion seminar					46	25	4, 5	CO3	