

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

Papers for M. Sc. (Biochemistry) Semester syllabus

	THEORY SEMESTER - I	CREDITS	Course Code
PAPER I	Basic Biochemistry	03	BCH2101C01
PAPER II	Protein Structure and Function & Basic Enzymology	03	BCH2102C02
PAPER III	Cell Biology	03	BCH2103C03
PAPER IV	Biophysical techniques and Biostatistics	04	BCH2109C09
PAPER V	Basic Molecular Biology	03	BCH2108C08
	Practical-I	09	BCH2106C06
	Viva (Internal)	01	BCH2107C07
	Total Credits	26	
	THEORY SEMESTER - II	CREDITS	Course Code
PAPER I	Metabolism I	03	BCH2201C08
PAPER II	Advance Cell Biology	03	BCH2202C09
PAPER III	Enzymology	02	BCH2209C16
PAPER IV	Basic Physiology	03	BCH2204C11
	Practical-II	09	BCH2206C13
	Viva (Internal)	01	BCH2207C14
	Seminar	01	BCH2208C15
	TOTAL CREDITS	22	

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

Papers for M. Sc. (Biochemistry) Semester syllabus

	THEORY SEMESTER - III	CREDITS	Course Code
PAPER I	Basic Immunology	03	BCH2301C01
PAPER II	Metabolism-II	03	BCH2302C02
PAPER III	Molecular Biology-II	03	BCH2311C09
PAPER IV	Endocrinology	03	BCH2304C04
PAPER V	Basic Pharmacology (Optional Paper- I)	03	BCH2308C08
PAPER V	Advanced Plant Biochemistry (Optional Paper- I)	03	BCH2309C08
PAPER V	Biochemical Toxicology (Optional Paper- I)	03	BCH2310C08
	Practical-III	09	BCH2305C05
	Viva (Internal)	01	BCH2306C06
	Seminar	01	BCH2307CO7
	Total Credits	26	
	THEORY SEMESTER - IV	CREDITS	Course Code
PAPER I	Genetics	03	BCH2411C16
PAPER II	Genetic Engineering, Genomics and Bioinformatics	03	BCH2412C17
PAPER III	Biochemical basis of diseases (Optional Paper 1)	03	BCH2406C14
PAPER III	Microbial Adaptive Biology (optional Paper I)	03	BCH2407C14
PAPER III	Structural Biology (Optional Paper- I)	03	BCH2408C14
PAPER IV	Neurochemistry (Optional Paper- II)	03	BCH2409C15
PAPER IV	Nutrition and Developmental Biology (Optional Paper- II)	03	BCH2410C15
	Practical -IV	04	BCH2403C11
	Viva (External)	01	BCH2404C12
	Project Work	06	BCH2405C13
	TOTAL CREDITS	23	

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

Programme Name: **MSc. (Biochemistry)**

Programme Specific Outcome (PSO)

Biochemistry helps in understanding life through understanding the complex chemistry that sustains life. It helps in the study of biological processes at the cellular and molecular level. It emerged as a distinct science, branching off from chemistry around 100 years ago when scientists combined chemistry, physiology, and biology to understand living systems in greater depths. The department of Biochemistry at the M.S. University of Baroda was established in the year 1955 and is one of the oldest and prominent departments in the country. This course offers students the entire range of subjects that comes under the purview of biochemical sciences. The course covers in depth topics in metabolism, proteins and enzymology, cell biology, molecular biology, physiology, endocrinology, immunology, genetics, plant biochemistry, neurochemistry etc.

At the end of the course students can go for PhD or can find job in pharmaceutical industry or academia.

Syllabus of Courses

 सत्यं शिवं सुन्दरम्	The Maharaja Sayajirao University of Baroda Faculty of Science Department of Biochemistry		Academic Year			2025-2026				
M.Sc. BIOCHEMISTRY: Regular Program										
Year	1	Core. Basic Biochemistry BCH2101C01	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) BCH2101C01										
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 biochemistry.										
Unit No.	Topic/Unit		Contact Hours	Weightage (%)	BT Level	CO	PSO	Elements of Employa	Relevance to Local	Relation to Gender

							bility (Emp)/ Entrepre neurship (Ent)/ Skill Develop ment (SD)	(L)/ National (N)/ Regional (R)/Glob al (G) develop mental needs	(G), Environ ment and Sustaina bility (ES), Human Values (HV)and Professio nal 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	34	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	33	1,2,3,4	CO3 toCO6				

Reference Books

1.	D. Voet (2010) Biochemistry, 4th edition, John Wiley & Sons (ISBN: 978-0-470-57095-1).
2.	<u>D. L. Nelson and M. M. Cox (2007) Lehninger Principles of Biochemistry, Fourth Edition.</u>
3.	R. H. Garrett and C. M. Grisham (2008) <u>Biochemistry</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) Biochemistry, Vol. 1 & II, 2 nd Edn., Academic Press.
7.	R. R. Crichton (2008) Biological Inorganic Chemistry : An Introduction, Elsevier.

Programme Specific Outcome (PSO)

Proteins being workhorses of a cell understanding their structure is absolutely essential for students of biochemistry 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. Enzyme inhibitions studies are 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. Biochemistry: Regular Program												
Year	I	Core: BCH2102C02 Protein Structure and Function & Basic Enzymology			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) BCH2102C02 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 Employa	Relevance to Local	Relation to Gender

							bility (Emp)/ Entrepre neurship (Ent)/ Skill Develop ment (SD)	(L)/ National (N)/ Regional (R)/Glob al (G) develop mental needs	(G), Environ ment and Sustaina bility (ES), Human Values (HV)and Professio nal 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) Biochemistry, 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 Biochemistry.								

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 Biochemistry SEMESTER I- Cell Biology

Programme Specific Outcome (PSO)

Cell Biology helps incoming student to understand the basic principles of Cell Biology. Cell evolution and theories to understand modern cell biology is one of the essential outcomes of this paper. The course also introduces the students to emerging tools and techniques in Cell Biology. Further, importance of different cellular organelles and the biochemical principles governing their functions are also covered.

Syllabus of Course

	The Maharaja Sayajirao University of Baroda Faculty of Science		Academic Year	2025-2026
M.Sc. Biochemistry-Regular Program				
Year	I	Core: BCH2103C03 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) BCH2103C03 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) development al 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. Walter, A. Johnson and M. Raff. (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 Biochemistry SEMESTER I- Analytical Biochemistry 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. (Biochemistry): Regular Program				
Year	I	Core / BCH2109C09 Biophysical techniques and biostatistics	Credits / Hours per week	04/04
Semester	I	Year of Introduction: 2012 Year of Syllabus Revision: 2019	Maximum Marks / Grade	100
Mode of Transaction		Lectures and Tutorials		
Course Outcome (CO) BCH2109C09 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 (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	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 ultrafiltration, equilibrium dialysis, solvent extraction, precipitation, 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, Fluorescence, 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 biostatistics, 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 Biochemistry : The Foundations of Molecular Biophysics, 2nd Edn., Springer, NY.
2.	P. J. Walla (2009) Modern Biophysical Chemistry, Wiley-VCH.
3.	D. Sheeham (2009) Physical Biochemistry 2nd Edn., Wiley-Blackwell.
4.	Wilson, K and Walker, J.M (2005) Principles and techniques of biochemistry 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 Biochemistry, Prentice Hall.
7.	Freifelder, D., 1982, Physical biochemistry: applications to biochemistry 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. (Biochemistry): Regular Programme				
Year	I	Core / BCH2108C08: Basic Molecular Biology	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) BCH2108C08 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	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	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 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.(Biochemistry)									
Year	I	Core BCH2106C06: Practicals I			Credits / Hours per week		09/18 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) BCH2106C06									
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 Biochemistry, Basics of laboratory principles, dos and don'ts in a biochemistry laboratory, BALANCES, PIPETTES; ACCURACY & PRECISION, BEER-LAMBERT'S LAW & COLORIMETERY, BUFFERS AND SOLUTIONS				32	16	1,2,3,4,5	CO1& CO2	PSO1
2	Basic Enzymology: Establishment of presence of enzyme as a catalyst --- Calculation of amounts/concentrations of product from OD values. --- Calculation/prediction of enzyme concentration --- Various types of blanks and their shortcomings, uses, pitfalls in usage. --- Measurement of dP or (-dS). Logic, obligatory situations, advantages and pitfalls behind use. Methods of terminating enzyme reactions: rationale. --- Plotting of data - various plots: uses, advantages, disadvantages, information obtained. --- Logic behind/purpose(s) of: measurement of variations of velocity with: {E}, {S}, pH, temp., time.				48	25	1,2,3,4,5	CO2	PSO1

3	Microbiology: Learning Laboratory techniques in Microbiology	48	25	1,2,3,4,5	CO2	PSO1
4	Biochemical analysis: Iron, phosphate, Ascorbic acid and Protein estimation by colorimetry	32	17	1,2,3,4,5	CO2	PSO2
5	Protein folding: Understanding mechanism of Protein folding	32	17	1,2,3,4,5	CO2	PSO1
Reference books						
1	Clinical Chemistry- Varley					
2	Biochemistry By Voet and Voet					

SEMESTER II

Syllabus of Courses

		The Maharaja Sayajirao University of Baroda Faculty of Science Department of Biochemistry		Academic Year		2025-2026					
M.Sc.(BIOCHEMISTRY) : Regular Programs											
Year	I	Core. Metabolism I BCH2201C08		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) BCH2201C08 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)/Entrepre	Relevance to Local (L)/ National (N)/	Relation to Gender (G), Environment 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	Carbohydrate Metabolism (organization, reactions, regulation etc.)- Glycolysis, Glycogenolysis, Glycogenesis & Gluconeogenesis; HMP, E-D, Glyoxylate pathways.	15	33	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) Biochemistry, 4th edition, John Wiley & Sons (ISBN: 978-0-470-57095-1).								
2.	D. L. Nelson and M. M. Cox (2007) <u>Lehninger Principles of Biochemistry, Fourth Edition.</u>								
3.	R. H. Garrett and C. M. Grisham (2008) <u>Biochemistry</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) Biochemistry, Vol. 1 & II, 2 nd Edn., Academic Press.								

SEMESTER II- Advance Cell Biology

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 in metabolism. 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
---	--	----------------------	------------------

M.Sc.(BIOCHEMISTRY) : Regular Programs									
Year	I	Core: Advance Cell Biology BCH2202C09	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) BCH2202C09 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) development al 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. Harvey Lodish Mol Cell Biology (2016).
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.
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.

Programme Specific Outcome (PSO)- Enzyme Mechanism & Regulation (BCH2203C09)

	The Maharaja Sayajirao University of Baroda Faculty of Science Department of Biochemistry				Academic Year		2025-2026			
M.Sc. BIOCHEMISTRY : Regular Programs										
Year	I	Core: BCH2209C16: Enzymology	Credits / Hours per week				2/2			
Semester	II	Year of Introduction: 2016 Year of Syllabus Revision: 2022	Maximum Marks / Grade				50			
Mode of Transaction		Lectures								
Course Outcome (CO) BCH2209C16										
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 (Emp)/ Entrepreneurship (Ent)/ Skill Development	Relevance to Local (L)/ National (N)/ Regional (R)/Global (G) development	Relation to Gender (G), Environment and Sustainability (ES), Human

							ment (SD)	mental needs	Values (HV)and Professio nal Ethics (PE)
1	Enzyme mechanism (acid, base, electrostatic, metal ion, free radical, transition state binding and covalent; proximity and orientation effects, contributions of strain; cofactors function; Experimental approaches to determine mechanism, along with illustration with eg.: chymotrypsin.	15	50	1,2,3,4	CO1 to CO6				
2	Allostery: co-operativity in hemoglobin; Hill equation & models of allostery; strategies of pathway regulation; multienzyme complexes and poly-functional proteins, their detection, purpose and importance for metabolic pathway; enzyme kinetics in vivo v/s in vitro. Logic behind and examples of Enzyme applications	15	50	1,2,3,4	CO1 to CO6				
Reference Books									
1.	D. Voet (2010) Biochemistry, 4th edition, John Wiley & Sons (ISBN: 978-0-470-57095-1).								
2.	<u>D. L. Nelson and M. M. Cox (2007) Lehninger Principles of Biochemistry, Fourth Edition.</u>								
3.	R. H. Garrett and C. M. Grisham (2008) <u>Biochemistry</u> 4th Edn., Brooks/cole Cengage Learning								
4.	PriceNC & Stevens.RL								
5.	Fersht, A. R. (1985) Enzyme structure and function, 2 nd Ed								
6.	Dixon and Webb, (1979) Enzymes.								

Programme Specific Outcome (PSO)

For a good in-depth understanding of Biochemistry 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 and Neurochemistry which are important for Biochemistry students. The course is basic and is compulsory for all Biochemistry students

This Physiology course will help in understanding the implications of diseases. A good understanding of this course will help students so 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. (Biochemistry): Regular Programme												
Year	I	Core / BCH2204C11: 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) BCH2204C11 CO1 Blood and its components; mechanism of homeostasis. CO2 Gastrointestinal physiology and Kidney function and its regulation CO3 Respiration and its regulation												
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 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	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)								

Programme Name: MSc. (Biochemistry)

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. (Biochemistry): Regular Programme							
Year	I	Core / BCH2206C13 : 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) BCH2206C13 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							
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	27	1,2	CO1	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	28	2	CO2	PSO2
3	Animal Experimentation: Introduction to animal Experiments, identification; sexing, tube feed, blood collection, injection, vaginal smear, marking, dissection.		16	10	2,3	CO3	PSO1, PSO2
4	Immunology: Basic experiments in immunological assays		16	10	3,4	CO4	PSO4
5	Molecular Biology: DNA isolation purification and Techniques in molecular biology		48	25	2,3	CO5	PSO1, PSO4
Reference Books							
1.	Biochemistry by Voet and Voet						
2.	Principles and techniques of Biochemistry 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				
MSC BIOCHEMISTRY-Regular Program										
Year	II	Core: BCH2301C01 Basic Immunology		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 BCH2301C01CO1- 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 Employability (Emp)/ Entrepreneurship (Ent)/ Skill	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)

							Develop ment (SD)		
1	Nature of Immunity; Cells and tissues of Immune system; Type of immunity: Innate and adaptive immunity, Innate Immunity, Tissue and Cells of the innate immunity, Phagocytes, NK cells, MALT system; Mechanisms of Migration of immune cells into primary and secondary lymphoid organs.	15	33.33	1, 2,3	CO1			National and Global Research	
2	Nature of Antigens; Role of Microbial Associated Molecular Patterns (Toll-like receptors & Nod Like Receptors); Complement System., Different types of complement system its role in immunity Structure and function of antibodies; Types of antibodies, generation of diversity	15	33.33	1,2,3	CO2				
3	Structure and function of T cell receptors, Generation of Diversity, Positive and Negative selection, Activation of T and B cells, Histocompatibility antigens - HLA and Disease, Antigen Presentation, T cell differentiation	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.

	The Maharaja Sayajirao University of Baroda Faculty of Science Department of Biochemistry	Academic Year	2025-2026	
MSC BIOCHEMISTRY				
Year	II	Core: BCH2302C02 Metabolism II	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) BCH2302C02 CO1- Learn about evolution of Electron Transport Chain and its variants in different living systems CO2- Learn about Thermodynamic considerations of ETC and its role in thermoregulation CO3- Learn about Theories of energy coupling in ETC CO4- Learn about production of ROS in ETC and its removal CO5-Learn about Nucleotide metabolism CO6-Learn about Integration of Metabolism CO7- Learn about in-born errors of Metabolism				

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	Bioenergetics: Thermodynamic Considerations of the operation of Electron Transport Chain and energy generation (Animals, Plants, and Bacteria). Chemiosmotic theory of Energy Coupling; BAT; Regulation of body temperature	15	33.33	1, 2,3	CO1, CO2			National and Global Research	
2	Integration of intermediary metabolism, Biochemical correlates of altered metabolism (diseased states),organ specialization; Mechanisms of 1-electron & 2-electron transfers, Fe-S clusters, cytochromes; In brief: generation of ROS and Mechanism of oxidative damage (Fenton reaction) & targets. Anti-oxidant defenses (SOD, Catalases etc.). Ageing..	15	33.33	1,2,3	CO3, CO4				
3	Nucleotide metabolism & disorders. Cancer cell metabolism. Metabolic specializations in Microorganisms.	15	33.33	1,2,3	CO5,C O6,CO7				
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. (Biochemistry): Regular Program										
Year	II	Core / Elective / Foundation BCH2311C09: Molecular Biology II	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) BCH2311C09 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 Employa bility (Emp)/ Entrepre neurship (Ent)/ Skill Develop ment (SD)	Relevan ce to Local (L)/ National (N)/ Regional (R)/Glob al (G) develop mental needs	Relation to Gender (G), Environ ment and Sustaina bility (ES), Human Values (HV)and Professio nal Ethics

							(PE)
1	Transcription: Structure of genes, promoters, enhancers. Structure and mode of action of E. coli RNA polymerase. Structure and mode of action of RNA polymerases I, II and III. 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: Gene expression profiling methods, Gene confirmation by gene disruption, gene knock outs. Techniques used for controlled gene expression: tet systems, antisense oligonucleotides, RNA interference etc. Applications of RFLP, AFLP, RAPDs 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): BCH2304C04: Endocrinology

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

 सत्यं शिवं सुन्दरम्	The Maharaja Sayajirao University of Baroda Faculty of Science Department of Biochemistry	Academic Year	2025-2026							
M.Sc. (Biochemistry): Regular Program										
Year	I	Core / Elective / Foundation BCH2304C04 : Endocrinology	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) BCH2304C04 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 ment (SD)	Relevan ce to Local (L)/ National (N)/ Regional (R)/Glob al (G) develop mental needs	Relation to Gender (G), Environ ment and Sustaina bility (ES), Human Values (HV)and Professio nal Ethics

									(PE)
1	General principles of endocrinology; Neuro-endocrinology- Neuro-immuno endocrinology, Chemistry, synthesis, catabolism and physiological action and mechanism of action of Hypothalamus and Pituitary hormones	15	40	1,2,3,4	CO1				
2	Chemistry, synthesis, catabolism and physiological action and mechanism of action, Thyroid, parathyroid, calcitonin, calcitriol, pancreatic and GIT hormones and their disorders.	15	30	1,2,3	CO2				
3	Chemistry, synthesis, catabolism and physiological action and mechanism of action of adrenals, Gonads and their disorders	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

Bloom's Taxonomy Levels:

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

Programme Specific Outcome (PSO)

The Pharmacology 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.

	The Maharaja Sayajirao University of Baroda Faculty of Science Department of Biochemistry		Academic Year	2025-2026
M.Sc. (BIOCHEMISTRY): Regular Programme				
Year	II	Core: Optional paper-I Basic Pharmacology BCH 2308C08	Credits / Hours per week	03/03
Semester	I	Year of Introduction: 2007 Year of Syllabus Revision: 2019	Maximum Marks / Grade	100
Mode of Transaction		Lectures and Tutorials		
Course Outcome (CO) BCH2308C08				

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	Types of Drugs, Drug absorption, distribution and excretion, Phase I & Phase II Biotransformation; Drug interactions; Drug reactions	15	40	1,2,3	CO1, CO2, CO3		This course is very important for jobs in pharma industry .		
2	Pharmacodynamics- Mechanism of action of drug at different target level. Receptor-ligand interactions. Theories of Receptor- ligand interactions; New Methods used in pharmacology. Drug Metabolism	15	30	1,2,3	CO1, CO2, CO3				
3	Basic aspects of drug development, Screening of Drugs, Lead identification & optimization. Preclinical development.	15	30	1,2,3	CO1, CO2, CO3				
Reference Books									
Dale's Pharmacology. 6th Edition. H.P. Rang James M. Ritter Maureen M. Dale Philip Moore									
Goodman & Gilman's The Pharmacological Basis of Therapeutics ed. Laurence Brunton, John Lazo, Keith Parker									
Pharmacology and Pharmacotherapeutics, RS Satoskar, SD Bhandarkar									

Programme Specific Outcome (PSO)

Biochemistry of plants has nuances slightly different from mammalian system. A good biochemists needs to understand the biochemical reactions and regulations in all systems. Advance plant biochemistry course is designed to give a flavor of the biochemical reactions in plants and to highlight the differences between different systems.

This is an optional subject and only students who desire to pursue PhD or academics in plant sciences take up the course.

Syllabus of Courses

 सत्यं शिवं सुन्दरम्	The Maharaja Sayajirao University of Baroda Faculty of Science Department of Biochemistry		Academic Year					2025-2026		
M.Sc. (Biochemistry): Regular Programme										
Year	II	Core: Optional paper-I BCH2309C08 Advanced Plant Biochemistry	Credits / Hours per week					03/03		
Semester	I	Year of Introduction: 2012 Year of Syllabus Revision: 2018	Maximum Marks / Grade					100		
Mode of Transaction		Lectures and Tutorials								
Course Outcome (CO) BCH2309C08 CO1: Understanding Phytohormones CO2: Adaptation to Light CO3: Secondary Metabolites										
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	Advances in Phytohormones and its Mechanism. Auxins, Gibberellins, Cytokinins, Ethylene, Abscissic Acid, Jasmonic acid, Brassinosteroids, etc		15	40	1,2,3	CO1				
2	Light Responses – Red, Far red and Blue light responses, photoreceptor involved and downstream signaling and its regulation		15	30	1,2,3	CO2				
3	Phenolic Metabolism - Shikimate, Phenylalanine and Phenylpropanoid pathways, Flavanoids, Lignins and Anthocyanin. Isoprenoid Metabolism - Terpenoids and Carotenoids; Alkaloids, Cyanogenic		15	30	1,2,3	CO3				

	glycosides and Non-protein amino acids.								
Reference Books									
1.	Plant Biochemistry by P. M. Dey (Editor), J. B. Harborne (2002)								
2.	Plant Physiology, Fourth Edition by Lincoln Taiz and Eduardo Zeiger (2006)								
3.	Biochemistry & Molecular Biology of Plants. Bob Buchanan, Wilhelm Gruissem, Russell Jones (2004)								
4.	Plant biochemistry by Lee and Ceopold (2000)								

Programme Specific Outcome (PSO)- BIOCHEMICAL TOXICOLOGY-Optional

Biochemical Toxicology course is designed to teach students how the body deals with foreign molecules like drug molecules and how they are metabolized. It also deals with short term and long term toxicity of some drug molecules that are used for treatment of common ailments and further deals with mechanisms of toxicity and symptoms of toxicity.

This is an optional subject that interested 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. (Biochemistry): Regular Programme												
Year	II	Core: Optional paper-I BCH2310C08 Biochemical Toxicology			Credits / Hours per week			03/03				
Semester	I	Year of Introduction: 2007 Year of Syllabus Revision: 2012			Maximum Marks / Grade			100				
Mode of Transaction		Lectures and Tutorials										
Course Outcome (CO) BCH2310C08 CO1 Understanding Metabolism of drugs in human body CO2 Understanding the mechanism of toxicity of drugs in human body CO3 Learn about chronic and acute toxicity and their symptoms												
Unit No.	Topic/Unit				Contact Hours	Weightage (%)	BT Level	CO	PSO	Element s of Employability (Emp)/ Entrepreneurship	Relevance to Local (L)/ National (N)/ Regional	Relation to Gender (G), Environment and Sustaina

							(Ent)/ Skill Develop ment (SD)	(R)/Glob al (G) develop mental needs	bility (ES), Human Values (HV)and Professio nal Ethics (PE)
1	Xenobiotic metabolism: Adsorption & Distribution. Phase I Reactions. Oxidation, reduction, hydrolysis and hydration. Phase II Reactions/Conjugation: Methylation, Glutathione and amino acid conjugations. Detoxification	15	40	1,2,3	CO1				
2	Biochemical basis of Toxicology: Mechanism of Toxicity : Disturbance of excitable membrane function, Altered calcium homeostasis. Covalent binding to cellular macromolecules and Genotoxicity. Tissue specificity of toxicity.	15	30	1,2,3	CO2				
3	Acute and chronic Toxicity: Principles and procedures of testing acute toxic effects: Regulatory guidelines, mammalian systems affected and clinical symptoms of systemic toxicity. Factors affecting acute toxicity studies..	15	30	1,2,3	CO3				
Reference Books									
1.	Rang & 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 Name: MSc. (Biochemistry) Practical-III (BCH2305C05)

Programme Specific Outcome (PSO)

PSO1 Analysis of biochemical parameters important for disease diagnosis

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. (Biochemistry): Regular Programme			

Year	II	Core / Elective / Foundation Practical-III (BCH2305C05)	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 (BCH2305C05) CO1 Estimation of metabolites for disease diagnosis CO2 Molecular diagnosis by PCR CO3 Genetic manipulations of bacteria CO4 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	1,2	CO4	
Reference books							
1	Clinical Chemistry- Varley						
2	Biochemistry By Voet and Voet						

SEMESTER IV

Programme Specific Outcome (PSO): Genetics (BCH2411C16)

Syllabus of Courses

		The Maharaja Sayajirao University of Baroda Faculty of Science Department of Biochemistry	Academic Year					2025-2026		
M.Sc. (Biochemistry): Regular Programme										
Year	II	Core / Elective / Foundation Genetics (BCH2411C16)	Credits / Hours per week					03/03		
Semester	II	Year of Introduction: 2007 Year of Syllabus Revision: 2012	Maximum Marks / Grade					100		
Mode of Transaction		Lectures and Tutorials								
Course Outcome (CO) BCH2411C16 CO1 Learn and understand classic genetic approaches in eukaryotic systems CO2 Learn and understand classic genetic approaches in bacterial systems CO3 Learn and understand gene transfer, mapping and yeast genetics										
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	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	40	1,2,3	CO1			
2	Classical Genetics (Eukaryotic): Scope and value of the classical genetic approach; model systems; their advantages and shortcomings. Molecular correlates of dominance & recessivity; tests of single gene mutations. Pleiotropy-uses; Penetrance and Expressivity. Mapping using deficiencies & duplication in Drosophila. Diagnosis of a-, hypo-, hyper-, neo- and anti-morphs and uses; ts mutations & uses; uses of mosaics; sexual/mitotic.	15	30	1,2,3	CO2			
3	Bacterial Genetics: Frequency of mutations; the fluctuation test and spontaneous and adaptive mutations. Methods of gene transfer and their uses; conjugation, transduction and transformation; lambda, P1; complementation testing and fine structure mapping of a gene. Yeast genetics. Mapping function and recombination frequency, Mapping by recombination in yeast and Neurospora crassa; tetrad analysis.	15	30	1,2,3	CO3			
Reference Books								
1	N. Trun & J. Trempy (2004) Fundamental Bacterial Genetics, Blackwell Publ.							
2	Freidberg, E. C., Walker, G. C., Siede, W., Wood, R. W., Schultz, R. A. and Ellenberger, T (2006) DNA repair and Mutagenesis, 2nd Edn., ASM Press.							
3	T.A. Brown Gene cloning and DNA analysis An Introduction, 5th Edition.							
4	Molecular Cloning: A Laboratory Manual (<i>Third Edition</i>) By Joseph Sambrook, David Russell,							
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. (Biochemistry): Regular Program										
Year	II	Core / Elective / Foundation BCH2412C17: Genetic Engineering, Genomics and bioinformatics	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) BCH2412C17 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. CO4: Learning bioinformatics tools for sequence analysis and prediction methods.										
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	Methods in Molecular Biology, Molecular Cloning Methods and Analysis of Cloned Genes: Enzymes used in recombinant DNA technology Restriction endonucleases; DNA modifying enzymes. Principles and uses of nucleic acid hybridizations. Cloning of genes – Construction of genomic and cDNA libraries; Molecular genetic and reverse genetic strategies.		15	25	1,2,3,4	CO2				

2	Heterologous Gene expression, Protein-protein interactions: Heterologous gene expression systems in <i>E.coli</i> , yeast, insect cell and mammalian cells. Properties and applications of plasmids, phagemids, phage vectors, cosmids, YAC, BAC, Techniques used to study protein-protein interactions including principle and applications of two hybrid systems (yeast, mammalian, <i>E.coli</i>) yeast 3-hybrid system, GST Pulldown, Far Western, Co-immunoprecipitation, Phage display etc	15	25	1,2,3,4	CO2, CO4			
3	Bioinformatics: Sequences alignment & database searching: Dot matrix, Needleman-Wunsch & Smith-Waterman algorithms. BLAST and BLAST variants and advanced BLAST programs, BLOSUM and Dayhoff matrices. Multiple sequence alignment: progressive and hierarchical methods, phylogenetics and tree construction. Gene prediction and RNA secondary structure. Introduction to Hidden Markov Model and Neural networks.	15	25	1,2,3	CO3			

Reference Books

1.	Primrose, S., Twyman R. & Old B. (2009) Principles Of Gene Manipulation & Genomics, 8 th Edn., Blackwell Science.
2.	Glick B. R., Pasternak J.J. and Pattern, C.L. (2010) Molecular Biotechnology- Principles And Applications Of Recombinant DNA, 4 th Edn., ASM Press
3.	J.D. Watson, R.M. Myers, A.A. Caudy, & J.A. (2006) Recombinant DNA: Genes & Genomes, 3 edition, W.H.Freeman Publication
4.	T.A. Brown (2006) Gene cloning and DNA analysis: An introduction, Blackwell Publishing Professional
5.	Molecular Cloning: A laboratory Manual, J.Sambrook, E.F. Fritsch and T.Maniatis, Cold Spring Harbor Laboratory Press, New York, 2000.
6.	Arthur M. Lesk. (2014) Introduction to Bioinformatics, 4 th Ed. (Oxford University Press)
7.	Andreas D. Baxevani and B. F. Francis Ouellette (2009) Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins. 3 rd Ed. (Wiley)
8.	David W. Mount. (2004) Bioinformatics: Sequence and Genome Analysis. 2 nd Edition (CSHL Press)

Bloom's Taxonomy Levels:

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

Programme Name: MSc. (BIOCHEMISTRY)**Programme Specific Outcome (PSO)**

Molecular medicine coursework is concerned with understanding of several diseases of various systems like GastroIntestinal, blood, Neurological and Life style disorders and molecular pathology associated with it. The course directs the aspects of research innovative and basis for translational research. The course is designed mainly to aim the students that are needed for their entry at academia; jobs of pharma industry, diagnostics, pathology. It will be beneficial for designing drug discovery research and this is an optional paper wherein students opt to cater the current research in the country and this course touches the basic aspects for translational research.

	The Maharaja Sayajirao University of Baroda Faculty of Science Department of Biochemistry		Academic Year	2025-2026
M.Sc. (BIOCHEMISTRY): REGULAR				
Year	II	Core: OPTIONAL PAPER I BCH2406C14 Biochemical basis of Diseases (Optional I)	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) BCH2406C14 CO1- Deals with GIT, Liver and Blood Disorders CO2- Emphasis on The Heart diseases CO3- Life style Disorders				

Unit No.	Topic/Unit	Contact Hours	Weightage (%)	BT Level	CO	PSO	Elements of Employ ability (Emp)/ Entrepr eneurshi p (Ent)/ Skill Develop ment (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 changes during liver diseases and excretory system disorders, Clinical symptoms, Diagnosis, current and Possible interventions.	15	40	1,2,3	CO1				
2	Cardiovascular physiology and anatomy, major disease conditions and molecular pathways involved in hypertension, infarction and atherosclerosis, Major hematological disorders, hemodynamics, biochemical basis of these disorders and possible future interventions.	15	30	1,2,3	CO2				
3	Biochemical basis of lifestyle disorders including obesity, hyperlipidemia, hypercholesterolemia, diabetes, female reproductive disorders associated with obesity, Biochemical changes in lifestyle disorders. like depression and Alzheimer’s, OCD, Current and future interventions.	15	30	1,2,3	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.									

Programme Name: MSc. (BIOCHEMISTRY)

Programme Specific Outcome (PSO)

Neurochemistry coursework is concerned with understanding of Brain structure and functions and diseases associated with it. Brain is complex organ and its functional understanding is needed for newer research. Neurochemistry is most demanding research area. The course is mainly designed for the students who aim to work in the area of neurosciences in Academic, research or industry set-up in their later career. It will be beneficial for drug design and discovery research. This is an optional paper wherein students opt to cater the current research in the country and this course touches the basic aspects for translational research.

	The Maharaja Sayajirao University of Baroda Faculty of Science	Academic Year	2025-2026						
M.Sc. (BIOCHEMISTRY): Regular Programme									
Year	II	Core: OPTIONAL PAPER II BCH2409C15 NEUROCHEMISTRY (Optional II)	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) BCH2409C15 CO4- Learn about different polyglutamine repeat neurodegenerative disorders CO5-Learn about mechanism behind neurodegeneration CO6-Learn about types of memories and brain regions involved CO7- Learn about circadian rhythm and its regulation									
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	Understanding types of nervous system- CNS, PNS, ANS; structure of Blood Brain Barrier, Types of	15	40						

	synapses and their advantages/function; Neurological organization and ultrastructure of cerebral cortex, cerebellar cortex and glial biology.								
2	Neurotransmitter synthesis, storage, release – endocytosis and exocytosis Metabotropic and Ionotropic receptors (ACh, Catecholamines, Monoamines, Glutamate, GABA). Physiology of sensory system- Visual, Auditory, Somatosensory, Chemosensory system.	15	30						
3	Various reflexes, adaptation, conditioning, facilitation, augmentation; Post-tetanic potentiation, sensitization; potentiation, desensitization, synaptic plasticity, learning and memory; Neurobiology of circadian rhythms – cellular rhythms, organismal rhythms-central and peripheral.	15	30	1,2,3	CO5,C O5,CO6 ,CO7				
Reference Books									
Eric Kandel, James Schwartz, Thomas Jessell. (2000) Principles of Neural Science. 4 th ed McGraw-Hill, Health Professions Division.									
Mark F. Bear, Barry W. Connors, Michael A. Paradiso (2007) Neuroscience 3ed., Lippincott Williams & Wilkins.									
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.									
Irvin Leritan and Leonard K Acznarck, (2001) The Neuron, Cell and Molecular Biology, 3rd Edn., Oxford University Press, USA.									

Programme Specific Outcome (PSO)

Structural Biology is an optional paper designed with the chief objective of teaching students about structure and folding of proteins. There are many disease chiefly arising out of failure in protein function, which is generally a consequence in failure in protein folding leading to either excessive degradation or aggregation. With increased life span of humans diseases like Alzheimer's and Parkinson's have become more common. Deeper understanding of structural biology helps in coming up with solutions to the neural diseases caused due to aging. Structural biology also is the choice field of research in many advanced basic research laboratories and R and D departments of pharmaceutical industry. Hence this optional course prepares students for a career 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. (Biochemistry): Regular Program			

Year	II	Core: BCH2408C14 STRUCTURAL BIOLOGY (Optional Paper I)	Credits / Hours per week					03/03		
Semester	II	Year of Introduction: Year of Syllabus Revision:	Maximum Marks / Grade					100		
Mode of Transaction		Lectures and Tutorials								
Course Outcome (CO) BCH2408C14 CO1: Learning about Protein structure and folding, knowledge of protein folding from in vitro studies CO2: Learning about Protein folding in vivo and chaperones CO3: Learning about Protein degradation and protein aggregation diseases										
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	Protein structure and folding, knowledge of protein folding from in vitro studies: Protein structure, folding in vitro, Protein stability – thermodynamics and kinetics, Effect of various factors on folding; Solvent engineering for protein folding; Folding intermediates- kinetic, equilibrium and molten globule intermediates; Techniques for studying the structure and folding of proteins. Prediction of secondary and tertiary structure of proteins; Single molecule studies.		15	40	1,2,3,4	CO1				
2	Protein folding in vivo and chaperones: Protein folding in vivo, chaperones, peptidyl prolyl isomerase (PPI), Protein disulfide isomerase (PDI) and bacterial disulfide bond forming proteins (Dsb’s); Cotranslational and post-translational modifications; Protein engineering - Recombinant proteins and domains; Protein evolution –		15	30	1,2,3	CO2				

	divergent and convergent, gene regulation with protein structural changes; Comparison of the structure and stability of proteins.								
3	Protein degradation and protein aggregation diseases: Protein loss, misfolding, aggregation, context dependence of protein secondary structure, Protein misfolding and aggregation diseases, therapeutic approaches; Protein degradation, exo- and endo-proteases, mechanisms to escape digestion by exopeptidases, Proteasomes, Ubiquitin dependent and independent mechanisms of protein degradation, Clps.	15	30	1,2,3	CO3				
Reference Books									
1.	T. E. Creighton Proteins: Structures and Molecular Properties								
2.	Arthur M. Lesk Introduction to Protein Science: Architecture, Function, and Genomics, 3 rd Edn., Oxford Univ. Press. 2016.								
3.	Biochemistry an approach based on chemical logic. (online) by H. Jakubowski.								
4.	A. Liljas, L. Liljas, M. –R. Ash, G. Lindblom, P. Nissen and M. Kjeldgaard Textbook of Structural Biology, 2 nd Edn. World Sci. Pub., 2016. 978-981-3142-47								
5.	A. Ben-Naim The Protein Folding Problem and its Solutions, World Sc. Pub., 2013. ISBN 978-981-4436-36-6								

Programme Specific Outcome (PSO)

The objective of this course is to introduce the novel and diverse biochemical pathways of bacteria. The course deals with primary metabolism and its regulation at the biochemical and genetic level. Major emphasis is on Carbon and Nitrogen metabolism of Gram negative bacteria.

	The Maharaja Sayajirao University of Baroda Faculty of Science Department of Biochemistry		Academic Year	2025-2026
	M.Sc. (Biochemistry): Regular Programme			
Year	II	Core BCH2407C14: Microbial Adaptive Biology (Optional Paper I)	Credits / Hours per week	03/03

Semester	II	Year of Introduction: 2012 Year of Syllabus Revision: 2016	Maximum Marks / Grade					100	
Mode of Transaction		Lectures and Tutorials							
Course Outcome (CO) BCH2407C14									
CO1	Sugar Catabolism in <i>Escherichia coli</i>								
CO2	Microbial Carbon catabolism								
CO3	Microbial Nitrogen Metabolism								
Unit No.	Topic/Unit	Contact Hours	Weightage (%)	BT Level	CO	PSO	Element s of Employa bility (Emp)/ Entrepre neurship (Ent)/ Skill Develop ment (SD)	Relevan ce to Local (L)/ National (N)/ Regional (R)/Glob al (G) develop mental needs	Relation to Gender (G), Environ ment and Sustaina bility (ES), Human Values (HV)and Professio nal Ethics (PE)
1	Structure of bacterial cell, Structure and Biosynthesis of bacterial cell wall; unique targets of cell wall for antimicrobial therapy.	15	40	1,2,3	CO1				
2	Flagellar structure and Biosynthesis; Mechanism of bacterial motility. Adaptation to stationary phase, heat and cold shock, osmolarity and salinity	15	30	1,2,3	CO2				
3	Adaptation to oxidative stress; Genetics of Pathogenesis: Model organisms, genetic approaches to pathogenesis.	15	30	1,2,3	CO3				
Reference Books									
1.	Epstein S. S. (2009) Uncultured Microorganisms. Microbiology Monographs Vol. 10 Springer-Verlag.								
2.	Wen-Tso Liu and Janet K. Jansson (2010) Environmental Molecular Microbiology Caister Academic Press.								
3.	Xu, J. (2010) Microbial Population Genetics, Caister Academic Press.								
4.	G. Storz and R. Hennigge (2010) Bacterial Stress Responses, 2nd Edn. ASM Press.								

Programme Specific Outcome (PSO) Optional Paper II

The objective of this course is to introduce the novel and diverse biochemical pathways of bacteria. The course deals with primary metabolism and its regulation at the biochemical and genetic level. Major emphasis is on Carbon and Nitrogen metabolism of Gram negative bacteria.

	The Maharaja Sayajirao University of Baroda Faculty of Science Department of Biochemistry	Academic Year	2025-2026							
M.Sc. (Biochemistry): Regular Programme										
Year	II	Core BCH2410C15: Nutrition and Developmental biology (Optional paper II)	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) BCH2410C15 Optional Paper II CO1 Biochemical basis of vitamins and other nutrients CO2 Role of nutrition in health and diseases CO3 Nutritigenomics and developmental biology										
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)
I	Elements of nutrition – Dietary requirement of carbohydrates, lipids and proteins. Biological value of proteins. Concept of protein quality. Protein sparing action of carbohydrates and fats. Essential amino		15	40	1,2,3	CO1				

	acids, essential fatty acids and their physiological functions. Basal metabolic rate: factors affecting BMR, measurement and calculation of BMR. Measurement of energy requirements. Specific dynamic action of proteins.								
II	Vitamins – Dietary sources, biochemical functions, requirements and deficiency diseases associated with vitamin B complex, C and A, D, E & K vitamins. Minerals – Nutritional significance of dietary calcium, phosphorus, magnesium, iron, iodine, zinc and copper.	15	30	1,2,3	CO2				
III	Basic concepts of development, Gametogenesis, fertilization and early development: cell adhesion molecules in sperm-egg recognition in animals; embryo sac development and double fertilization in plants; zygote formation, cleavage, blastula formation, embryonic fields, gastrulation and formation of germ layers in animals; embryogenesis, establishment of symmetry in plants; seed formation and germination.	15	30	1,2,3	CO3				
Reference Books									
1.	Nutritional Biochemistry: Current Topics in Nutrition Research, 1st Edition Chad Cox								
2.	Biochemical, Physiological, and Molecular Aspects of Human Nutrition_ Martha H. Stipanuk								
3.	S. F. Gilbert: Developmental Biology Sinaur associates Inc USA								
4.	Klaus Kalthoff: Analysis of biological development Mc-Graw Hill								
5.	Tom Brody: Nutritional Biochemistry Academic Press								
6.	Chad Cox: Current topics in nutrition research CRC Press								

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.(Biochemistry)										
Year	II	Core BCH2403C11:- Practicals IV- Advanced Research Techniques				Credits / Hours per week		04/16 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) BCH2403C11										
CO1 Introduction to Advanced research techniques in Molecular Biology, Cell Biology, Immunology, Proteomics, Genomics.										
CO2 Practical demonstration of Advanced Research 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 Advanced research techniques in Molecular Biology, Cell Biology, Immunology, Proteomics, Genomics					36	20	1, 2	CO1	
2	Practical demonstration of Advanced Research Techniques like qPCR, Immunofluorescence, FRET analysis					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 BCH2405C13: Project Work			Credits / Hours per week		06/16 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) BCH2405C13 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	