

FACULTY OF BIOMEDICAL SCIENCES, TECHNOLOGY & RESEARCH

M. Sc - BIOTECHNOLOGY

PROGRAM OUTCOMES – COURSE OUTCOMES

MAPPING

PROGRAMME OUTCOMES (PO)

Upon completion of the M. Sc Biotechnology programme, the candidate should be able to:

PO1: Demonstrate knowledge for in-depth analytical and critical thinking to identify, formulate and solve the issues related to Biotechnology Industry, Pharma industry, Medical or hospital related organizations, Regulatory Agencies, & Academia.

PO2: Develop an ability to solve, analyze and interpret data generated from experiments done in project work or practical courses.

PO3: Demonstrate skills to use modern analytical tools/ software/ equipments and analyze and solve problems in various courses of biotechnology.

PO4: Appreciate and execute their professional roles in society as biotechnology professionals, employers and employees in various industries, regulators, researchers, educators and managers.

PO5: Adopt code of ethics in professional and social context and demonstrate exemplary professional, ethical and legal behaviors in decision making.

PO6: Apply written and oral communication skills to communicate effectively in healthcare, industry, academia and research.

PO7: Apply responsibilities to promote societal health and safety, upholding the trust given to the profession by the society.

PO8: Develop skills, attitude and values required for self-directed, lifelong learning and professional development.

COURSE OUTCOMES (CO)

Year I

SEMESTER I

BIOCHEMISTRY OF BIOMOLECULES (PBT15CT101)

Upon completion of the course:

CO101.1: The student would be able to comprehend the structures of the major classes of macromolecules

ADVANCED CELL BIOLOGY (PBT15CT103)

Upon completion of the course:

CO103.1: The student would be able to comprehend the cell organelle, cell membrane

CO103.2: The student would be able to signal transduction and its implications

CO103.3: The student would be able to cell cycle and its relevance

ANALYTICAL TECHNIQUES (PBT15CT105)

Upon completion of this course:

CO105.1: The student will be able to handle the equipment available and identify the suitable and appropriate experiments for their research

CO105.2: The student would have gained sufficient knowledge about the assays and analyzing data

ADVANCED MICROBIOLOGY (PBT15CT107)

Upon completion of the course:

CO107.1: The student will be able to understand microbial diversity; physiology and nutrition;

CO107.2: The student will be able to identify microbes using modern techniques

BIOMOLECULES AND ANALYTICAL TECHNIQUES (PG15BTCL151)

Upon completion of the course, the student shall be able to understand:

CO151.1: The properties of biomolecules that are used for their analysis

CO151.2: The principle concepts in using analytical and preparatory techniques

CO151.3: How to quantify and assay for a biomolecule

BIOLOGY OF CELLS AND MICROBES (PG15BTCL153)

Upon completion of the course, the student shall be able to:

CO153.1: Understand the basics of techniques to study cells

CO153.2: Basics of microscopy

CO153.3: Aseptic techniques and microbial culture methods

SEMESTER II

MOLECUAR BIOLOGY (PBT15CT102)

Upon completion of the unit the student shall be able to:

CO102.1: Understand what genes are

CO102.2: How they are inherited

CO102.3: How they control cellular activity and they respond to environment

BIOPROCESS TECHNOLOGY (PBT15CT104)

Upon completion of the course, the student will be:

CO104.1: Aware of various methodologies for biomass production

CO104.2: Product isolation using various analytical methods

BIOLOGICAL CALCULATIONS AND BIostatISTICS (PBT15CT106)

Upon completion of the course, the student shall be able to:

CO106.1: Understand simple calculations

CO106.2: How to plan and execute research designs

CO106.3: Analyse data, interpret, and present information

CO106.4: Publishing research data

CO106.5: Calculate; analyse and compare observed data; perform simple sums in proportions and algebraic functions

PROTEIN BIOLOGY (PBT15CT108)

Upon completion of the course, the student shall be able to:

CO108.1: Comprehend the structure of the proteins

CO108.2: Understand the biological sequence analysis

CO108.3: Understand the concepts associated to Genomics and apply the same in various fields

BIOINFORMATICS (PBT15DE110 [BGE023])

Upon completion of the course the student will be able to:

CO110.1. Get to know effective use of Office package

CO110.2. Create a patient record database in MS Access and handle queries on the same.

CO110.3. Store and Retrieve drug related information using online tools

CO110.4. Design a questionnaire using word processing package

CO110.5. Comprehend the utility of tools & databases available in genomic & proteomics

PROTEIN METHODS (PBT15CL152)

Upon completion of the course, the student shall be able to:

CO152.1: Comprehend basic concepts of isolating, purifying and characterizing proteins

CO152.2: Understand the principles and applications of these technologies

ANIMAL CELL CULTURE TECHNOLOGY (PBT15SL154; BSL015)

Upon completion of the course, the student shall be able to:

CO154.1: Comprehend basic concepts of establishing animal cell cultures

CO154.2: Understand the principles and applications of these technologies

M. Sc BIOTECHNOLOGY - YEAR 2

SEMESTER-III

IMMUNOTECHNOLOGY (PBT15CT201)

Upon completion of the course the student must have -

CO201.1: Understood the principles of immunology

CO201.2: Understood methods of studying immune reactions

CO201.3: Applications of this core science

CANCER BIOLOGY (PBT15CT203)

Upon completion of the course, the student shall be able to:

CO203.1: Understand terms in cancer biology

CO203.2: Causes of cancer

CO203.3: The technologies used in cancer research and diagnosis

ENVIRONMENTAL BIOTECHNOLOGY (PBT15CT205)

Upon completion of the course, the student shall be able to comprehend:

CO205.1: The basic concepts of ecology.

CO205.2: Microbial association and functions.

GENETIC ENGINEERING (PBT15CT207)

Upon completion of the course, the student shall be able to comprehend:

CO207.1: Comprehend the cloning principles and strategies

CO207.2: Analysis of the clones.

PHRAMACEUTICAL BIOTECHNOLOGY (PBT15DE209 [BDE 005])

Upon completion of the course, the student shall be able to understand:

CO209.1: The biotechnological approaches to therapy

CO209.2: Understand the principles of the new biotechnology based assays

CO209.3: The therapeutic uses of plant products

SCIENTIFIC WRITING AND RESEARCH METHODOLOGY (PBT15AE211)

Upon completion of the course, the student shall be able to understand:

CO211.1: Understand the different types or formats of scientific communications

CO211.2: Practice and learn through case studies the right form of communication

CO211.3: Understand the need for ethics in conduct of research program

CO211.4: Design a project proposal

CO211.5: Develop a manuscript for publication

CO211.6: Grant writing proposals

GENETIC ENGINEERING PRACTICALS (PBT15CL251)

Upon completion of the course, the student shall be able to understand:

CO251.1: Comprehend the skills required to do experimental cloning

CO251.2: Set up experiments using advanced tools of selecting vectors for cloning; sequencing analysis, PCR, expression of cloned products

CANCER BIOLOGY AND IMMUNOTECHNOLOGY (PRACTICALS) (PBT15CL253)

Upon completion of the course, the student shall be able to understand:

CO253.1: Understand various types of cancer, tumor invasion, markers in cancer research and diagnosis.

CO253.2: Demonstrate antigen-antibody relationships and their detection methods.

SEMESTER- IV

DISSERTATION AND VIVA VOCE (PBT15RP252)

Upon completion of the course, the student shall be able to understand:

CO252.1: Learn how to collect, read and manage research information

CO252.2: Plan experiments, conduct and observe results

CO252.3: Write and publish results effectively

ELECTIVES

BIOLOGY OF VIRUSES (BDE001)

Upon completion of the course, the student shall be able to understand:

CO001.1: The basics of virology

CO001.2: How viruses are isolated and studied

CO001.3: Molecular aspects of viruses infecting bacteria and plants.

DISORDERS OF METABOLISM (BDE002)

Upon completion of the course, the student shall be able to understand:

CO002.1: disorders of the various metabolic pathways

MOLECULAR DIAGNOSTICS (BDE003)

Upon completion of the course, the student shall be able to understand:

CO003.1: Modern tools in diagnosis

CO003.2: The wide range of techniques used

MOLECULAR GENETICS (BDE004)

Upon completion of the course, the student shall be able to understand:

CO004.1: Gene concept and organization and their implications

CO004.2: Plasmid and its types

CO004.3: Molecular aspects of viruses infecting bacteria and plants.

FACULTY OF BIOMEDICAL SCIENCES, TECHNOLOGY & RESEARCH

M. Sc BIOTECHNOLOGY

PROGRAM OUTCOMES (PO) – COURSE OUTCOMES (CO)

MAPPING

YEAR - I

SEMESTER – I

(H- High; M- Medium; L - Low)

BIOCHEMISTRY OF BIOMOLECULES (PBT15CT101)	CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
	CO101.1	MH	H	M	M	M	M	M	M

ADVANCED CELL BIOLOGY	CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
	CO103.1	H	H	H	M	L	M	L	M
	CO103.2	H	H	H	M	L	M	L	M
	CO103.3	H	H	H	M	L	M	L	M

ANALYTICAL TECHNIQUES (PBT15CT105)	CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
	CO105.1	H	H	H	H	H	M	M	H
	CO105.2	H	H	H	H	H	M	M	H

ADVANCED MICROBIOLOGY (PBT15CT107)	CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
	CO107.1	H	HM	M	H	H	M	M	H
	CO107.2	H	HM	M	H	H	M	M	H

BIOMOLECULES AND ANALYTICAL TECHNIQUES (PG15BTCL151)	CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
	CO151.1	H	H	H	H	H	M	H	H
	CO151.2	H	H	H	H	H	M	H	H
	CO151.3	H	H	H	H	H	M	H	H

BIOLOGY OF CELLS AND MICROBES (PG15BTCL153)	CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
	CO153.1	H	H	H	M	M	M	M	M
	CO153.2	H	H	H	M	M	M	M	M
	CO153.3	H	H	H	M	M	M	M	M

SEMESTER-II

MOLECULAR BIOLOGY (PBT15CT102)	CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
	CO102.1	H	H	H	H	M	H	M	H
	CO102.2	H	H	H	H	M	H	M	H
	CO102.3	H	H	H	H	M	H	M	H

BIOPROCESS TECHNOLOGY (PBT15CT104)	CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
	CO104.1	H	H	H	H	H	M	L	M
	CO104.2	H	H	H	H	H	M	L	M

BIOLOGICAL CALCULATIONS AND BIOSTATISTICS (PBT15CT106)	CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
	CO106.1	H	H	H	M	M	M	M	M
	CO106.2	H	H	H	M	M	M	M	M
	CO106.3	H	H	H	M	M	M	M	M
	CO106.4	H	H	H	M	M	M	M	M
	CO106.5	H	H	H	M	M	M	M	M

PROTEIN BIOLOGY (PBT15CT108)	CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
	CO108.1	H	H	H	M	M	M	M	H
	CO108.2	H	H	H	M	M	M	M	H
	CO108.3	H	H	H	M	M	M	M	H

BIOINFORMATICS (PBT15DE110 [BGE023])	CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
	CO110.1	H	H	H	M	M	M	M	M
	CO110.2	H	H	H	M	M	M	M	M
	CO110.3	H	H	H	M	M	M	M	M
	CO110.4	H	H	H	M	M	M	M	M
	CO110.5	H	H	H	M	M	M	M	M

PROTEIN METHODS (PBT15CL152)	CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
	CO152.1	H	H	H	M	M	M	M	M
	CO152.2	H	H	H	M	M	M	M	M

ANIMAL CELL CULTURE TECHNOLOGY (PBT15SL154; BSL015)	CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
	CO154.1	H	H	H	M	M	M	M	M
	CO154.2	H	H	H	M	M	M	M	M

GENETIC ENGINEERING (PBT15CT207)	CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
	CO207.1	H	H	H	H	H	M	H	H
	CO207.2	H	H	H	H	H	M	H	H

PHARMACEUTICAL BIOTECHNOLOGY (PBT15DE209 [BDE 005])	CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
	CO209.1	H	M	M	M	M	M	M	M
	CO209.2	H	M	M	M	M	M	M	M
	CO209.3	H	M	M	M	M	M	M	M

SCIENTIFIC WRITING AND RESEARCH METHODOLOGY (PBT15AE211)	CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
	CO211.1	H	H	H	H	H	H	M	M
	CO211.2	H	H	H	H	H	H	M	M
	CO211.3	H	H	H	H	H	H	M	M
	CO211.4	H	H	H	H	H	H	M	M
	CO211.5	H	H	H	H	H	H	M	M
	CO211.6	H	H	H	H	H	H	M	M

GENETIC ENGINEERING PRACTICALS (PBT15CL251)	CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
	CO251.1	H	H	H	M	M	H	H	
	CO251.2	H	H	H	M	M	H	H	H

CANCER BIOLOGY AND IMMUNOTECHNOLOGY (PRACTICALS) (PBT15CL253)	CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
	CO253.1	H	H	H	M	H	M	M	M
	CO253.2	H	H	H	M	H	M	M	M

SEMESTER-IV

DISSERTATION AND VIVA VOCE (PBT15RP252)	CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
	CO252.1	H	H	H	H	H	H	M	H
	CO252.2	H	H	H	H	H	H	M	H
	CO252.3	H	H	H	H	H	H	M	H

ELECTIVES

BIOLOGY OF VIRUSES (BDE001)	CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
	CO001.1	H	H	M	M	M	M	M	M
	CO001.2	H	H	M	M	M	M	M	M
	CO001.3	H	H	M	M	M	M	M	M

DISORDERS OF METABOLISM (BDE002)	CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
	CO002.1	H	H	H	M	M	M	M	H

MOLECULAR DIAGNOSTICS (BDE003)	CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
	CO003.1	H	H	H	M	M	M	M	M
	CO003.2	H	H	H	M	M	M	M	M

MOLECULAR GENETICS (BDE004)	CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
	CO004.1	H	H	H	M	M	M	M	M
	CO004.2	H	H	H	M	M	M	M	M
	CO004.3	H	H	H	M	M	M	M	M

M. Sc – HUMAN GENETICS
PROGRAM OUTCOMES – COURSE OUTCOMES
MAPPING

Program outcomes

Upon completion of Masters Degree in Human Genetics, the students are expected to have achieved the following:

PO1- A comprehensive understanding of the chemical basis of heredity

PO2- Knowledge and understanding of clinical genetics, inheritance patterns for genetic diseases and approaches to the study of human genetic disease

PO3- Acquire skills in various genetic methodologies and an understanding of its application in various fields of human genetics

PO4- The ability to describe different ways to identify disease genes, describe the use of different model systems in studies and how quantification of heritable traits in families and populations provide insight into cellular and molecular mechanisms

PO5- A systemic understanding of the molecular and immunogenetic basis of cancer and other genetic diseases.

PO6- Awareness of the harmful agents and materials and its irreversible impact in on the genome

PO7- An understanding of the ethical guidelines and biosafety procedures when handling human or animal models

PO8 – The ability to design, conduct experiments, analyze and interpret data for investigating research problems in human genetics and allied fields

PO9- Develop skills, attitude and values required for self-directed, lifelong learning and professional development

COURSE OUTCOMES (CO)

YEAR I - SEMESTER I

Molecular Cell Biology & Physiology – (PHG15CT101)

CO101.1: Be able to understand the structures and basic components of prokaryotic and eukaryotic cells.

CO101.2: Be able to understand the cellular components underlying mitotic cell division and cell death.

CO101.3: Be able to understand the cellular responses to environmental or physiological changes, or alterations of cell function.

Biochemical Genetics – (PHG15CT103)

CO103.1: Be able to understand the clinical, biochemical and molecular features of biochemical genetic disorders.

CO103.2: Be able to develop required laboratory skills to perform, interpret and analyze core/widely used biochemical techniques.

CO103.3: Be able to perform, analyze and interpret tests as relevant to the biochemical disorders with a genetic basis

Medical Genetics – (PHG15CT105)

CO105.1: Be able to describe the chromosomal basis of inheritance and how alterations in chromosome number or structure may arise during mitosis and meiosis.

CO105.2: Be able to understand the clinical implications of phenomena such as incomplete penetrance, variation in expression, anticipation and new mutations.

CO105.3: Be aware of the differences and similarities between diagnostic, predictive and carrier genetic testing.

Biophysics & Instrumentation – (PHG15DE107)

CO107.1: To enable application of the theories and laws of physics to biological structure and functioning.

CO107.2: To understand the principles and working of instruments commonly used to study biological material.

Biostatistics – (PHG15AE111)

CO111.1: To understand the statistics concepts, theories and formulae

CO111.2: To be able to utilize the biostatistics tools for applications in the areas of life sciences in general and human health in particular

Bio-analytical Techniques – (PHG15CL151)

CO151.1: Be able to diagnose a specific biochemical genetic disorder.

CO151.2: Be able to develop technical aspects of analyses for a diagnostic biochemical genetics laboratory.

CO151.3: Be able to handle various equipment's used in biochemical analysis and troubleshoot them.

Cytogenetic Techniques – (PHG15CL153)

CO153.1: Be able to take a family history and construct and interpret a pedigree.

CO153.2: Be aware of the different laboratory techniques to investigate genetic material and their advantages and limitations.

CO153.3: Be able to interpret a standard genetics laboratory report (cytogenetic and molecular genetics).

YEAR I - SEMESTER II

Advanced Molecular Genetics – (PHG15CT102)

CO102.1: Be able to understand genes at the molecular level from the theory concept, research and human health care perspectives.

CO102.2: To acquire the required laboratory skills to perform, interpret and analyze core/widely used molecular biology techniques.

CO102.3: Be able to contribute to the development of newer application.

Cancer Genetics – (PHG15CT104)

CO104.1: Be able to describe the etiology and mutations and chromosomal alteration involved carcinogenesis.

CO104.2: Be able to understand the different cancer predisposition syndromes and their features, inheritance patterns, and cancer risks.

CO104.3: Be able to describe the genetic basis and hereditary predisposition to cancer and treatment strategies

Human Development & Prenatal Genetics – (PHG15CT106)

CO106.1: Be able to describe the underlying conceptual framework regarding how genes control embryo development.

CO106.2: Be able to explain the development of human and each gestational period.

CO106.3: Know the principles and applications of prenatal genetic sampling and testing.

Genetic Counseling – (PHG15DE108)

CO108.1: To understand the relevance, approaches and implications of genetic counseling from the subject area concepts, theory, practice and human health-care perspectives

CO108.2: To acquire the skills as required for genetic counseling.

Genetic Research Skills Development – (PHG15AE112)

CO112.1: To be able to learn dissertation /theses writing

CO112.2: To be able to prepare a manuscript, research publication for presentation

CO112.3: To be able to develop skill of presentation

Molecular Biology Techniques – (PHG15CL152)

CO152.1: Be able to understand functional significance of DNA technology.

CO152.2: To acquire the required laboratory skills to perform, interpret and analyze core/widely used molecular biology techniques.

CO152.3: Be able to apply the techniques for research applications

Developmental Genetics & Prenatal Diagnosis – (PHG15CL154)

CO154.1: Be able to relate developmental changes from animal to humans.

CO154.2: Be able to have the skills to culture prenatal samples for genetic testing.

CO154.3: Be able to relate the genetics test report to a disease and explaining the risk

YEAR II - SEMESTER III

Radiation Genetics and Toxicology – (PHG15CT201)

CO201.1: Be able to describe radiation interactions in a biological system.

CO201.2: Be able to elucidate the signaling mechanism involved in cell damage, repair and carcinogenesis.

CO201.3: Be able to understand the basis behind individual response to radiation and chemicals

Immunogenetics – (PHG15CT203)

CO203.1: To understand the implications of human immune system

CO203.2: Be able to understand the functioning from the subject area concepts, theory, experimental, research.

CO203.3: Be able to integrate into the health-care perspectives.

Population Genetics & Genetic Epidemiology – (PHG15CT205)

CO205.1: Be able to understand the inheritance of genes for a trait.

CO205.2: Be able to estimate risk and association for a particular genotype to a disease.

CO205.3: Be able to use various software for the risk estimation of a genotype.

Stem Cell Genetics and Regenerative Medicine – (PHG15DE207)

CO207.1: To understand the implications of the functioning of genes in stem cells from the subject area concepts, theory, experimental, research and health-care perspectives.

CO207.2: To understand the applications of stem cell genetics including for tissue engineering and in vitro directed differentiation purposes.

Research Methodology – (PHG15AE211)

CO211.1: To understand the importance of the methodological approach to research.

CO211.2: To acquire the required skills to approach a research project in a scientifically sound manner, from forming the hypothesis to publication of the research findings.

Immunotechniques – (PHG15CL251)

CO251.1: To acquire the required laboratory skills to perform, interpret and analyze core/widely used immunotechniques.

CO251.2: Be able to perform the techniques and relate to health care.

CO251.3: Be able to integrate the skill into to research and development.

Biomarkers and Genetic Toxicity- (PHG15CL253)

CO253.1: Be able to describe the radiation effects on normal cells.

CO253.2: Be able to describe the radiation effects on tumor cells.

CO253.3: Be able to understand means of therapeutic efficacy.

YEAR II - SEMESTER IV

Practice of Genetic Testing and Accreditation – (PHG15AE206)

COAE206.1: To become familiar with and practice good laboratory practices and standard operating protocols.

COAE206.2: To become familiar with the documentation and other requirements required for the accreditations for testing laboratories (with relevance/emphasis to genetic testing).

Clinical Rotations – (PHG15CR206)

COCR206.1: To understand the clinically relevant genetic disorders from a human health-care approach

COCR206.2: To link the genetic theory concepts, disease associations and clinical outcomes

COCR206.3: The students will visit the following clinical departments to apply their theoretical knowledge into clinics.

Dissertation – (PHG15RP252)

CO252.1: To understand the importance of research methodology concepts and to put them in practice while working on dissertation projects.

CO252.2: To acquire the technical writing skills and presentation skills apart from practically utilizing all aspects of research methodology that they had learnt earlier.

CO252.3: To be able to integrate all aspects of the research project into a dissertation of print form as can be evaluated by internal and external experts.

M.Sc. Human Genetics
PROGRAM OUTCOMES (PO) – COURSE OUTCOMES (CO) - MAPPING
(L- Low, H- High; M- Medium)

		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
YEAR - I, SEMESTER – I										
Molecular Cell Biology & Physiology – (PHG15CT101)	CO101.1	H	M	H	M	H	M	M	H	H
	CO101.2	H	H	H	M	H	H	M	H	H
	CO101.3	H	M	H	H	H	H	M	H	H
Biochemical Genetics – (PHG15CT103)	CO103.1	H	H	H	H	M	M	M	H	H
	CO103.	M	H	H	H	M	M	H	H	H
	CO103.3	H	H	H	H	M	H	M	H	H
Medical Genetics – (PHG15CT105)	CO105.1	H	H	H	H	H	H	H	H	H
	CO105.2	H	H	H	H	H	M	H	H	H
	CO105.3	M	H	H	H	H	M	H	H	H
Biophysics & Instrumentation –	CO107.1	L	H	H	M	L	M	L	H	H

(PHG15DE107)	CO107.2	L	M	H	M	L	L	L	H	H
Biostatistics (PHG15AE111)	CO111.1	L	M	M	H	L	L	L	H	H
	CO111.2	L	H	M	H	M	L	L	H	H
Bio-analytical Techniques (PHG15CL151)	CO151.1	H	M	H	H	H	H	H	H	H
	CO151.2	M	H	H	H	M	H	H	H	H
	CO151.3	L	M	H	H	M	M	M	H	H
Cytogenetic Techniques (PHG15CL153)	CO153.1	H	H	H	H	H	M	H	H	H
	CO153.2	M	H	H	H	H	H	H	H	H
	CO153.3	H	H	H	H	H	H	H	H	H
YEAR - I, SEMESTER – II										
Advanced Molecular Genetics (PHG15CT102)	CO102.1	H	H	H	H	M	H	H	H	H
	CO102.2	M	H	H	H	H	H	H	H	H
	CO102.3	M	H	H	H	H	M	H	H	H

Stem Cell and Regenerative Medicine (PHG15DE207)	CO207.1	M	M	H	H	M	H	H	H	H
	CO207.2	M	M	H	H	M	H	H	H	H
Research Methodology (PHG15AE211)	CO211.1	L	L	H	H	M	M	M	H	H
	CO211.2	L	L	H	H	M	M	M	H	H
Immunotechniques – (PHG15CL251)	CO251.1	M	H	H	H	H	H	H	H	H
	CO251.2	M	H	H	H	H	H	H	H	H
	CO251.3	M	M	H	H	H	H	H	H	H
Biomarkers and Genetic Toxicity- (PHG15CL253)	CO253.1	M	M	H	H	H	H	H	H	H
	CO253.2	M	M	H	H	H	H	H	H	H
	CO253.3	M	H	H	H	H	H	H	H	H
YEAR II - SEMESTER IV										
Practice of Genetic Testing and Accreditation (PHG15AE206)	COAE206.1	L	L	H	M	M	H	H	H	H
	COAE206.2	L	M	H	M	M	H	H	H	H

M.Sc. MEDICAL BIOINFORMATICS
PROGRAMME OUTCOMES – COURSE OUTCOMES MAPPING
PROGRAMME OUTCOMES (PO)

Upon completion of the M.Sc. Medical Bioinformatics programme, the candidate should be able to:

PO1: Demonstrate analytical skills and critical thinking to identify and suggest solutions pertaining to the medical bioinformatics domain.

PO2: Exhibit the knowledge-driven ability to analyze, organize and interpret the information generated.

PO3: Demonstrate skills to use bioinformatics tools and databases in various areas of medical bioinformatics.

PO4: Assume self-starter roles in managing as an individual and working coordinately as a member of a team in all the sub-domains of healthcare.

PO5: Appreciate and execute their professional roles in society as medical bioinformatics professionals.

COURSE OUTCOMES (CO)

Year I

SEMESTER I

Basic Medical Sciences (PBI 15CT 101)

Upon completion of the course the student shall be able to:

CO101.1: Explain the structure and function of the human body

CO101.2: Explain the functions of each organ relative to the human body at the molecular and cellular levels

CO101.3: Explain the disease pathology at the molecular and cellular levels

CO101.4: Explain how socioeconomic circumstances and lifestyle have an effect on human health show awareness of research ethics necessary in the conduct of research and willingness to abide by the latest bioethics principles throughout their research career

CO101.5: Obtain an overview on infectious and communicable diseases, immunization and family planning, medicine including pediatrics, surgery including orthopedics and urology, obstetrics & gynecology, ophthalmology and ENT, anesthesia and oncology, radio-diagnosis

Hardware & C Programming (PBI 15CT 103)

Upon completion of the course the student shall be able to:

CO103.1: Can learn other computer languages easily

CO103.2: Can understand the modules in bioinformatics using C language

Cell & Molecular Biology (PBI 15CT 105)

Upon completion of the course the student shall be able to:

CO105.1: Can learn the basic composition of our living system

CO105.2: Can learn fine detail of genetic material and its role

Biomathematics & Biostatistics (PBI 15CT 107)

Upon completion of the course the student shall be able to:

CO107.1: The candidate will be able to understand and apply the Mathematics & Biostatistics in Bioinformatics.

CO107.2: The candidate will be able to use the software independently for the data analysis

Biophysics (PBI 15DE 109)

Upon completion of the course the student shall be able to:

CO109.1: Expertise in the techniques used in studying biological structure and function

Bioinformatics Algorithms & Tools (PBI 15CT 102)

Upon completion of the course the student shall be able to:

CO102.1: Get to know the public database and use them effectively

CO102.2: Able to annotate the sequences with software tools

CO102.3: Have understanding of the algorithm employed and its outcome

Genomics & Comparative Genomics (PBI 15CT 104)

Upon completion of the course the student shall be able to:

CO104.1: To know what the term genome means and to elucidated complete genomes of species.

CO104.2: Understand why researchers have honed in on conserved DNA sequences between other vertebrates and humans.

CO104.3: To familiarize students with the tools and databases available for genomic analysis, with an appreciation of the quantitative concepts that form the basis of those tools

Proteomics (PBI 15CT 106)

Upon completion of the course the student shall be able to:

CO106.1: Discuss the advantages, limitations and challenges associated with analysis of the proteome by different techniques

CO106.2: Demonstrate knowledge of the differences between techniques for protein identification and characterization

CO106.3: Have an ability to analyze and characterize a protein of interest using various protein bioinformatics software tools

Web technology & PHP (PBI 15CT 108)

Upon completion of the course the student shall be able to:

CO108.1: Have good programming skills

CO108.2: Develop a website on their own

Database Management System (PBI 15DE 110)

Upon completion of the course the student shall be able to:

CO110.1: Have gained knowledge and understanding of what is involved in the design of a database.

CO110.2: Have gained knowledge and understanding of the models used for structuring data in database systems.

CO110.3: Be able to implement a database and report on the process.

CO110.4: Be able to query a database

Structural Bioinformatics & Drug Design (PBI 15CT 201)

Upon completion of the course the student shall be able to:

CO201.1: Have knowledge of macromolecular structures and their properties

CO201.2: Get to know the interactions of drugs and proteins

CO201.3: Acquired knowledge of the insilico tools and their applications

Python & High Performance Computing (PBI 15CT 203)

Upon completion of the course the student shall be able to:

CO203.1: You can have good programming skills

CO203.2: Can develop tools on their own

Artificial Intelligence & Datamining PBI 15CT 205

Upon completion of the course the student shall be able to:

CO205.1: Understand the development and applications of Artificial intelligence and Datamining

CO205.2: Apply and integrate various artificial intelligence techniques in intelligent system development as well as understand the importance of maintaining intelligent systems.

CO205.3: Display a comprehensive understanding of different datamining tasks and the algorithms most appropriate for addressing them.

CO205.4: Evaluate models/algorithms with respect to their accuracy and demonstrate capacity to perform a self directed piece of practical work that requires the application of data mining techniques.

Health Informatics (PBI 15CT 207)

Upon completion of the course the student shall be able to:

CO207.1: Evaluate the opportunities and limitations of Information and Communications **CO207.2:** Technology in improving the quality, cost-effectiveness and efficiency of healthcare delivery

CO207.3: Conceive and design effective user-centered systems to support medical work and decision-making.

CO207.4: Effectively interface between health information systems developers and healthcare users of those systems to deliver the benefits of ICT in healthcare delivery

Research Methodology (PBI 15AE209)

Upon completion of the course the student shall be able to:

CO209.1: Students use research data to formulate or evaluate new research questions, using reason and persuasion in a logical argument.

CO209.2: Students summarize and evaluate a body of research including primary literature, and can compare psychology's methods with other disciplines' methods.

CO209.3: Students analyze phenomena at multiple levels of analysis including the biological, individual, family, community, & society.

Visual Studio (PBI 15AE 211)

Upon completion of the course the student shall be able to:

CO211.1: Students can create their own online or offline tool

Applied Bioinformatics & Systems Biology PBI 15DE202

Upon completion of the course the student shall be able to:

CO202.1: demonstrate critical thinking skills and familiarity with research techniques needed **CO202.2:** to successfully pursue a research project in computational and systems biology.

CO202.3: conceive and execute a research project upon which the student engages current methods and theory.

CO202.4: communicate original scholarly findings to peers both in oral and written form. **CO202.5:** work productively as part of a research team.

Mapping POs with COs
(H- High; M- Medium; L - Low)

Basic Medical Sciences (PBI 15CT 101)

CO	PO1	PO2	PO3	PO4	PO5
CO101.1	L	L	L	L	L
CO101.2	L	L	L	L	L
CO101.3	L	L	L	L	L
CO101.4	L	L	L	L	L
CO101.5	L	L	L	L	L

Hardware & C Programming (PBI 15CT 103)

CO	PO1	PO2	PO3	PO4	PO5
CO103.1	L	L	L	L	L
CO103.2	L	L	L	L	L

Cell & Molecular Biology (PBI 15CT 105)

CO	PO1	PO2	PO3	PO4	PO5
CO105.1	M	M	M	M	M
CO105.2	M	M	M	M	M

Biomathematics & Biostatistics (PBI 15CT 107)

CO	PO1	PO2	PO3	PO4	PO5
CO107.1	L	L	L	L	L
CO107.2	L	L	L	L	L

Biophysics (PBI 15DE 109)

CO	PO1	PO2	PO3	PO4	PO5
CO109.1	L	L	L	L	L

Bioinformatics Algorithms & Tools (PBI 15CT 102)

CO	PO1	PO2	PO3	PO4	PO5
CO102.1	H	H	H	H	H
CO102.2	H	H	H	H	H
CO102.3	H	H	H	H	H

Genomics & Comparative Genomics (PBI 15CT 104)

CO	PO1	PO2	PO3	PO4	PO5
CO104.1	H	H	H	H	H
CO104.2	H	H	H	H	H
CO104.3	H	H	H	H	H

Proteomics (PBI 15CT 106)

CO	PO1	PO2	PO3	PO4	PO5
CO106.1	H	H	H	H	H
CO106.2	H	H	H	H	H
CO106.3	H	H	H	H	H

Web technology & PHP (PBI 15CT 108)

CO	PO1	PO2	PO3	PO4	PO5
CO108.1	L	L	L	L	L
CO108.2	L	L	L	L	L

Database Management System (PBI 15DE 110)

CO	PO1	PO2	PO3	PO4	PO5
CO110.1	M	M	M	M	M
CO110.2	M	M	M	M	M

CO110.3	M	M	M	M	M
CO110.4	M	M	M	M	M

Structural Bioinformatics & Drug Design (PBI 15CT 201)

CO	PO1	PO2	PO3	PO4	PO5
CO201.1	H	H	H	H	H
CO201.2	H	H	H	H	H
CO201.3	H	H	H	H	H

Python & High Performance Computing (PBI 15CT 203)

CO	PO1	PO2	PO3	PO4	PO5
CO203.1	M	M	M	M	M
CO203.2	M	M	M	M	M

Artificial Intelligence & Datamining PBI 15CT 205

CO	PO1	PO2	PO3	PO4	PO5
CO205.1	H	H	H	H	H
CO205.2	H	H	H	H	H
CO205.3	H	H	H	H	H
CO205.4	H	H	H	H	H

Health Informatics (PBI 15CT 207)

CO	PO1	PO2	PO3	PO4	PO5
CO207.1	M	M	M	M	M
CO207.2	M	M	M	M	M
CO207.3	M	M	M	M	M
CO207.4	M	M	M	M	M

Research Methodology (PBI 15AE209)

CO	PO1	PO2	PO3	PO4	PO5
CO209.1	M	M	M	M	M
CO209.2	M	M	M	M	M
CO209.3	M	M	M	M	M

Visual Studio (PBI 15AE 211)

CO	PO1	PO2	PO3	PO4	PO5
CO211.1	M	M	M	M	M

Applied Bioinformatics & Systems Biology PBI 15DE202

CO	PO1	PO2	PO3	PO4	PO5

CO202.1	H	H	H	H	H
CO202.2	H	H	H	H	H
CO202.3	H	H	H	H	H
CO202.4	H	H	H	H	H
CO202.5	H	H	H	H	H

BSc. (Hons) BIOMEDICAL SCIENCES
**PROGRAM OUTCOMES – COURSE OUTCOMES &
MAPPING**

PROGRAMME OUTCOMES (PO)

Upon completion of the B Sc (hons) Biomedical Sciences programme, the candidate should be able to:

PO1: The background objective of this program is to train and prepare the aspiring students to become Researchers in the field of Biomedical Sciences.

PO2: 4 year degree course (Semester pattern) reinforced by a strong practical laboratory component.

PO3: The program offers the students the opportunity to get trained in the specialized fields and will have the tag of major subject opted.

- Human Genetics
- Biotechnology
- Bioinformatics.
- Biomedical Sciences

PO4: Skill based learning in the field of Pathology, Molecular diagnostics, Biochemistry, Microbiology, Immunology, Medical Genetics, Developmental biology, Psychology, Biotechnology, and Bioinformatics etc.

PO5: Biomedical scientists are also employed in a variety of roles including the veterinary service, the Health and Safety Executive, university and forensic laboratories, and as product manufacturers.

PO6: This degree will open the doors to higher education (master's and doctoral) and academic staff positions at leading universities and research institutes in India and across the globe.

PO7: Apply written and oral communication skills to communicate effectively in patient care, industry, academia and research.

PO8: Apply responsibilities to promote societal health and safety, upholding the trust given to the profession by the society.

COURSE OUTCOMES (CO)

Year I

SEMESTER I

Basic Plant & Animal Biology & Practical - UBM15CT101 & UBM15CL151

Upon completion of the unit the student shall be able to:

Learning objectives:

- ✓ To understand the relevance, basic concepts and functions of plants and plant systems
- ✓ To understand the relevance, basic concepts and functions of animals and animal systems
- ✓ To understand the basic physiology as can be utilized for understanding advanced concepts later in the course
- ✓ To understand the basic concepts and approaches to study plant and animal biology
- ✓ To understand the ethical guidelines as applicable for using animals and plant material for academic studies
- ✓ To understand about alternates for animal and plant biological material as can be utilized to understand the structure and functions of biological systems

Learning outcomes:

The techniques and approaches to study plant and animal biology and also the ethical issues involved along with basic concepts of simulations.

Biochemistry - I (UBM15CT103) & UBM15CL153

Upon completion of this course the student should be able to:

Learning objectives:

- ✓ To understand the relevance, basic concepts and theories of chemistry as relevant to a biological systems.

- ✓ To understand the properties of biomolecules and their nature of existence in the living system
- ✓ To understand the relevance and basic concepts of experimental biochemistry
- ✓ To understand the nature and commonly used types of biochemical experiments

Learning outcome:

- ✓ Students would gain knowledge on the importance and structures of biomolecules related with their biological functions

Environmental Science & Toxicology (UBM15CT105) & UBM15CL155

Learning objectives:

- ✓ To understand the relevance, basic concepts, components and organization of ecosystems
- ✓ To understand the factors that affect ecosystems
- ✓ To understand the ways in which ecosystems can be protected
- ✓ To understand the relevance of basic analysis performed in environmental quality assessment
- ✓

Learning outcomes:

To understand the structure of ecosystems, the factors affecting them and ways in which a balanced ecosystem can be sustained.

Human Anatomy (UBM15DE107) & UBM15DL157

Upon completion of the course, the student shall be able to:

Learning objectives:

- ✓ To understand the relevance, basic concepts and structures of human anatomy
- ✓ To integrate the structure and function concepts of human systems
- ✓ To understand the relevance, basic concepts and structures of human anatomy
- ✓ To integrate the structure and function concepts of human systems

Learning outcome:

- ✓ Students gain knowledge on the human anatomical functions as connected to their structures.
- ✓ Students should be able to correlate structure-function concepts

English (UBM15AE111)

Learning objectives:

- ✓ To enable speaking and writing grammatically correct sentences in English.
- ✓ To develop effective writing skills
- ✓ To build fluency in English

Learning outcome:

- ✓ Students would build spoken and written competency in English

Semester II

Human Physiology UBM15CT102 & UBM15CL152

Learning objectives:

- ✓ To understand the basic concepts of human physiology
- ✓ To understand the physiological functions of various organs
- ✓ To understand the implications of physiological functions and their deviations

Learning outcome:

- ✓ Students would understand the mechanisms of physiological functions at organ and organ system levels
- ✓ Students would understand the significance of physiological functions and their implications under abnormal conditions

Basic Microbiology UBM15CT104 & UBM15CL154

Learning objectives:

- ✓ To understand the relevance and basic concepts of microbiology
- ✓ To understand the classification, physiology and importance of microbes
- ✓ To understand the health-care implications of microbes

Learning outcomes:

- ✓ To understand microbial classification and their environmental and health-care implications
- ✓ To understand the ways in which microbes can be studied

Molecular Cell Biology UBM15CT106 & UBM15CL156

Learning objectives:

- ✓ To understand the relevance, basic concepts and theories of cell structure and functions
- ✓ To utilize the knowledge on the relevance, basic concepts and theories of cell structure and functions to understand the mechanisms of cellular functions

Learning outcome:

- ✓ To understand the implications of prokaryotic and eukaryotic cell structure and functions from the subject area concepts, theory, experimental, research and health-care perspectives
- ✓ To gain experience in the techniques and in using instruments that are commonly used to study cells

General Chemistry UBM15DE108 & UBM15DL158

Learning objectives:

- ✓ To understand the basic concepts in chemistry
- ✓ To understand the significance of chemical substances and their applications in biomedical sciences

Learning outcome:

- ✓ Students would be able to integrate the basic concepts of chemistry in analytical techniques and in physiological conditions.
 - ✓ To gain expertise in performing basic chemical assays and techniques.

Mathematics UBM15AE112 & UBM15DL158

Learning objectives:

- ✓ To understand the basic concepts and theories of mathematics
- ✓ To understand the applications of mathematics to other areas of studies

Learning outcome:

- ✓ To understand math concepts, theories and formulae
- ✓ To be able to utilize the mathematics for applications in other areas of life sciences

Semester III

Medical Genetics UBM15CT201 & UBM15CL251

Learning objectives:

- ✓ To understand the relevance, basic concepts and theories regarding genes involved in human disorders
- ✓ To utilize the knowledge on the relevance, basic concepts, theories and functions of the genes involved in human disorders to understand the complex mechanisms of human genetic disorders

Learning outcome:

- To understand the implications of genes in human health from the subject area concepts, theory, experimental, research and health-care perspectives
 - The students will be familiar with microscopy techniques and chromosome analysis

Developmental Biology UBM15CT203 & UBM15CL253**Learning objectives:**

- ✓ To understand the relevance, basic concepts, theories and functions of the animal and human development
- ✓ To utilize the knowledge on the relevance, basic concepts, theories and functions of the human development in understanding the mechanisms of embryonic and fetal development

Learning outcomes:

- ✓ To gain insights on the relevance, basic concepts, theories and mechanisms of animal and human development – from Gametogenesis to embryonic development and prenatal disorders/defects. Students would learn the various in-vitro artificial fertilization methods
 - ✓ Students will be familiar with dissecting the chick embryo

Endocrinology UBM15CT205 & UBM15CL255**Learning objectives:**

- ✓ To understand the relevance and basic concepts regarding the endocrine system
- ✓ To utilize the knowledge on the relevance, basic concepts of the endocrine system as its impact on human health

Learning outcome:

- To understand the implications of hormones in human health from the subject area concepts, theory, experimental, research and health-care perspectives
 - Students would gain knowledge on the techniques involved in the laboratory to assay the metabolite and hormones

Molecular Pathology UBM15DE207 & UBM15CL255

Learning objectives:

- ✓ To understand the relevance, basic concepts and theories of molecular nature of human diseases
- ✓ To utilize the knowledge to understand mechanisms that cause/induce human diseases

Learning outcome:

- To understand the implications of molecular nature of human diseases from the subject area concepts, theory, experimental, research and health-care perspectives
 - To gain expertise on sectioning, staining and handling instruments related to study biological material

Communication & Soft skills UBM15AE211

Learning objectives:

- ✓ This course is designed to equip the students with essential soft skills needed for workplace and improve personality.

Learning Outcome:

- ✓ This course is designed to help the students to Foster healthy attitude.
- ✓ Develop effective inter and intra personal skills to be an effective team worker. Communicate effectively in both academic and professional setup

Semester IV

Molecular Biology UBM15CT202 & UBM15CL252

Learning objectives:

- ✓ To understand the relevance, basic concepts and theories of nucleic acids as genetic material
- ✓ To understand the significance and impact of genes, their structure and their functions
- ✓ To utilize the knowledge on the relevance, basic concepts and theories of the genetic material to understand basic genetic mechanisms

Learning outcome:

- ✓ To understand the implications of genes, their structure and functions from the subject area concepts, theory, experimental, research and health-care perspectives
- ✓ To gain a hands-on experience in techniques used in molecular biology and their applications

Bioprocess Technology UBM15CT204 & UBM15CL254

Learning objectives:

- ✓ To understand the relevance, basic concepts and theories of utilizing bioprocesses for industrial applications
- ✓ To understand the ways in which bioprocess technology can be value-added

Learning outcomes:

- ✓ To understand bioprocesses for industrial applications and ways in which industrial productivity can be enhanced
 - ✓ To gain a hands-on experience in techniques used in bioprocess technology and their applications

Enzyme Technology UBM15CT206 & UBM15CL256

Learning objectives:

- ✓ To understand the nomenclature and general properties of enzymes
- ✓ To understand the basic concepts of enzyme functions and their applications

Learning outcomes:

- ✓ Students would be able to understand general properties of enzymes & its relevance with their functions
 - ✓ Students would gain knowledge on the procedure of isolation commonly used to study/analyze enzymes and interpretation of enzyme activities through kinetic studies

Pharmacology UBM15DE208 & UBM15DL258

Learning objectives:

- ✓ To understand the relevance, basic concepts, theories of pharmacology
- ✓ To utilize the knowledge on relevance, basic concepts, theories of pharmacology to understand the mechanisms of drug action and toxicity

Learning outcome:

- To understand the implications of types of drugs and their mechanisms of actions) from the subject area concepts, theory, experimental, research and health-care perspectives.
- Students would be competent enough to understand the effective route of administration of drugs for an effective therapy and also learn importance of pharmacological preparations in various forms

Basic Biostatistics UBM15AE212**Learning objectives:**

- ✓ To understand the relevance, basic concepts and theories statistics
- ✓ To utilize the knowledge on relevance, basic concepts and theories of statistics as can be applied to life sciences

Learning outcome:

- To understand statistics concepts, theories and formulae
- To be able to utilize the bio-mathematics and biostatistics tools for applications in the areas of life sciences in general and human health in particular

Semester V**Recombinant DNA Technology UBM15CT301 & UBM15CL351****Learning objectives:**

- ✓ To understand the relevance, basic concepts and principles of techniques used in molecular biology and genetics
- ✓ To understand the application of rDNA technology
- ✓ To be able to integrate the theory concepts and the experiments/techniques

Learning outcome:

- To understand the implications of rDNA techniques from the subject area concepts, theory, experimental, industrial, research and health-care perspectives
- To understand the implications of rDNA techniques from the subject area concepts, theory, experimental, industrial, research and health-care perspectives

Molecular Immunology UBM15CT303 & UBM15CL353

Learning objectives:

- ✓ To understand the relevance, basic concepts, theories and functions of the human immune system
- ✓ To utilize the knowledge on the relevance, basic concepts, theories and functions of the human immune system to understand the mechanisms of immune system functioning

Learning outcome:

- To understand the implications of human immune system functioning from the subject area concepts, theory, experimental, research and health-care perspectives
- To understand the implications of human immune system functioning from the subject area concepts, theory, experimental, research and health-care perspectives

Cancer Biology UBM15CT305 & UBM15CL355**Learning objectives:**

- ✓ To understand the relevance, basic concepts and theories regarding cancer biology
- ✓ To utilize the knowledge on the relevance, basic concepts and theories regarding cancer biology in understanding the complex mechanisms involved

Learning outcome:

- To understand cancers, the mechanisms involved from theory concept, experimental, research and human health-care perspectives
- To acquire the required experimental skills in cancer biology from research and human healthcare perspectives

Computing and Web Applications UBM15DE307 & UBM15DL357**Learning objectives:**

- ✓ To get familiarize with the environment of computer
- ✓ To develop ability skills in using office packages
- ✓ To develop skills of web page creation and programming

Learning outcomes:

- To enhance with the emerging trends of information technology.
- To enhance with the emerging trends of information technology

Laboratory Safety Measures UBM15AE311

Learning objectives:

- ✓ To understand the concepts, significance and relevance of safety measures that should be taken in laboratories
- ✓ To understand the health hazards as associated with laboratories
- ✓ To understand the trouble shooting and emergency measures that are required for laboratories

Learning outcomes:

- ✓ To gain experience in the laboratory safety and preparedness for emergencies as applicable for chemical and biological laboratories
- ✓ To gain an understanding in the regulatory concerns/guidelines as applicable for chemical and biological laboratories

Semester VI

Tissue Engineering UBM15CT302 & UBM15CL352

Learning objectives:

- ✓ To understand the relevance, significance and principles of tissue engineering
- ✓ To understand the tools and applications of tissue engineering

Learning outcomes:

- ✓ To understand the significance and gain experience in using the tools of tissue engineering in human health-care.
- ✓ To understand the implications of tissue engineering from the subject area concepts, theory, experimental, research, drug discovery and health-care perspectives

Biophysics & Bioinstrumentation UBM16CT304 & UBM16CL354

Learning outcome:

- ✓ To enable application of the theories and laws of physics to biological structure and functioning
- ✓ To understand the principles and working of instruments commonly used to study biological material and for human health care , basic functioning and application of instruments

Basic Bioinformatics UBM15CT306 & UBM15CL356

Learning objectives:

- ✓ To have an overview of the expanse of biological data
- ✓ To understand software tools for biological sequence analysis
- ✓ To learn the concepts associated to genomics and proteomics and apply the same in various fields

Learning outcome:

- Understand the biological sequence analysis
- The student will be able to understand the concepts associated to genomics and proteomics and apply the same in various fields

Molecular Epidemiology UBM15DE308 & UBM15DL358

Learning objectives:

- ✓ To understand the relevance, significance and principles of epidemiology
- ✓ To understand the tools and applications of epidemiology

Learning outcomes:

- ✓ To understand the significance and gain experience in using the tools of epidemiology in human health-care.
- ✓ To understand the implications of epidemiology from the subject area concepts, theory, experimental, research and health-care perspectives.

Management Principles UBM15AE312

Learning outcomes:

- ✓ To understand the significance and gain experience in managing and enhance skills in entrepreneurship.

VII semester

Basics of Research Methodology UBM15CT401

Learning objectives:

- ✓ To understand the relevance, basic concepts, theories and approaches towards research project planning, execution, report submissions and research publications
- ✓ To utilize the understanding (as above) for applications in all areas of research methodology
- ✓ To be able to integrate the theory concepts to real-time research situations/examples/case-studies

Learning outcome:

- To understand the importance of the methodological approach to research
- To acquire the required skills to approach a research project in a scientifically sound manner, from forming the hypothesis to publication of the research findings.

Elective VII semester Biomedical Sciences

Clinical Biochemistry UBS15DE403 & UBS15DL451

Learning objectives:

- ✓ To understand the relevance, basic concepts and theories regarding the biochemical nature of diseases
- ✓ To understand the metabolic diseases, their causes and interventions as specifically required

Learning outcomes:

- To enable the students to understand the disorders of carbohydrate, lipid and protein metabolism and blood disorders.
- Students could analyze, interpret and infer the clinical abnormalities and their related metabolism

Advanced Biomaterials UBS15DE405 & UBS15DL453

Learning objectives:

- ✓ To understand the relevance, concepts and theories and regarding biomaterials
- ✓ To understand the properties, examples and applications of biomaterials

Learning outcome:

- To understand the implications of biomaterials from the subject area concepts, theory, experimental, research, drug discovery and health-care perspectives
- To understand the implications of biomaterials from the subject area concepts, theory, experimental, research, drug discovery and health-care perspectives.

Stem cells and Regenerative Medicine UBS15DE407 & UBS15DL455

Learning objectives:

- ✓ To understand the concepts and theories regarding Stem cells and Regenerative medicine
- ✓ To understand the ethical issues and clinical applications of stem cells

Learning outcome:

- Students understand about the biology, therapeutic application and ethical regulations related to stem cells

Elective VII semester Bioinformatics

Bioinformatics Tools UBI15DE403 & UBI15DL453

Learning objectives:

- ✓ To understand the relevance, basic concepts and theories regarding bioinformatics tools
- ✓ To understand the approaches in bioinformatics tools for human healthcare
- ✓ To understand the applications of bioinformatics tools for human healthcare

Learning outcome:

- To understand the relevance, concepts and the tools in bioinformatics from the theory and practical applications in human health care perspectives

Genomics & Proteomics UBI15DE405 & UBI15DL453

Learning Objectives

- ✓ To understand the various concepts associated to Genomics
- ✓ To understand the characteristics of various genes & genomes
- ✓ To understand the concepts associated to Proteomics
- ✓ To comprehend the applications of proteomics in varied fields

Learning Outcomes

- ✓ The student will be able to understand the all concepts associated to Genomics , characteristics of various genes & genomes
- ✓ The student will be able to understand the concepts associated to Proteomics and comprehend the applications of proteomics in varied fields

Perl for Bioinformatics UBI15DE407 & UBI15DL455

Learning objectives:

- ✓ To develop Programming skills in the field of bioinformatics
- ✓ To develop an interactive Programming skills using biological data

Learning outcome:

- The student will be able to do programming using Perl
 - The students will be able to apply it solve bioinformatics problems

Elective VII semester Biotechnology**Biology of Non-Coding RNAs UBT15DE403 & UBT15DL451****Learning Objectives:**

- ✓ Basic aspects of RNAi biology, use of siRNA and microRNAs for gene silencing,
- ✓ RNAi vectors and generation of transgenic animals and plants expressing dsRNA.
- ✓ Potential applications of RNAi in healthcare and agriculture

Learning Outcome:

- Understand RNAi phenomenon in cells, mechanism and its innovative uses

- The student should have obtained and explored the databases available for RNA biology

Model Organisms in Biomedical Research UBT15DE405 & UBT15DL453**Learning Objectives:**

- ✓ This course has been designed to introduce the various tools and techniques in modern era of biology.

It introduces some of the different model organisms, what they are used for, which techniques can be applied.

Learning Outcome:

- Appreciation the importance of selecting the right model
- Understand basic biology of these model organisms & how to employ them in research

Environmental Biotechnology UBT15DE407 & UBT15DL455**Learning Objectives:**

It is designed to help students understand that environment restoration and sustainable reuse includes biotechnological approaches

Learning Outcome:

- ✓ Understands some environmental problems
- ✓ Using biotechnology knowledge to identify and address the issue

Elective VII semester Human Genetics

Prenatal & Pre-Implantation Genetics UHG15DE403 & UHG15DL451

Learning objectives:

- ✓ To understand the relevance, basic concepts, theories and approaches for prenatal genetics and developmental genes
- ✓ To perform apt experiments to enhance the understanding of the human development, prenatal genetics and developmental genes

Learning outcome:

- To understand the implications of human development from the theory concept, research and human health care perspectives.

Radiation Genetics UHG15DE405 & UHG15DL453

Learning objectives:

- ✓ To understand the relevance, basic concepts, theories of radiation genetics
- ✓ To utilize the knowledge on relevance, basic concepts, theories of genotoxicity as induced by radiation to understand the complex mechanisms of genotoxicity
- ✓ To be able to understand the approaches to detect and measure genotoxicity

Learning outcome:

- To understand the implications of genotoxicity (with special emphasis on radiation-induced damages) from the subject area concepts, theory, experimental, research and health-care perspectives
- Students would become aware of the radiation causing effects at the genetic level
Students would be expertise in the field of assessing the chromosomal aberrations and micronuclei estimations etc.

Advance Molecular Biology and Biotechnology UHG15DE407 & UHG15DL455

Learning objectives:

- ✓ To understand the significance of advances in Molecular Biology and Biotechnology

Learning outcomes:

- ✓ To understand the significance of biotechnology in human health-care
- ✓ To understand the significance of Molecular Biology in human health-cares

Elective VIII semester Biomedical Sciences

Pharmaceutical Biotechnology UBS15DE402 & UBS15DL452

Learning objectives:

- ✓ To understand the significance of advances in biotechnology for their pharmaceutical applications
- ✓ To understand the ways in which biotechnology can be utilized for pharmaceutical applications

Learning outcomes:

- ✓ To understand the significance of industrial application of pharmaceutical biotechnology in human health-care.
- ✓ To understand the implications of epidemiology from the subject area concepts, theory, experimental, research, drug discovery and health-care perspectives

Elective VIII semester Bioinformatics

Molecular Modelling UBI15DE402 & UBI15DL452

Learning objectives:

- ✓ To learn the representation of chemical structures
- ✓ To know the approaches for protein structure analysis
- ✓ To understand the principles of macromolecular interactions

Learning outcome:

- Get to know the representation of small molecules and proteins
- Able to understand the drug discovery process, Have practical exposure of in-silico drug design

Elective VIII semester Biotechnology**Phytomedicines UBT15DE402 & UBT15DL452****Learning objectives:**

- ✓ An introduction to herbal medicines commonly prescribed and dispensed by health care professionals.
- ✓ Herbal medicine - traditional uses and principles of evidence-based practice

Learning outcome:

- ✓ Critically analyse the current and potential role of herbal medicine in health care.
- ✓ Understand the relationship between botany and herbal medicine

Elective VIII semester Human Genetics**Transplant Immunology & Antibody Engineering UHG15DE402 & UHG15DL452****Learning objectives:**

- ✓ To understand the relevance, basic concepts of transplantation immunology
- ✓ To understand the relevance, basic concepts of antibody engineering
- ✓ To utilize the knowledge to understand the mechanisms of immune reactions against grafts and transplants
- ✓ To utilize the knowledge to understand the approaches to antibody engineering

Learning outcome:

- To understand the implications of human immune system role in transplantations from the subject area concepts, theory, experimental, research and health-care perspectives
- To understand the implications of antibody engineering from the subject area concepts, theory, experimental, research and health-care perspectives

Clinical Rotation UBM15CR454**Learning objectives:**

- ✓ To understand the relevance, basic concepts and approaches in patient care

- ✓ To visit and obtain „first-hand-experience“ on patient care from the clinics in specialties of relevance to Biomedical Sciences
- ✓ To identify the genetic disorders and understand their management from a clinical perspective

Learning outcome:

- To understand the clinically relevant genetic disorders from a human health-care approach
- The students will visit the following clinical departments to apply their theoretical knowledge into clinics.

Research Project UBM16RP456

Learning objectives:

- ✓ To understand the relevance, basic concepts and importance of research projects.
- ✓ To utilize the knowledge on the relevance, basic concepts and importance of research projects to perform a research project.
- ✓ To utilize the understanding of the research methodology concepts to successfully complete a short-time, experiment-based research project

Learning outcome

- To understand the importance of research methodology concepts and to put them in practice while working on projects.
- To acquire the technical writing skills and presentation skills apart from practically utilizing all aspects of research methodology that they had learnt earlier. To be able to integrate all aspects of the research project into a project of print form as can be evaluated by internal and external experts.

BSc. (Hons) BIOMEDICAL SCIENCES

PROGRAM OUTCOMES – COURSE OUTCOMES

PROGRAM OUTCOMES (PO) – COURSE OUTCOMES (CO)

MAPPING

YEAR - I

SEMESTER – I

(H- High; M- Medium)

Basic Plant & Animal Biology & Practical - UBM15CT101 & UBM15CL151	CO	PO	Biochemistry UBM15CT103) & UBM15CL153	CO	PO	Environmental Science & Toxicology (UBM15CT105) & UBM15CL155	CO	PO	Human Anatomy (UBM15DE107) & UBM15DL157	CO	PO	English (UBM15AE111)	CO	PO
	CO1	H		CO1	H		CO1	H		CO1	H		CO1	M
	CO2	M		CO2	H		CO2	M		CO2	H		CO2	M

Semester II

Human Physiology UBM15CT102 & UBM15CL152	CO	PO	Basic Microbiology UBM15CT104 & UBM15CL154	CO	PO	Molecular Cell Biology UBM15CT106 & UBM15CL156	CO	PO	General Chemistry UBM15DE108 & UBM15DL158	CO	PO	Mathematics UBM15AE112 & UBM15DL158	CO	PO
	CO1	H		CO1	H		CO1	H		CO1	H		CO1	M
	CO2	H		CO2	H		CO2	H		CO2	H		CO2	M

Semester III

Medical Genetics UBM15CT201 & UBM15CL251	CO	PO	Developmental Biology UBM15CT203 & UBM15CL253	CO	PO	Endocrinology UBM15CT205 & UBM15CL255	CO	PO	Molecular Pathology UBM15DE207 & UBM15CL255	CO	PO	Communication & Soft skills UBM15AE211	CO	PO
	CO1	H		CO1	H		CO1	H		CO1	H		CO1	M
	CO2	H		CO2	H		CO2	H		CO2	H		CO2	M

Semester IV

Molecular Biology UBM15CT202 & UBM15CL252	CO	PO	Bioprocess Technology UBM15CT204 & UBM15CL254	CO	PO	Enzyme Technology UBM15CT206 & UBM15CL256	CO	PO	Pharmacology UBM15DE208 & UBM15DL258	CO	PO	Basic Biostatistics UBM15AE212	CO	PO
	CO1	H		CO1	H		CO1	H		CO1	H		CO1	M
	CO2	H		CO2	H		CO2	H		CO2	H		CO2	H

Semester V

Recombinant DNA Technology UBM15CT301 & UBM15CL351	CO	PO	Molecular Immunology UBM15CT303 &UBM15CL353	CO	PO	Cancer Biology UBM15CT305 & UBM15CL355	CO	PO	Computing and Web Applications UBM15DE307 & UBM15DL357	CO	PO	Laboratory Safety Measures UBM15AE311	CO	PO
	CO1	H		CO1	H		CO1	H		CO1	H		CO1	H
	CO2	H		CO2	H		CO2	H		CO2	H		CO2	M

Semester VI

Tissue Engineering UBM15CT302 & UBM15CL352	CO	PO	Biophysics & Bioinstrumentation UBM16CT304 & UBM16CL354	CO	PO	Basic Bioinformatics UBM15CT306 & UBM15CL356	CO	PO	Molecular Epidemiology UBM15DE308 & UBM15DL358	CO	PO	Management Principles UBM15AE312	CO	PO
	CO1	H		CO1	H		CO1	H		CO1	H		CO1	M
	CO2	H		CO2	H		CO2	H		CO2	H			

Elective VII semester Biomedical Sciences

Basics of Research Methodology UBM15CT401	CO	PO	Clinical Biochemistry UBS15DE403 & UBS15DL451	CO	PO	Advanced Biomaterials UBS15DE405 & UBS15DL453	CO	PO	Stem cells and Regenerative Medicine UBS15DE407 & UBS15DL455	CO	PO
	CO1	H		CO1	H		CO1	H		CO1	H
	CO2	H		CO2	H		CO2	H		CO2	H

Elective VII semester Bioinformatics

Basics of Research Methodology UBM15CT401	CO	PO	Bioinformatics Tools UBI15DE403 & UBI15DL453	CO	PO	Genomics & Proteomics UBI15DE405 & UBI15DL453	CO	PO	Perl for Bioinformatics UBI15DE407 & UBI15DL455	CO	PO
	CO1	H		CO1	H		CO1	H		CO1	H
	CO2	H		CO2	H		CO2	H		CO2	H

Elective VII semester Biotechnology

Basics of Research Methodology UBM15CT401	CO	PO	Biology of Non-Coding RNAs UBT15DE403 & UBT15DL451	CO	PO	Model Organisms in Biomedical Research UBT15DE405 & UBT15DL453	CO	PO	Environmental Biotechnology UBT15DE407 & UBT15DL455	CO	PO
	CO1	H		CO1	H		CO1	H		CO1	H
	CO2	H		CO2	H		CO2	H		CO2	H

Elective VII semester Human Genetics

Basics of Research Methodology UBM15CT401	CO	PO	Prenatal & Pre- Implantation Genetics UHG15DE403 & UHG15DL451	CO	PO	Radiation Genetics UHG15DE405 & UHG15DL453	CO	PO	Advance Molecular Biology and Biotechnology UHG15DE407 &	CO	PO
	CO1	H		CO1	H		CO1	H		CO1	H
	CO2	H		CO2	H		CO2	H		CO2	H

Elective VIII semester Biomedical Sciences

Pharmaceutical Biotechnology UBS15DE402 & UBS15DL452	CO	PO	Clinical Rotation UBM15CR454	CO	PO	Research Project UBM16RP456	CO	PO
	CO1	H		CO1	H		CO1	H
	CO2	H		CO2	H		CO2	H

Elective VIII semester Bioinformatics

Molecular Modelling UBI15DE402 & UBI15DL452	CO	PO	Clinical Rotation UBM15CR454	CO	PO	Research Project UBM16RP456	CO	PO
	CO1	H		CO1	H		CO1	H
	CO2	H		CO2	H		CO2	H

Elective VIII semester Biotechnology

Phytomedicines UBT15DE402 & UBT15DL452	CO	PO	Clinical Rotation UBM15CR454	CO	PO	Research Project UBM16RP456	CO	PO
	CO1	H		CO1	H		CO1	H
	CO2	H		CO2	H		CO2	H

Elective VIII semester Human Genetics

Transplant Immunology & Antibody Engineering UHG15DE402 & UHG15DL452	CO	PO	Clinical Rotation UBM15CR454	CO	PO	Research Project UBM16RP456	CO	PO
	CO1	H		CO1	H		CO1	H
	CO2	H		CO2	H		CO2	H