Annexure-5.2 B

MGM SCHOOL OF BIOMEDICAL SCIENCES,
NAVI MUMBAI
(A constituent unit of MGM INSTITUTE OF HEALTH SCIENCES)

M.Sc. Medical Biotechnology

((As per **CHOICE BASED CREDIT SYSTEM** With effect

From the Academic Year 2018–2019)

DIRECTOR'S MESSAGE

Dear Students,

Greetings!!!!!

I take this opportunity to welcome you on behalf of MGM family to the Masters Degree at MGM School of Biomedical Sciences (MGM SBS).

MGM School of Biomedical Sciences (MGM SBS) established in the year 2007, the MGM School of Biomedical Sciences envisaged building a progressive learning community and is committed to pursuit of excellence in higher education, total development of personality and shaping the students into sensitive, self-reliant citizens of the country imbued with the ideals of secularism and a scientific aptitude. We set global standards to make our students scientifically as well as ethically stronger. The college adopts the national qualification frame work for the post-graduate programs which has adopted Credit Base Choice System (CBCS) so that, we construct a value based system of education that encourages critical thinking and creativity, a research platform as opposed to rote learning.

The P.G (M.Sc.) courses offered are; Medical Anatomy, Medical Physiology, Medical Biochemistry, Medical Microbiology, Medical Pharmacology, Biotechnology, Genetics, Molecular Biology, Masters in Hospital administration and Biostatistics, M.Sc. Cardiac Care Technology, M.Sc. Medical Radiology and Imaging Technology, M. Optometry. Over time, the program has evolved, to meet the challenges of the ever changing field of biomedical education system.

With Best Wishes,

Director
MGM School of Biomedical Sciences

ABOUT MGM SCHOOL OF BIOMEDICAL SCIENCES

Mission

To improve the quality of life, both at individual and community levels by imparting quality medical education to tomorrow's doctors and medical scientists and by advancing knowledge in all fields of health sciences though meaningful and ethical research.

Vision

By the year 2020, MGM Institute of Health Sciences aims to be top-ranking Centre of Excellence in Medical Education and Research. Students graduating from the Institute will have the required skills to deliver quality health care to all sections of the society with compassion and benevolence, without prejudice or discrimination, at an affordable cost. As a research Centre, it shall focus on finding better, safer and affordable ways of diagnosing, treating and preventing diseases. In doing so, it will maintain the highest ethical standards.

About – School of Biomedical Sciences

MGM School of Biomedical Sciences is formed under the aegis of MGM IHS with the vision of offering basic Allied Science and Medical courses for students who aspire to pursue their career in the Allied Health Sciences, teaching as well as research.

School of Biomedical Sciences is dedicated to the providing the highest quality education in basic medical sciences by offering a dynamic study environment with well equipped labs. The school encompasses 21 courses each with its own distinct, specialized body of knowledge and skill. This includes 7 UG courses and 14 PG courses. The college at its growing years started with mere 100 students has recorded exponential growth and is now a full-fledged educational and research institution with the student strength reaching approximately 581 at present.

Our consistent theme throughout is to encourage students to become engaged, be active learners and to promote medical research so that ultimately they acquire knowledge, skills, and understanding so as to provide well qualified and trained professionals in Allied Health Sciences to improve the quality of life.

As there is increased need to deliver high quality, timely and easily accessible patient care system the collaborative efforts among physicians, nurses and allied health providers become ever more essential for an effective patient care. Thus the role of allied health professionals in ever-evolving medical system is very important in providing high-quality patient care.

Last **but** by no means least, School of Biomedical Sciences envisions to continuously grow and reform. Reformations are essential to any growing institution as it fulfills our bold aspirations of providing the best for the students, for us to serve long into the future and to get ourselves updated to changing and evolving trends in the health care systems.

Name of the Degree: M.Sc. Medical Biotechnology

AIMS OF THE PROGRAM

Innovative biotechnologist are in great demand of India and abroad. This program is designed to train students to deal in technological applications involved biological application systems, living organisms, or derivatives thereof, to make or modify products to processes for specific use to bridge the gap between industry requirements and the growing demand for skilled manpower in Biotechnology sector.

Postgraduate qualification in Biotechnology can earn to placements in research laboratories run by the government and the corporate sector. Private sector placements are in both technical and managerial positions. The biotech business is growing at an accelerated rate, with a number of companies launching innovative biotech applications. The entry of corporate sector in biotechnology makes career prospects in this field bright.

In academics, one can go for higher qualifications like Ph.D. in various field of biology. There is a great demand of this course abroad as most of the foreign countries are looking for expert in this field. After completion of the course, one can work as Marketing manager, Bioinformationist, Business development Manager.

Duration of Study: The duration of the study for M.Sc. Medical Biotechnology will be of four semesters spread over two years.

Program pattern

- First Semester: July
- Second Semester: January
- Third Semester: July
- Fourth Semester: January

Eligibility Criteria: As a minimum criterion of eligibility, aspiring candidates are needed to have attained a B.Sc. in any discipline of Life Sciences, Biosciences, Bachelor's degree in any of Physics, Biological Sciences, M.B.B.S, BDS, BAMS, BHMS, B.Pharm., B.Tech (Biotechnology), Bachelor's Degree in Agricultural, Veterinary and Fishery Sciences, or equivalent examination with a minimum aggregate score of 50%.

For any query visit the website: www.mgmsbsnm.edu.in

CURRICULUM FOR M. Sc. MEDICAL BIOTECHNOLOGY

1ST YEAR

Semester I							
	Syllabus Ref. No.	**Subject**	**Credits**	**Teaching hours**	**Marks**		
	Theory				**Internal Assessment**	**Semester Exam**	**Total**
	BT 101 T	Cell Biology	4	4	20	80	100
	BT 102 T	Immunology & Immunotechnology	4	4	20	80	100
	BT 103 T	Analytical Instrumentation	4	4	20	80	100
	BT 104 T	Basic Biochemistry & Biomolecules ▲ (Multidisciplinary/Interdisciplinary)	4	4	20	80	100
	Practical						
	BT 101 P	Cell Biology	2	4	10	40	50
	BT 102 P	Immunology & Immunotechnology	2	4	10	40	50
	BT 103 P	Analytical Instrumentation	2	4	10	40	50
	BT 104 P	Basic Biochemistry & Biomolecules ▲ (Multidisciplinary/Interdisciplinary)	2	4	10	40	50
		Total	24	32	120	480	600

Semester II							
	Syllabus Ref. No.	**Subject**	**Credits**	**Teaching hours**	**Marks**		
	Theory				**Internal Assessment**	**Semester Exam**	**Total**
	BT 105 T	Molecular Biology & Genomics	4	4	20	80	100
	BT 106 T	Recombinant DNA Technology	4	4	20	80	100
	BT 107 T	Bioinformatics	4	4	20	80	100
	CC 001 T	Research Methodology & Biostatistics (Core Course)	4	4	20	80	100
	Practical						
	BT 105 P	Molecular Biology & Genomics	2	4	10	40	50
	BT 106 P	Recombinant DNA Technology	2	4	10	40	50
	BT 107 P	Bioinformatics	2	4	10	40	50
	CC 001 P	Research Methodology & Biostatistics (Core Course)	2	4	10	40	50
		Total	24	32	120	480	600

2ND YEAR

Semester III							
	Syllabus Ref. No.	**Subject**	**Credits**	**Teaching hours**	**Marks**		
	Theory				**Internal Assessment**	**Semester Exam**	**Total**
	BT 108 T	Plant Biotechnology	4	4	20	80	100
	BT 109 T	Animal Biotechnology	4	4	20	80	100
		Core Elective course**	4	4	20	80	100
	BT 110 T	Medical Microbiology					
	BT 111 T	Human Genetics					
	BT 112 T	Nanobiotechnology					
	BT 113	Dissertation/Project Proposal*	6	12	50	-	50
	Practical						
	BT 108 P	Plant Biotechnology	2	4	10	40	50
	BT 109 P	Animal Biotechnology	2	4	10	40	50
	BT 110 P BT 111 P BT 112 P	Core Elective practical Medical Microbiology Human Genetics Nanobiotechnology	1	2	10	40	50
	BT 114	Seminar*	1	2	50	0	50
		Total	24	36	190	360	550

Semester IV							
	Syllabus Ref. No.	**Subject**	**Credits**	**Teaching hours**	**Marks**		
	Theory				**Internal Assessment**	**Semester Exam**	**Total**
		General elective **	4	4	100	0	100
	GE 001 T	Pursuit of Inner Self Excellence (POISE)					
	GE 002 T	Bioethics, Biosafety, IPR & Technology Transfer					
	GE 003 T	Disaster Management and Mitigation Resources					
	GE 004 T	Human rights					
	BT 113	Dissertation / Project*	18	36	-	200	200
	Practical						
	BT 115 P	Educational Tour / Field Work/Industrial Visit/Hospital Visit*	2	0	50	-	50
		Total	24	40	150	200	350

*(a) ***Dissertation / Project* Course** commences in III Semester

(b) ***Educational Tours / Field Works*** Course may be carried out in any Semester or all Semesters but evaluated and Grade Points are to be added in 4th Semester.

(Elective): Any one subject is to be chosen from the following (Subjects offered may change from time to time depending on the availability of expertise)

**Elective courses may or may not have practical and/or field work.

▲ Multidisciplinary / Interdisciplinary

EDUCATIONAL/INDUSTRIAL TOUR:

Industrial visit has its own importance in building a career of a student which is pursuing a professional degree. Objections of industrial visit are to provide students an insight regarding internal working of reputed hospitals and labs. Industrial visits provides students an opportunity to learn practically thoughts interactions, working methods and employment practices as theoretical knowledge is not enough for making a competent and skilful professionals.

Programme Objectives & Outcome

Programme Objectives:	1. Biotechnology is the basic science that has as its goal an explanation of life processes at the sub cellular and molecular level. 2. Recent years have seen explosive advances in the study of DNA biotechnology, including gene cloning, sequencing and mapping. 3. Developments in biotechnology have opened new areas of study and provided powerful techniques that are revolutionizing the pharmaceutical, health, and agricultural industries 4. They have spawned new industries in biotechnology, and opened avenues for answering basic and applied questions in all of the life sciences. 5. Biotechnology students complete a comprehensive curriculum in the fundamentals of science and are prepared to address problems in the biochemical, biological and agricultural sciences. 6. The requirements of the molecular biology major assure competence in the broad scientific theory and application of biotechnology, while allowing flexibility for students to develop strength in their biochemical, biological or agricultural discipline.
Programme Outcome:	1. Exhibit a knowledge base in genetics, cell and molecular biology, and anatomy and physiology, microbiology, biochemistry etc. 2. Demonstrate the knowledge of common and advanced laboratory practices in biotechnology. 3. Exhibit clear and concise communication of scientific data 4. Engage in review of scientific literature in the areas of biomedical sciences 5. Critique and professionally present primary literature articles in the general biomedical sciences field

ACADEMIC SYLLABUS FOR SEMESTER-I

Name of the Programme	**M. SC MEDICAL BIOTECHNOLOGY**
Course Code	**BT 101 T**
Name of the Course	**CELL BIOLOGY (THEORY)**

Course Objective	1. To apprehend the candidate with on skill full developmental knowledge in critical thinking in molecular biology, and evaluate literature in related areas. 2. Outline the structure of the biomolecules found in all living organisms 3. Compare and contrast the mechanisms of bacterial and eukaryotic DNA replication, DNA repair, transcription, and translation & to explain 4. How DNA topology and chromatin structure affects the processes of DNA replication, repair, and transcription 5. Describe mechanisms by which DNA can be damaged and describe the molecular mechanisms by which protein complexes repair different forms of DNA damage, to provide examples of how homologous recombination
Course Outcomes	1. On satisfying the requirements of this course, students will have the knowledge and skills to Compare 2. The structure and function of cells from different domains. 3. Discuss the elementary biochemistry of the molecules of life and describe the relationship between the structure and function of biomolecules. 4. Discuss the development of cells and the role of cell specialization in multicellular organisms 5. Accurately record raw experimental data and use this to synthesize written reports to present data meaningfully and discuss the significance of results.

Unit no.	Topics	Hours allotted 60hrs
1.	**Cytology:** Development history of cytology. Cell – basic unit of life: Structure and function of cell, Cell cycle- Different phases, Maturation promoting factor, Families of cyclins and cyclin. Dependent kinases, Regulation and cell cycle checkpoints, Inhibitors of cell cycle Progression, M phase- Mitosis and Meiosis, Cytokinesis, Fertilization. Prokaryotic & Eukaryotic cell, Structure Pancreatic islets, Neurons, Muscle cells, Tissues & their composition	**12 hrs**
2.	**Concept of Cyto-receptors***:* Function of membrane receptors. Methods of introduction of substances to cells: endo and excocytosis, pinocytosis, phagocytosis. Mechanism of transport substances through membrane: diffusion, osmosis, ion channels, active and passive transport, ion pumps	**12 hrs**
3.	**Structural organization andmechanism of sorting and regulation** of intracellular transport, electrical properties of membranes**:**Cell wall, nucleus,Mitochondria, Golgi bodies, lysosomes, endoplasmic reticulum, structure & function of cytoskeleton and its role in motility	**10 hrs**
4.	**Cell signaling***:*Hormones and their receptors, cell surface receptor, signaling through G protein coupled receptors, signal transduction pathways, second messengers, and regulation of signaling pathways	**10 hrs**
5.	**Cellular communication:**General principles of cell communication, cell adhesion and roles of different adhesion molecules, gap junctions, desmosomes, tight junction, extracellular matrix, integrins, neurotransmission and its regulation	**10 hrs**
6.	**Pathogenecity of cell***:*Living cells Vs dead cell, Necrotic Vspycnotic death, Programmed cell death, Regeneration of cell	**06 hrs**

Reference Books:

1. Cell and Molecular biology, Gerald Karp, John Wiley and sons Inc
2. Cell Biology by C.B. Powar.
3. Cell and Molecular Biology; DeRobertis; Lippincott Williams & Wilkins 8thEdition (2001)
4. Molecular Biology of the Cell and the Hypercell with CDROM; Alberts, Bray;Garland Publishing 1st Edition (1999)
5. Molecular Biology of the Cell with CDROM Alberts, Bruce; Johnson,Alexander; Lewis, Julian 4th Edition (2005).
6. Molecular Cell Biology, H. Lodish, A. Berk, S. L. Zipursky, W. H. PreemanandCompany

Name of the Programme	**M. SC MEDICAL BIOTECHNOLOGY**
Course Code	**BT 102 T**
Name of the Course	**IMMUNOLOGY & IMMUNOTECHNOLOGY (THEORY)**

Course Objective	1. To apprehend the candidate with and research. 2. Topics covered include: An overview of the immune system including organs, cells and receptors. 3. Recognition of pathogens; antigen processing and presentation. 4. Co-stimulatory signals for T cell activation and role of cytokines in lymphocyte maturation and activation. 5. Cell mediated and antibody-mediated immunity work to protect a host. 6. Immunity to infection and pathological consequences of immunodeficiency's,Immune responses to viral infections, HIV and AIDs. 7. Molecular basis of antigen recognition. Antibodies and applications,Approaches to vaccination from pathogenic organisms and harmful substances. 8. Immunotherapy's,Cancer immunology and vaccines and Transplantation immunology.
Course Outcomes	1. At end of the course accomplishment the students will marvel in: The defense mechanisms that can establish a state of immunity againstinfection, and Immune-related diseases. 2. Discuss the elementary biochemistry of the molecules of life and describe the relationship between the structure and function of biomolecules. 3. The clonal selective theory impacts the immune system's ability torecognize millions of antigens. 4. Determine the strategies that could viruses and tumor cells interfere with to decrease 5. The presentation of viral peptides on MHC class I molecules at the surface of infected cells and the consequences of such situation on NK cells and cytotoxic T lymphocytes.

Unit no.	Topics	Hours allotted 60hrs
1.	**Introduction to immune system**Innate and adaptive immunity; Cells and organs of the immune system; Primary and secondary immune responses; Antigens; Antibodies and T cell receptors: Antigens, Structure and function of immunoglobulin, Monoclonal antibodies, B and T cell receptors and co-receptors	**15 hrs**
2.	**Generation and regulation of immune responses**B Cell Generation, activation and differentiation; Clonal selection and immunological memory; Complement system; Leukocyte activation and migration; Cell mediated cytotoxic responses; Regulation of immune responses; Immunological tolerance, Antigen processing and presentation; MHC-restriction; Cytokines; T Cell Maturation, activation and differentiation	**15 hrs**
3.	**Antigen-antibody Reactions :** Strength of Antigen-Antibody Reactions (Antibody Affinity, Avidity and Cross Reactivity), In Vivo Antigen-Antibody Reactions, In Vitro Antigen-Antibody Reactions Precipitation (In Fluid and In Gel Immunoelectrophoresis), Agglutination (Heamagglutination, Bacterial agglutination, Passive agglutination and Agglutination Inhibition), Radioimmunology Assay (RIA), Enzyme Linked Immunosorbant Assay (ELISA),Western Bio, Immuno Fluorescence	**15 hrs**
4.	**Disorders of Human Immune System**Primary and secondary immunodeficiency; Autoimmune disorders; Hypersensitive reactions; Cytokine related diseases	**15 hrs**

Reference Books:

1. Essential Immunology: Ivan Roitt.
2. Kuby Immunology: Goldsby, Kindt and Osborne.
3. Immunology: Roitt, Brostoff, Mole.
4. Introductory Immunology:Huw Davies

Name of the Programme	**M. SC MEDICAL BIOTECHNOLOGY**
Course Code	**BT 103 T**
Name of the Course	**ANALYTICAL INSTRUMENTATION (THEORY)**

Course Objective	To apprehend the candidate with: 1. Develop an understanding of the range and theories of instrumental methods available in analytical chemistry 2. Develop an understanding of the role of the chemist in measurement and problem solving in chemical analysis 3. Extend skills in procedures and instrumental methods applied in analytical tasks. 4. The rapid analysis of elements in a variety of matrices including aqueous, semi-conductor, petrochemical, soil, metallurgical and slurries . 5. The fully simultaneous measurement of the complete, inorganically relevant, mass range. 6. Expand skills in the scientific method of planning, developing, conducting, reviewing and reporting experiments with validated instrumentation results. 7. Extend understanding of the professional and safety responsibilities residing in working on environmental problems. 8. Analysis and sorting, compliance screening, environmental analysis and mining applications
Course Outcomes	At end of the course accomplishment the students will marvel in 1. The Analytical Instrumentation course covers principles, installation, calibration, and maintenance of conductivity probes, and methods of stack gas monitoring. 2. To install, calibrate, and maintain pH and ORP measurement instruments and operation, installation, calibration, and maintenance of several optical analyzers. 3. Discusses principles and safe practices governing sensors used in measuring oxygen, carbon monoxide, carbon dioxide, and other products of combustion. 4. With operation, calibration, and system components in liquid and gas chromatography.

Unit no.	Topics	Hours allotted 60hrs
1.	**Chromatography:** Basic Principles *Types :* Adsorption chromatography, Partition chromatography , Liquid chromatography, Gas-liquid chromatography, Ion-exchange chromatography, Affinity chromatography, HPLC *Applications of chromatographic techniques in biol*ogy	**12 hrs**
2.	**Spectroscopy:** Interaction of radiation with matter, absorption of radiation, emission of radiation**,** Beer-Lambert relationship, Components of spectrophotometer, Types of detectors *Types***:** UV-Vis Spectrophotometer, Fluorimetric methods, Atomic absorption spectroscopy Flame photometry, Magnetic resonance spectroscopy, NMR, PMR, ESR *Applications of different spectroscopic technique*	**17 hrs**
3.	**Electrophoresis :** Factors affecting electrophoresis *Types:* Vertical, submarine and gradient electrophoresis , Isoelectric focusing, Capillary electrophoresis, Immuno-electrophoresis, *Applications of electrophoresis in biology* ***Centrifugation:*** Preparative and analytical centrifuges; RCF, zonal, equilibrium and density gradients	**11 hrs**
4.	**Radioisotopes:** Nature of radioactivity, types of radioactive decay, unit of radioactivity. Detection and measurement of radioactivity. Geiger counter, scintillation counters, autoradiographyApplications of isotopes in biology (tracers, radio immunoassay	**15 hrs**
5.	**Flow cytometry** DNA sequencing, Micro array, 2d Gel Electrophoresis	**05 hrs**

Reference Books:

1. Instrumental methods of chemical analysis.B.K. Sharma, Goel Publishing House, 25thedition
2. Principles and techniques of biochemistry and molecular biology, Wilson and Walker, Cambridge University Press, 6th edition
3. Instrumental methods of chemical analysis, Chatwal and Anand, Himalaya Publishing House, 5th Edition
4. Tools and techniques of biotechnology, MousumiDebnath, Pointer Publishers, 1stedition
5. Biophysical chemistry-Principles and techniques, Upadhyay; Upadhyay and Nath, H Himalaya Publishing House, 3rd Edition
6. Physical biochemistry- applications to biochemistry and molecular biology, David Freifelder, Freeman and Co., 2nd edition.

Name of the Programme	**M. SC MEDICAL BIOTECHNOLOGY**
Course Code	**BT 104 T**
Name of the Course	**BASIC BIOCHEMISTRY & BIOMOLECULES (THEORY)**

Course Objective	To apprehend the candidate with: 1. Define biochemistry and identify the five classes of polymeric biomolecules and their monomeric building blocks. 2. Explain the specificity of enzymes (biochemical catalysts), and the chemistry involved in enzyme action. 3. Explain how the metabolism of glucose leads ultimately to the generation of large quantities of ATP. 4. Describe how fats and amino acids are metabolized, and explain how they can be used for fuel. 5. Recognize and explain the functions of the key molecular components and steps of thesynthesis, assembly, and degradation of biological macromolecules Relate digestive processes and body production of usable and storable chemical energy tothe chemical composition of foodstuffs, including vitamin and nutrient requirements
Course Outcomes	At end of the course accomplishment the students will marvel in 1. Intermediates in enzyme-catalyzed reactions and their investigations. 2. The principles of globular protein structure, as well as the techniques used for elucidation of structures and approaches to their prediction from sequence. 3. The behavior of proteins in solution and the principles of molecular recognition. The principles of membrane protein structure determination. 4. Intermediates in enzyme-catalyzed reactions and their investigations. 5. Identification/quantization of polypeptide similarity. Identification of polypeptide families &super families. Large scale sequencing projects, data analysis including comparative analysis.

Unit no.	Topics	Hours allotted 60hrs
1	**Chemical basis of life;** Composition of living matter; Water –properties, pH, ionization and hydrophobicity; Emergent properties of biomolecules in water; Biomolecular hierarchy; Macromolecules; Molecular assemblies; Structure-function relationships.	**08 hrs**
2	**Chemistry of carbohydrates:** Biomedical importance, Classification, chemistry and functions ,Monosaccharide, Disaccharides, Polysaccharides including glucosamine glycans, Glycoproteins	**08 hrs**
3	**Chemistry of Lipids:** Biomedical importance, classification, Chemistry and functions of tri-acyl glycerol Phospholipids glycolipids , Fatty acids, Prostaglandins ,Steroids and lipoproteins	**08 hrs**
4.	**Chemistry of proteins:** Biomedical importance , General nature of amino acids ,Various ways of classification of amino acids , Biologically important peptides ,Classification, properties and biological importance of proteins , Structural organization of proteins, Plasma proteins-functions, clinical significance of various fractions, Methods of separation of proteins	**10 hrs**
5	**Enzymes:** Nomenclature and classification, General properties , Factors affecting enzyme activity, Enzyme kinetics, Michaelis-Menten equation, L-B plot , Mechanism of action : Reaction mechanisms and catalysis, active site studies and specific enzyme case examples of enzymes, Concept of Vmax, turnover number , Enzyme inhibition , Regulation of enzyme activity	**08 hrs**
6	**Vitamins:** Water soluble and Fat soluble vitamins, Chemistry and functions of Hb and MyoHb.	**06 hrs**
7	**Hormones:** Characteristics and classification of hormones, Mechanism of action of peptide and steroid hormones, Hormone receptors and diseases	**06 hrs**
8	**Biological Oxidation:** Bioenergetics **,** Biological oxidation **,** Electron transport chain**,** Oxidative phosphorylation	**06 hrs**

Reference Books:

1. Biochemistry- Stryer,Berg, 6th Edition,W.H.Freeman and Co.,2007.
2. Biochemistry-Metzler;DE, 2nd Edn.,Academic press,2001.
3. Lehninger' Principles of biochemistry-Nelson,Cox, 4th Edn., W.H.Freeman and Co.,2005.
4. Biochemistry –Voet; D, Voet; J, 3rdEdn.John Wiley and sonsInc. 2004.
5 Outlines of Biochemistry-Conn;E, Stumpf,5th Edn. Tata-McGraw Hill, 1988.
6 Harper's Principles of Biochemistry-Murray, Gardener, Mayes, Rodwell, 27th Edn.McGraw Hill Education, 2006
7 Biochemistry- Rawn, D, Pamina publications, 2004
8.Textbook of biochemistry-West,Todd,Mason,VanBrergen,4th edn. Oxford&IBH, 1966.
9.Biochemistry-Satyanarayan.U, Books&Allied (P) Ltd., 2003.
10. Biochemistry-Champe; P, 3rdEdn. Lippincott Willams&Wilkins, 2005.
11. Biochemistry-Zubay; G, 3rdEdn. Pearson Education P.Ltd, 2003

Name of the Programme	**M. SC MEDICAL BIOTECHNOLOGY**
Course Code	**BT 101 P**
Name of the Course	**CELL BIOLOGY (PRACTICAL)**

Sr No	**Practical (60 Hrs.)**
1	Sterilization techniques (Wet and Dry Sterilization, Chemical Sterilization and Ultra-filtration)
2	Microscopy
3	Cell counting (using Haemocytometer) a) WBC- Differential Staining b) Total Count
4	RBC osmotic fragility
5	Cell Viability Assay- (using Typhan blue Stain)
6	Preparation of monolayer cell
7	Preparation of microbial, animal for microscopic observation (anucleated and nucleated cells)
8	Osmosis , exosmosis and endosmosis
9	Fixation of cells & different fixatives
10	Microtomy (Demonstration)

****Note: Any 5 Practical from each paper is mandatory.**

Name of the Programme	**M. SC MEDICAL BIOTECHNOLOGY**
Course Code	**BT 102 P**
Name of the Course	**IMMUNOLOGY & IMMUNOTECHNOLOGY (PRACTICAL)**

Sr No	**Practical (60 Hrs.)**
1	Blood film preparation and identification of cells
2	Lymphoid organs and their microscopic organization
3	To test the pattern of antigen-antibody interaction through Ouchterlony double diffusion assay
4	Separation of mononuclear cells by Ficoll-Hypaque
5	Western-blotting (Demonstration)
6	To detect the antigen/antibody using Enzyme Linked Immuno Sorbent Assay (ELISA). (Demonstration)
7	VDRL test (Demonstration)
8	Immunodiagnostics (demonstration using commercial kits)
9	Blood group typing using haemagglutination tests.

****Note: Any 5 Practical from each paper is mandatory.**

Name of the Programme	**M. SC MEDICAL BIOTECHNOLOGY**
Course Code	**BT 103 P**
Name of the Course	**ANALYTICAL INSTRUMENTATION (PRACTICAL)**

Sr No	**Practical (60 Hrs.)**
1	Practical based on Centrifugation: Density gradient centrifugation
2	Practical based on Spectrophotometer: Plotting a standard graph using a gradient solution and determination of concentration given sample.
3	Practical based on Chromatography: Paper chromatography, column chromatography
4	Practical based on Chromatography: column chromatography
5	Practical based on Electrophoresis: AGE
6	Practical based on Electrophoresis: SDS-PAGE
7	Dialysis / Membrane filtration: Separation of colloids and crystalloids using column sephadex for sugars and proteins

****Note: Any 5 Practical from each paper is mandatory.**

Name of the Programme	**M. SC MEDICAL BIOTECHNOLOGY**
Course Code	**BT 104 P**
Name of the Course	**BASIC BIOCHEMISTRY & BIOMOLECULES (PRACTICAL)**

Sr No	**Practical (60 Hrs.)**
1	Estimation of uric acid
2	Estimation of urea
3	Precipitation reactions of proteins
4	Estimation of enzyme activity ALT/AST
5	Protein estimation by Biuret , Albumin estimation of BCG and A/G ratio
6	Estimation of calcium
7	Estimation of phosphorous
8	Normal urine analysis
9	Estimation of glucose by GOD - POD method
10	Estimation of bilirubin by auto analyzer
11	Hemoglobinopathaties screening
12	Estimation of HbA1C by HPLC

****Note: Any 5 Practical from each paper is mandatory.**

ACADEMIC SYLLABUS FOR SEMESTER-II

Name of the Programme	**M. SC MEDICAL BIOTECHNOLOGY**
Course Code	**BT 105 T**
Name of the Course	**MOLECULAR BIOLOGY AND GENOMICS**

Course objective	1. Nucleic acid structure and interactions, signaling proteins and membrane proteins, enzyme kinetics and drug discovery and protein design. 2. It includes all steps in eukaryotic gene expression from chromatin accessibility to translation and mRNA turnover. Including the dynamics of proteins and membrane-bound organelles in eukaryotic cells. 3. Including cell and molecular biology of signaling and cancer, DNA repair and apoptosis. 4. Protein synthesis mechanisms, especially with respect to ribosome structure-function and accuracy of translation, considered mainly in prokaryotes. 5. Nucleosome positioning in relation to promoter architecture; promoter remodelling. The roles of histone acetylation, and the targeted acetylases (and deacetylases), and the action of ATP-dependent 'chromatin remodelling machines'.
Course outcomes	At end of the course accomplishment the students will marvel in 1. Molecular biology is the basic science that has as its goal an explanation of life processes at the sub cellular and molecular level. 2. The organization of the genome, the replication, the formation of RNA (transcription), the processing of pre mRNA and the protein synthesis (translation). 3. Relate properties of cancerous cells to mutational changes in gene function. 4. Account for regulation of cell form and movement; including cytoskeleton organization and generation of force and cell motility. 5. Describe and carry out basic molecular genetic methods; including work with bacteria, PCR amplification and analysis and electrophoresis of nucleic acid. 6. They will generate and test hypotheses, analyze data using statistical methods where appropriate, and appreciate the limitations of conclusions drawn from experimental data.

Unit no.	Topics	Hours allotted 60hrs
1	**Structure of Nucleic Acid:** DNA, RNA, mRNA, tRNA, rRNA, Denaturation and Renaturation of DNA, Tm; GC content from Tm, Renaturation kinetics of DNA and complexity of DNA, Cot curves Satellite DNA: Repetitive DNA, SNP, STR,	**10 hrs**
2	**DNA Replication:** Prokaryotic and eukaryotic DNA replication, Mechanism of DNA replication, Enzymes and accessory proteins involved in DNA replication. DNA Damage & Repair.	**8 hrs**
3	**DNA Recombination** Models of homologous recombination - Homologous recombination protein machinery - Homologous recombination in eukaryotes	**8 hrs**
4	**Transcription**Prokaryotic transcription, Eukaryotic transcription, RNA polymerases, General and specific transcription factors, Regulatory elements and mechanisms of transcription regulation, 5'-Cap formation, Transcription termination, 3'-end processing and polyadenylation, Post-transcriptional gene silencing	**10 hrs**
5	**RNA splicing** Nuclear splicing, splice some and small nuclear RNAs, group I and group II introns, *Cis*- and *Trans*-splicing reactions, tRNA splicing, alternate splicing.	**8 hrs**
6	**Translation** Prokaryotic and eukaryotic translation: Synthesis of aminoacyltRNAsynthesases, Mechanism of initiation, elongation and termination, Regulation of translation, co-and post-translational modifications of proteins	**8 hrs**
7	**Regulation of gene expression** Induction and repression, operon theory, *lac* operon, *trp*operon, ara operon, attenuation, positive and negative control, catabolite repression, regulation of transcription by Camp and CRP	**8 hrs**

Reference Books:

1) Molecular Biology; David Freifelder, Narosa Publishing House,2nd edition (2004)
2) Microbial Genetics; David Freifelder, Narosa Publishing House, 2ndedition(2004)
3) Principles of Gene Manipulations; S. B. Primrose, R. M. Twyman, R. W. old, Blackwell Science,6th Edition (2003).
4) Gene VIII; Benjamin Lewin; Oxford Univ. Press, 8thedition (2004)
5) Advanced Molecular Biology; R. M. Twyman, 1st Edition, (2003)
6) Instant Notes on Molecular Biology; P.C. Turner, A. G. Mclennan, A. D. Bates & M. R. H. White, 2nd Edition (2002)

Name of the Programme	**M. SC MEDICAL BIOTECHNOLOGY**
Course Code	**BT 106 T**
Name of the Course	**RECOMBINANT DNA TECHNOLOGY (THEORY)**

Course objective	To apprehend the candidate with: 1. Site-specific recombination and transposition can promote both genome stability and genetic diversity. 2. To explain the molecular mechanisms behind different modes of gene regulation in bacteria and eukaryotes at both pre- and posttranscriptionallevels; to compare and contrast various ways in which gene expression is regulated by small RNAs. 3. Distinguish between different molecular biology techniques that are used to isolate, separate, and probe for specific proteins, nucleic acids, and their interactions; to identify limitations of these techniques. 4. Describe the structure of DNA, and explain how it carries genetic information in its base sequence. 5. DescribeRNA and protein synthesis. Control as exerted both at the level of higher order structure and nucleosome occlusion of promoters, both of which are naturally repressive. Nucleosome positioning in relation to promoter architecture; promoter remodelling.
Course outcomes	At end of the course accomplishment the students will marvel in: 1. The arrangement of genes on human chromosomes. 2. The polymerase chain reaction can be used to amplify DNA segments, and how it may be used to analyze DNA. Contrast in vivo and ex vivo gene therapy techniques. 3. Evaluate and understand the meaning of DNA sequence and amino acidpolymorphisms. 4. A general understanding of methods for gene transferinto tissue culture cells and the power of transgenictechnologies. 5. Analyze significance of model organisms in recombinant DNA technology.

Unit no.	Topics	Hours allotted 60hrs
1	**Enzymes used in DNA technology:** Restriction and modification enzymes, Other nucleases, Polymerases, ligases, kinases and phosphotases. Cloning vectors: plasmids, phages, cosmids, artificial chromosomes, shuttle vectors, expression vectors.	**10 hrs**
2	**DNA transactions in Microbes:** Transformation, transduction and conjugation. Cloning , Vectors – Plasmids, cosmids, λ, phagemids, yeast artificial chromosomes.	**10 hrs**
3	**Cloning Methodologies** Insertion of Foreign DNA into Host Cells; Transformation; Construction of libraries; Cdna and genomic libraries; Cdna and genomic cloning; Expression cloning; Jumping and hopping libraries; **Direct and indirect methods**. Probe Preparation (radiolabel ling and non radiolabel ling). Methods based on Nucleic acid homology (Southern, northern, western, southern-western, colony and plaque hybridization, chromosomal walk, etc.).	**12 hrs**
4	**PCR and Its Applications** Primer design; Fidelity of thermos table enzymes; DNA polymerases; Types of PCR – multiplex, nested, reverse transcriptase, real time PCR, touchdown PCR, hot start PCR, colony PCR, cloning of PCR products; PCR in gene recombination; Deletion; addition; Overlap extension; and Site specific mutagenesis; PCR in molecular diagnostics; Viral and bacterial detection; PCR based mutagenesis, Mutation detection: SSCP, RFLP, Oligo Ligation Assay (OLA), MCC (Mismatch Chemical Cleavage, ASA (Allele-Specific Amplification), PTT (Protein Truncation Test)	**14 hrs**
5	**Introduction of DNA** into mammalian cells; Transfection techniques; Gene silencing techniques; Introduction to siRNA; siRNA technology; Micro RNA; Principle and application of gene silencing; Gene knockouts and Gene Therapy; Creation of knockout mice; Disease model; Somatic and germ-line therapy- in vivo and ex-vivo; Suicide gene therapy; Gene replacement; Gene targeting; Transgenics; Cdna and intragenic arrays; Differential gene expression and protein array.	**14 hrs**

Reference Books:

1. Recombinant DNA: Watson et. al.
2. Genetic engineering :SandyaMitra
3. Principles of gene manipulation : Old & Primrose
4. Molecular Biology Lab fax I &II : T. A. Brown
5. Genetic Engineering and its applications. (2004) 2/e, Joshi. P: Agrobios, India
6. Gene Cloning and DNA analysis: An introduction, (2006) 5/e . T. A. Brown,Black Well Publishing Company.
7. Principles of Gene Manipulation; S. B. Primrose, R. M. Twyman& R. W. old;Blackwell Science, 6th Edition (2001).
8. Essential Molecular Biology (volume I) Practical Approach; Edited By T. A.Brown; Oxford University Press, 2nd Edition (2001).
9 .Molecular Cloning lab manual; Joseph Sambrook, David W. Russell, cold SpringHarbor Laboratory Press, 3rd Edition (2001)

Name of the Programme	**M. SC. MEDICAL BIOTECHNOLOGY**
Course Code	**BT 107 T**
Name of the Course	**BIOINFORMATICS (THEORY)**

Course objective	To apprehend the candidate with: 1. A project in bioinformatics using databases, current data analysis techniques and the development of appropriate computer software. 2. Describe the different types of data found at the NCBI and EBI resources Explain how to locate and extract data from key bioinformatics databases and resources. 3. To function software effectively to extract information from large databases and to use this information in computer modeling. 4. An understanding of the intersection of life and information sciences, the core of shared concepts, language and skills the ability to speak the language of structure-function relationships, information theory, gene expression, and database queried
Course outcomes	At end of the course accomplishment the students will marvel in 1. Locate and use the main databases at the NCBI and EBI resources. 2. Know the difference between databases, tools, repositories and be able touse each one to extract specific information. 3. Extract data from specific databases using accessions numbers, gene names etc. 4. Use selected tools at NCBI and EBI to run simple analyses on genomic sequences.

Unit no.	**Topics**	**Hours allotted 60 hrs**
1	**Introduction to Genomic data and Data Organization:** **Sequence Data Banks** – Introduction to sequence date banks *Protein sequence data bank*. NBFR-PIR, SWISSPROT, Signal peptide data bank, *Nucleic acid sequence data bank* – GenBank, EMBL nucleotide sequence data bank, AIDS virus sequence data bank, **Structural data banks** – protein Data Bank (PDB), The Cambridge Structural Database (CSD): Genome data bank – Metabolic path way data: Microbial and Cellular Data Banks.	**10 hrs**
2	**Sequence analysis:** Analysis Tools for Sequence Data Banks; Pair wise alignment – NEEDLEMAN and Wunsch algorithm, Smith Waterman, BLAST, FASTA algorithms to analyze sequence data: Sequence patterns motifs and profiles.	**15 hrs**
3	**Secondary Structure predictions:** Protein secondary structure classification databases: HSSP,	**10 hrs**

	FSSP, CATH, and SCOP. Protein secondary structure prediction methods: GOR, Chou-Fasman, PHD, PSI- PRED, J-Pre	
4	**Tertiary Structure predictions:** Protein Tertiary structure prediction methods: Homology Modeling, Fold Recognition, and Abintio Method. Protein folding, Molecular Dynamics of Protein, Molecular Docking of Protein, Small molecule and Nucleotide, Concepts of Force Field	**10 hrs**
5	**Motif and Domain:** Motif databases and analysis tools. Domain databases (CDD, SMART, Pro Dom) and Analysis tools. HMM (Hidden Markov Model): Introduction to HMM, its application in Sequence alignment and Structure prediction, HMM based Softwares (HMMER and HMMSTR	**15 hrs**

Reference Books:

1. Introduction to Bioinformatics – Teresa Atwood and David J.Parry, Pearson smith publication (2003)
2. Introduction to Bioinformatics – lesk, Oxford press (2003)
3. Fundamental Concepts of Bioinformatics - Dan E. Krane, Michael L. Raymer, Pearson education (2004)
4. Sequence structure and Database – Des Higgins, Willice Taylor, oxford press (2003)
5. Bioinformatics: Sequence and Genome analysis by David W. Mount CBS Publishers & Distributors, 2004 reprint
6. Bioinformatics: Sequence, Structure and Databanks A Practical Approach, Higgins, ISBN: 0195667530, I.K. International Publishing House Pvt. Ltd
7. Bioinformatics: Theory and Practice, Chikhale NJ and Gomase VS,b ISBN:978−81−8318−831−9, Himalaya Publication House
8. Proteomics: Theory and Practice, Gomase VS and Chikhale NJ, Himalaya Publication House
9. Discovering Genomics, Proteomics and Bioinformatics, Campbell, ISBN: 9788131715598, Pearson Education
10. Bioinformatics: Databases, Tools, and Algorithms, Orpita Bosu, Simminder Kaur, Thukral , ISBN: 9780195676839, Oxford University Press

Name of the Programme	**M. SC MEDICAL BIOTECHNOLOGY**
Course Code	**CC 001 T**
Name of the Course	**RESEARCH METHODOLOGY & BIOSTATISTICS (CORE COURSE)**

Teaching Objective	The course is intended to give an overview of research and statistical models commonly used in medical and bio-medical sciences. The goal is to impart an intuitive understanding and working knowledge of research designs and statistical analysis. The strategy would be to simplify, analyse the treatment of statistical inference and to focus primarily on how to specify and interpret the outcome of research.
Learning Outcomes	Student will be able to understand develop statistical models, research designs with the understating of background theory of various commonly used statistical techniques as well as analysis interpretation & reporting of results and use of statistical software.

Sr. No.	**Topics**	**Hours allotted 60hrs**
A	**Research Methodology:**	
1	Scientific Methods of Research: Definition of Research, Assumptions, Operations and Aims of Scientific Research. Research Process, Significance and Criteria of Good Research , Research Methods versus Methodology, Different Steps in Writing Report, Technique of Interpretation, Precaution in interpretation, Significance of Report Writing, Layout of the Research Report	5
2	Research Designs: Observational Studies: Descriptive, explanatory, and exploratory, Experimental Studies: Pre-test design, post-test design, Follow-up or longitudinal design, Cohort Studies, Case Control Studies, Cross sectional studies, Intervention studies, Panel Studies.	5
3	Sampling Designs: Census and Sample Survey, Implications of a Sample Design, Steps in Sampling Design Criteria of Selecting a Sampling Procedure, Characteristics of a Good Sample Design, Different Types of Sample Designs (Probability sampling and non probability sampling), How to Select a Random Sample?, Systematic sampling, Stratified sampling, Cluster sampling, Area sampling, Multi-stage sampling, Sampling with probability proportional to size, Sequential sampling.	5
4	Measurement in research: Measurement Scales, Sources of Error in Measurement, Tests of Sound Measurement, Technique of Developing Measurement Tools, Scaling Meaning of Scaling, Scale Classification Bases, Important Scaling Techniques, Scale Construction Techniques, Possible sources of error in measurement, Tests of sound measurement	5

5	Methods of Data Collection: Types of data, Collection of Primary Data, Observation Method, Interview Method, Collection of Primary Data	5
6	Sampling Fundamentals : Need and importance for Sampling, Central Limit Theorem, Sampling Theory, Concept of Standard Error, Estimation, Estimating the Population Mean Estimating Population Proportion, Sample Size and its Determination, Determination of Sample Size through the Approach Based on Precision Rate and Confidence Level.	5
B	**Biostatistics**	
7	Data Presentation: Types of numerical data: Nominal, Ordinal, Ranked, Discrete and continuous. Tables: Frequency distributions, Relative frequency, Graph: Bar charts, Histograms, Frequency polygons, one way scatter plots, Box plots, two way scatter plots, line graphs	3
8	Measures of Central Tendency and Dispersion: Mean, Median, Mode Range, Inter quartile range, variance and Standard Deviation, Coefficient of variation, grouped mean and grouped standard deviation (including merits and demerits).	3
9	Testing of Hypotheses: Definition, Basic Concepts, Procedure for Hypothesis Testing, Measuring the Power of a Hypothesis Test, Normal distribution, data transformation Important Parametric Tests, Hypothesis Testing of Means, Hypothesis Testing for Differences between Means, Hypothesis Testing for Comparing Two Related Samples, Hypothesis Testing of Proportions, Hypothesis Testing for Difference between Proportions, Hypothesis Testing for Comparing a Variance to Some Hypothesized Population Variance, Testing the Equality of Variances of Two Normal Populations.	6
10	Chi-square Test: Chi-square as a Non-parametric Test, Conditions for the Application Chi-square test, Steps Involved in Applying Chi-square Test, Alternative Formula, Yates' Correction, and Coefficient by Contingency.	2
11	Measures of Relationship: Need and meaning, Correlation and Simple Regression Analysis	2
12	Analysis of Variance and Covariance: Analysis of Variance (ANOVA):Concept and technique of ANOVA, One-way ANOVA, Two-way ANOVA, ANOVA in Latin-Square Design Analysis of Co-variance (ANOCOVA), ANOCOVA Technique.	4
13	Nonparametric or Distribution-free Tests: Important Nonparametric or Distribution-free Test Sign test, Wilcoxon signed-Rank Test, Wilcoxon Rank Sum Test: Mann-Whitney U test Kruskal Walli's test, Friedman's test, and Spearman Correlation test.	3
14	Vital Health Statistics: Measurement of Population: rate, crude rate, specific rate, Measurement of fertility: specific fertility rate, Total fertility rate, Reproduction rate, Gross Reproduction Rate, Net Reproduction Rate, Measures related to mortality: Crude Death Rate (CDR), Age-specific death Rate, Infant and child mortality rate, Measures related to morbidity.	4
15	Computer Application Use of Computer in data analysis and research, Use of Software and Statistical package. Introduction to SPSS. Importing data from excel, access, tab and comma separated files. Entering data, labeling a variable, coding and recoding a categorical and continuous variable. Converting data from string to numeric variables, sorting & filtering, merging, appending data sets. Frequencies, descriptive statistics, cross tabulations. Diagrammatic presentation include histogram, bar chart, pie chart, scatter diagram, box plot, line chart. Parametric test of hypothesis-one sample, Independent and paired sample t test, one way ANOVA& post HOC test. Testing for normality, Chi-square test with measures of association. Pearson correlation. Non parametric test.	3

Name of the Programme	**M. SC MEDICAL BIOTECHNOLOGY**
Course Code	**BT 105 P**
0Name of the Course	**MOLECULAR BIOLOGY & GENOMICS (PRACTICAL)**

Sr No.	**Practical (60 Hrs.)**
1	DNA extraction from blood - Manual Method
2	Isolation of RNA
3	Purification and Concentration of the DNA/RNA- Spectrophotometer
4	Estimation of DNA by Chemical Means- Diphenyl amine method
5	Estimation of RNA by Chemical Means- Orcinol Method
6	**I**solation of nucleic acids from the given sample and determination of the DNA and RNA content.
7	PCR analysis of DNA fragments by agarose gel electrophoresis

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****Note: Any 5 Practical from each paper is mandatory.**

Name of the Programme	**M. SC MEDICAL BIOTECHNOLOGY**
Course Code	**BT 106 P**
Name of the Course	**RECOMBINANT DNA TECHNOLOGY (PRACTICAL)**

Sr No	**Practical (60 Hrs.)**
1	Making bacterial cells competent
2	Isolation of plasmid DNA- Kit Based Method
3	PCR based diagnosis of diseases
4	In *vitro* DNA ligation
5	Bacterial conjugation
6	DNA blotting technique Northern blotting technique & Southern blotting
7	RFLP technique

****Note: Any 5 Practical from each paper is mandatory.**

Name of the Programme	**M. SC MEDICAL BIOTECHNOLOGY**
Course Code	**BT 107 P**
Name of the Course	**BIOINFORMATICS (PRACTICAL)**

Sr No	Practical (60 Hrs.)
1	Literature databases (searching & downloading)
2	Nucleic Acid sequence databases: Gen Bank, EMBL, DDBJ
3	Searching protein sequences related to an unknown sequence: PIR-PSD,
4	Swiss Prot
5	TrEMBL/GenPept
6.	Finding the secondary structure of an unknown sequence
7	Using Clustal W
8	Database searches: Text-based searching, Simple and advanced forms Manipulation of displays , Entrez /SRS-query engines
9	Computational molecular biology & genetics: Overview, Exploring EMBOSS series, Exploring OMIM
10	Database searches: Sequence comparisons & alignment, NW , SW,BLAST & FAST

****Note: Any 5 Practical from each paper is mandatory.**

CC 001 P – Research Methodology & Biostatistics

Sr. No.	Topics	Hours allotted 60hrs
A	**Research Methodology**	
1	Sampling Designs	**4 hrs**
2	Measurement in research	**5 hrs**
3	Methods of Data Collection	**3 hrs**
4	Sampling Fundamentals	**3 hrs**
B	**Biostatistics**	
5	Data Presentation	**4 hrs**
6	Measures of Central Tendency and Dispersion	**4 hrs**
7	Testing of Hypotheses	**12 hrs**
8	Chi-square Test	**2 hrs**
9	Measures of Relationship	**3 hrs**
10	Analysis of Variance and Covariance	**4 hrs**
11	Nonparametric or Distribution-free Tests	**4 hrs**
12	Vital Health Statistics: Measurement of Population	**6 hrs**
13	Computer Application Using Statistical Software	**6 hrs**

ACADEMIC SYLLABUS FOR SEMESTER-III

Name of the Programme	**M. SC MEDICAL BIOTECHNOLOGY**
Course Code	**BT 108 T**
Name of the Course	**PLANT BIOTECHNOLOGY**

Course objective	The course will provide capability to: 1. This course explores the use of biotechnology to both generate genetic variation in plants and to understand how factors at the cellular level contribute to the expression of genotypes and hence to phenotypic variation. 2. To expand the understanding in an emphasis on the molecular mechanisms directing plant gene expression under diverse environmental and developmental stimuli. 3. To improvise the knowledge is central to our ability to modify plant responses and properties for global food security and commercial gains in biotechnology and agriculture.
Course outcomes	At the end of the course student will be execute 1. To explain the basics of the physiological and molecular processes that occurs during plant growth and development and during environmental adaptations. 2. To understand how biotechnology has been used to develop knowledge of complex processes that occur in the plant. 3. To use basic biotechnological techniques to explore molecular biology of plants. 4. To understand the processes involved in the planning, conduct and execution of plant biotechnology experiments. 5. Explain how biotechnology is used for plant improvement and discuss the ethical implications of that use.

Unit no.	Topics	Hours allotted 60hrs
1	**Introduction to cell and tissue culture**; Tissue culture as aTechnique to produce novel plants and hybrids. *Tissue culture media* (Composition and Preparation). Sterilization and agents of Sterilization used in tissue culture labs. **Initiation and maintenance of callus and suspension cultures***;* Single cell clones. **Organogenesis;** Somatic embryogenesis; Transfer and establishment of whole plants in soil. Shoot tip culture; Rapid clonal propagation and production of virus-free plants. Embryo culture and embryo rescue	**15 hrs**
2	**Protoplast isolation, culture and fusion;**Selection of hybrid cells and regeneration of hybrid plants; Symmetric and asymmetric hybrids, cybrids. Anther, pollen and ovary culture for production of haploid plants and homozygous lines.	**10 hrs**
3	**Chemistry of Natural Products** – General pharmacognosy – Cultivation of medical plants, Selection and breeding of medicinal plants, factors affecting plant growth Preparation of drugs from plants to pharmaceuticals –n Adulteration, Secondary plant metabolites, Dusting powder- hairs & fabrics	**10 hrs**
4.	**Chemistry of Natural Products** – Alkaloids- General reactions, Phenylalkyl amine alkaloids, Pyridine alkaloids, Pyrrolizidine alkaloids, Pipperine alkaloids, Quinoline alkaloids, Isoquinoline alkaloids, Quinolizidine alkaloids, Tropolone alkaloids, Purine alkaloids, Tropane alkaloids, Volatile oils, terpenes, Oxegenatedterpenes, Lipids & Fixed oils, fats & waxes, Vitamins & minerals	**10 hrs**
5.	**Quality control of herbal products**, Validation of methods, Tissue culture, Gas chromatography (basis, instrumental, applications, Q.C. by finger print by GLC analysis of natural products), HPLC(basis, instrumental, applications, Q.C. by finger print by HPLC analysis of natural products, Structural elucidation of natural products (UV, IR, 1D & 2D NMR & Mass spectroscopy)	**15 hrs**

Reference Books:

1. Introduction to Plant Tissue Culture, M. K. Razdan
2. Plant Tissue Culture - 3rd Edition - Elsevier
3. Plant Tissue Culture: Techniques ...Book by Robert H. Smith
4. Plant Tissue Culture: An Introductory Text
5. Book by Prem Kumar Dantu and S. S. Bhojwani

Name of the Programme	**M. SC MEDICAL BIOTECHNOLOGY**
Course Code	**BT 109 T**
Name of the Course	**ANIMAL BIOTECHNOLOGY**

Course objective	The students will inculcate with: 1. The application of biotechnology to animals will be examined. Challenges facing the intensive and extensive livestock industries, as well as wildlife management and conservation, will be discussed and debated in the context of biotechnologies that may be applied. 2. Problems specific to horses and companion animals will be also considered. 3. The contribution of biotechnology to laboratory animal models for human and animal disease will be addressed. In addition, the use of biotechnology for animal related issues such as food safety, disease control and biosecurity will be considered. 4. A range of genetic, immunological and reproductive technologies will be introduced with some practical exposure. The integration of these technologies to improve animal production, health and welfare will be explored.
Course outcomes	At the end of the course the student will adroit: 1. Describe the limitations and challenges facing the animal industries and discipline. 2. Describe the various biotechnologies available to the animal related fields. 3. Explain how developments in biotechnology may have applications in those fields. 4. Evaluate and discuss public and ethical concerns over the use of animal biotechnology. 5. Locate and critically evaluate scientific literature and experimental studies relating to animal biotechnology and be able to effectively communicate the findings in oral and written form.

Unit no.	Topics	Hours allotted 60hrs
1	**Structure and organization of animal cell.** Equipments and materials for animal cell culture technology	**10 hrs**
2	**Introduction** to the balanced salt solutions and simple growth medium.	**05 hrs**
3	**Brief discussion on the chemical**, physical and metabolic functions of different constituentsof culture medium. Role of carbon dioxide. Role of serum and supplements. Serum andProtein free defined media and their application	**15 hrs**
4.	**Primary and established cell line cultures**. Measurement of viability and cytotoxicity.Biology and characterization of the cultured cells, measuring parameters of growth.	**10 hrs**
5.	**Basic techniques of mammalian** cell culture in vitro; disaggregation of tissue and primaryCulture; maintenance of cell culture; Cell cloning and cell separation. Cell synchronization.Cell transformation. Scaling up of animal cell culture. Stem cell cultures, embryonic stemcells and their Applications, embryo technology	**08 hrs**
6.	**Applications of animal biotechnology:**Use of cell culture for production of a regulatoryprotein, Use of cell culture forproduction of a hormone (e.g. Insulin), Use of cell culture forproductionofvaccines, Cell hybridization and human hybridization. Use of cell culture inDrugtargeting and drug toxicity analysis. Transplantation of cultured cells.	**12 hrs**

Reference Books:

1. Principles and Practice of Animal Tissue Culture (Second Edition)
2. An Introduction to Animal Tissue Culture John Anthony Sharp
3. Culture of animal cell, sixth edition, R.IanFresheey
4. Principles & Practices Of Animal Tissue Culture ,GangalSudha

CORE ELECTIVE COURSE**

Name of the Programme	**M. SC MEDICAL BIOTECHNOLOGY**
Course Code	**BT 110 T**
Name of the Course	**MEDICAL MICROBIOLOGY**

Course objective	To inculcate the candidate with : 1. To define/explain within multiple microbiology disciplines the core theories and practices. 2. Describe/ explain the processes used by microorganisms for their replication, survival, and interaction with their environment, hosts, and host populations. 3. To demonstrate practical skills in the use of tools, technologies and methods common to microbiology, and apply the scientific method and hypothesis testing in the design and execution of experiments. 4. To evaluate and respond to a complex question or challenge, using perspectives and scholarship drawn from microbiology and from cognate and non-cognate fields.
Course outcomes	At the end of course students will adroit : 1. Students will be able to acquire, articulate, retain and apply specialized language and knowledge relevant to microbiology. 2. Students will acquire and demonstrate competency in laboratory safety and in routine and specialized microbiological laboratory skills applicable to microbiological research or clinical methods, including accurately reporting observations and analysis. 3. Students will communicate scientific concepts, experimental results and analytical arguments clearly and concisely, both verbally and in writing. Students will demonstrate engagement in the Microbiology discipline through involvement in research or internship activities.

Unit no.	Topics	Hours allotted 60hrs
1	**Historical Introduction:**Definition of Medical Microbiology. Concepts of disease, Evolution of Medical Microbiology, Important scientists & their contributions of Leeuwenhoek, Louis, Lister Robert Koch, Koch postulates	**08 hrs**
2	**Classification of living beings** Kingdom Protista, Prokaryotic & eukaryotic cells, Units of measurement. Microscopy – Principles &parts of light microscope. Other types of microscopes.	**08 hrs**
3	**Study of bacteria** Wet mount, staining methods – Grams stain, ZN stain, special stains. Size, shape & arrangement of different bacteria. Classification of bacteria (GmPos&Neg), Examples of acid fast orgs.	**06 hrs**
4.	**Structure of bacterial cell** Composition, function of various parts (I) & same (II)	**05 hrs**
5.	**Growth & multiplication of bacteria** Bacterial growth curve, nutritional and other growth requirements	**07 hrs**
6.	**Need for sterilization**, Definitions, classification of physical agents with egs., Details of autoclave and hot air oven *Culture media, Identification of bacteria biochemical tests*	**05 hrs**
7.	**Infection** – Pathogenecity& virulence factors, disease burden, investigation of epidemics	**05 hrs**
8.	**Bacterial genetics:**Antibiotic sensitivity test & drug resistence, Antibacterial – Mode of action, classification, Antifungal, Antiviral, Antiparasitic – Antiprotozoal &Antihelminths	**08 hrs**
9.	**Virology** – Structure, properties of viruses, replication Classes – DNA &RNA & list of diseases caused, viral & bacterial vaccines, Vectors – Viral & bacterial	**08 hrs**

Reference Books:

1. Textbook of Microbiology ;R. Ananthnarayan, C. K. J. Panicker, Orient Longman 6th Edition (2003)
2. Immunology: Introductory textbook;Nandini Shetty, New Age International pvt.Ltd. 1st Edition (2003)
3. Principles of Virology by SJ Flint, LW Enquist, RM Krug, VR Racaniello, AM
4. Skalka ASM Press Washington 1st edition (2002)
5. An introduction to genetic engineering by ST Desmond and Nicholl CambridgeUniversity Press 2nd edition(2004)
6. General Microbiology Vol. II by Powar and Daginawala Himalaya Publ. House8th edition (2004)

Name of the Programme	**M. SC MEDICAL BIOTECHNOLOGY**
Course Code	**BT 111 T**
Name of the Course	**HUMAN GENETICS**

Course objective	To Inculcate the candidate with: 1. To understands the Mendelian and non mendelian modes of inheritance that govern passage of genetic traits across generation. 2. To use this knowledge of inheritance to track alleles through generations and categorize and predict genotypes and phenotypes; to understand basic structure and function of DNA and chromosomes. 3. To draw the stages of mitosis and meiosis and explain how the process of mutation occurs and generates phenotypic diversity. 4. To understand the Hardy-Weinberg equilibrium equation; to understand the basics of the molecular processes of DNA replication. 5. To be particularly familiar with the molecular basis for sickle cell anemia
Course outcomes	At the end of course accomplishment the student will adroit in: 1. Demonstrate a high level of proficiency in navigating relevant literature, web sites and databases for research into human genetics and in using these sources to develop and test hypotheses in the field of human genetics 2. Describe the approaches used to identify the genetic basis of simple, heterogeneous and complex traits and appreciate the duties, responsibilities and challenges facing the professionals who perform these analyses. 3. Explain the genetic (coding and non-coding) and epigenetic mechanisms of gene expression control and their role in human inherited disease. 4. Explain the theoretical and practical basis of the latest advances in genomic technologies and their application to disease gene identification and personalized medicine.

Unit no.	Topics	Hours allotted 60hrs
1	**Mendelism and its extensions** Law of segregation; Law of independent assortment; Chromosomal basis of segregation and independent assortment; Linkage; Crossing over; Multiple allelism; Pleiotropy; Cytoplasmic inheritance	**08 hrs**
2	**Cytogenetic** International System for Human Chromosome Nomenclature; Mechanisms of numerical and structural chromosomal aberrations; Chromosomal basis of sex determination; Nonchromosomal basis of sex determination; Cytoplasmic inheritance	**08 hrs**
3	**Population genetics** Allelic and genotypic frequencies, Hardy-Weinberg Equilibrium, Changes in allelic frequencies, Inbreeding and out breeding.	**10 hrs**
4.	**History of Human Genetics:Pedigrees-** gathering family history; Pedigree symbols;Construction of pedigrees; Presentation of molecular genetic data in pedigrees; Pedigreeanalysis of monogenic traits: Autosomal inheritance-dominant, recessive; Sex-linkedinheritance- X-linked recessive, dominant; Y–linked; Sex-limited and sex-influenced traits;Mitochondrial inheritance; MIM number; Complications to the basic pedigreepatterns I: Non-penetrance, variable expressivity, pleiotropy, onset, dominance problem;Anticipation;	**10 hrs**
5.	**Historical overview of genetic counseling:**Models of Eugenic, Medical/Preventive,Decision making, Psychotherapeutic counseling; current definition and goals, Componentsof genetic counseling Indications and purpose, Information gathering and construction ofpedigree, Medical Genetic evaluation, Basic components of Medical History, Past medicalhistory, social & family history, Physical examination	**12hrs**
6.	**Genetic disorders** Inborn errors of metabolism: Phenylketonuria; Neurogenetic disorders: Alzheimer'sdisease; Muscle genetic disorders: Duchenne Muscular Dystrophy; Genetic disorders ofHaematopoitic systems: Sickle cell anemia; Multifactorial disorders: Diabetes mellitus;Mitochondrial syndromes; Management of genetic disorders	**12 hrs**

Reference Books:

1. Gardner EJ, Simmons MJ, Snustard DP,(2004).Principles of Genetics.8th Ed,John Wily & sons Inc
2. Jain H K, (2004), Genetics: Principles, Concepts & Implications. Oxford & IBH PublishingCo.P.Ltd
3. Robert.R.H,(2002), Principles of Genetics, 7thEd.Tata McGraw Hill PublishingCo.Ltd
4. Sambamurthy AVSS, (1999).Genetics.Narosa Publishing House
5. Winter P C, Hickey G I, Fletcher H L, (2003).Instant notes of Genetics, 2nd Ed, Viva BooksPvt Ltd
6. Verma PS, Agarwal VK.(2007).Cell Biology,Genetics,MolecularBiology ,Evolution andEcology.S.Chand
7. Strickberger, Genetics, 3rd edition, McMillan, 1985.
8. Snustad& Simmons, Principles of Genetics, 4th Edition, Wiley, 2005.
9. Griffiths et al, Modern genetic analysis, 2nd Edition, Freeman, 2002.
10. Hartl and Jones, Genetics-Principles and Analysis, 4th Edition, Jones & Bartlett, 1998.
11. Lewin, Genes IX, 9th Edition, Jones & Bartlett, 2007.

Name of the Programme	**M. SC MEDICAL BIOTECHNOLOGY**
Course Code	**BT 112 T**
Name of the Course	**NANOBIOTECHNOLOGY**

Course objective	The course will function on : 1. Relevant knowledge from the disciplines of physics and chemistry to give you a fundamental understanding of the integrated multidisciplinary nature of Nanotechnology. 2. Experiment and computatecharacterisation of nanomaterials.on current microtechnologies including the design and fabrication of microelectronic circuits, microsystems and optoelectronics for biological studies. 3. Molecular medicine is the study of molecular and cellular phenomena in biological systems that enhances our understanding of human diseases and facilitates discovery research in disease prevention, diagnosis and therapy. 4. The study will includenclude new implant technologies, regenerative engineering, new nanomedicines to combat cancer and drug resistance, targeted medicines for treatment with reduced side effects, diagnostic technologies using nanomaterials etc.
Course outcomes	At the successfulcompletion of the course the student will: 1. Describe the basic science behind the properties of materials at the nanometer scale, and the principles behind advanced experimental and computational techniques for studying nonmaterials. 2. Communicate clearly, precisely and effectively using conventional scientific language and mathematical notation. 3. Systematically solve scientific problems related specifically to nanotechnological materials using conventional scientific and mathematical notation.

Unit no.	Topics	Hours allotted 60hrs
1	**Functional Principles of Nanobiotechnology**: From Biotechnology to Nanobiotechnology. What is Nanobiotechnology? Information-Driven Nanoassembly, Energetic, Top down and bottom up approach for building nanomaterials, Chemical Transformation Biomaterials, Machine-Phase Nanobiotechnology	**10 hrs**
2	**Chemical methods for synthesis of Nanomaterials:** colloids and colloids in solutions, colloids in vacuum, colloids in medium, synthesis of colloids, growth of nanoparticles, synthesis of metal nanoparticles, synthesis of semiconductor nanoparticles, langmuir-blodgett method, micro emulsions, sol-gel method	**15 hrs**
3	**Biological synthesis of Nanomaterials:** synthesis using microorganisms, synthesis using plant extracts, synthesis using proteins and DNA template	**15 hrs**
4.	**Characterization Methods:** Optical Microscopy – Scanning Electron Microscopy – Transmission Electron Microscopy - Atomic Force Microscopy – Scanning Tunneling Microscopy – Optical Absorption and Emission Spectroscopy – Thermo gravimetric Analysis – Differential Scanning Calorimetry – Thermo mechanical Analysis- X-Ray Diffraction.	**10 hrs**
5.	**Application of Bionanotechnology:** Biosensors as Precursors of Bioelectronics, Fictionalization of Sensing Substrates, Biochip, Nanosensors-Miniaturization of Biosensors, Nanomaterial Based Biosensors. Electron Transfer of Biomolecules, Nanoparticle-Biomaterial Hybrid Systems for Sensing and Electronic Devices, Effect of Biosensor in biological and physicochemical techniques	**10 hrs**

Reference Books:

1. Nanotechnology: An Introduction, By Jeremy Ramsden
2. Nanotechnology in Agriculture and Food Science, edited by Monique A. V. Axelos, Marcel Van de voorde
3. Nanotechnology: "Risk, Ethics and Law", edited by Geoffrey Hunt, Michael Mehta
4. Introduction to Nanotechnology, By Poole

Name of the Programme	**M. SC MEDICAL BIOTECHNOLOGY**
Course Code	**BT 113**
Name of the Course	**DISSERTATION/PROJECT PROPOSAL**

****The Dissertation work will begin from 3rd Semester, and will continue through the 4th Semester.**

Name of the Programme	**M. SC MEDICAL BIOTECHNOLOGY**
Course Code	**BT 108 P**
Name of the Course	**PLANT BIOTECHNOLOGY (PRACTICAL)**

Sr No	**Practical (60 Hrs.)**
1	Preparation of plant cell culture media.
2	Surface sterilization.
3	Organ Culture.
4	Callus propagation,
5	Organogenesis, transfer of plants to soil
6	Anther culture, production of Haploids.

****Note: Any 5 Practical from each paper is mandatory.**

Name of the Programme	**M. SC MEDICAL BIOTECHNOLOGY**
Course Code	**BT 109 P**
Name of the Course	**ANIMAL BIOTECHNOLOGY (PRACTICAL)**

Sr No	**Practical (60 Hrs.)**
1	Sterilization and preparation of animal cell culture media
2	Isolation and culture of lymphocytes
3	Cell counting and cell viability
4	Trypsinization of monolayer and sub culturing
5	Cryopreservation and thawing.
6	Measurement of doubling time
7	Role of serum in cell culture.

****Note: Any 5 Practical from each paper is mandatory.**

CORE ELECTIVE (Practical)

Name of the Programme	**M. SC MEDICAL BIOTECHNOLOGY**
Course Code	**BT 110 P**
Name of the Course	**MEDICAL MICROBIOLOGY**

Sr No	**Practical (30 hrs)**
1	Glassware used in Microbiology laboratory & its cleaning.
2	Study of different equipments- Bunsen burner, water bath, Autoclave, Laminar air flow, Incubator, Hot air oven, Centrifuge, and Refrigerator.
3	Study of Microscope- Compound Microscope & its parts. Use of oil Immersion objective.
4	Preparation of liquid medium -nutrients broth, sugar fermentation media.
5	Preparation of nutrient agar, agar slant.
6.	Isolation of microorganism by streak plate method.
7	Isolation of microorganism by pour plate method.
8	Isolation of microorganism by spread plate method.
9	Enumeration and cultivation of microorganisms
10	Isolation of bacteria from mixture
11	Isolation of antibiotic producers from soil and identification of the isolated culture
12	Staining Techniques
13	Haemagglutination test
14	Commercial kits-based diagnosis
15	Antibiotic sensitivity (bacterial).

Name of the Programme	**M. SC MEDICAL BIOTECHNOLOGY**
Course Code	**BT 111 P**
Name of the Course	**HUMAN GENETICS**

Sr No	**Practical (30 Hrs.)**
1	Lymphocyte culture and chromosome preparations
2	Chromosome preparations-PHA-stimulated short-term blood cultures
3	G-banding of chromosomes
4	Karyotype preparation
5	Preparation of Pedigree chart of some common phenotypic characters of human
6	Risk assessment in Pedigree
7	Study of Sex-chromatin from buccal smear
8	Facial landmarks and dermatoglyphia
9	In situ hybridization-FISH (example with centromeric and telomeric probes)
10	RT-PCR based Diagnosis

Name of the Programme	**M. SC MEDICAL BIOTECHNOLOGY**
Course Code	**BT 112 P**
Name of the Course	**NANOBIOTECHNOLOGY**

Sr No	**Practical (30 Hrs.)**
1	Verification of Lambert Beer's law and determination of concentration of unknown solution by UV-Vis spectrophotometer
2	Preparation of colloidal Silver (Ag) nanoparticles with trisodium citrate and their characterization by UV-Vis spectroscopy
3	Preparation of metal oxide nanoparticles by micro emulsion technique.
4	Surface plasmon absorbance of metal nanoparticles – UV-vis spectroscopy
5	Preparation of colloidal metallic nanoparticles with trisodium citrate by chemical method and their characterization by UV-Vis spectroscopy
6	Preparation of colloidal metallic nanoparticles with trisodium citrate by biological method and their characterization by UV-Vis spectroscopy

Name of the Programme	**M. SC MEDICAL BIOTECHNOLOGY**
Course Code	**BT 114**
Name of the Course	**SEMINAR**

For seminar/presentation there will be a maximum of 50marks. Seminar / presentations will be evaluated by the teachers of the dept. The marks obtained in the same will be kept confidentially with the Head of the Dept. and will be submitted along with the internal assessment marks.

ACADEMIC SYLLABUS FOR SEMESTER - IV

ELECTIVE COURSE

Name of the Programme	**M. SC MEDICAL BIOTECHNOLOGY**
Course Code	**GE 001 T**
Name of the Course	**PURSUIT OF INNER SELF EXCELLENCE (POISE)**

Course objective	1. To inculcate moral values in students – Self-Discipline , Time Management, Develop attitude of Service with humility, Empathy, Compassion, brotherhood, Respect for teachers, colleagues & society members. 2. Develop Effective means of communication & presentation skills in students 3. To develop wisdom in students for deciding their career based on their areas of interest and inner skills. 4. Introduce techniques for Relaxation, Meditation & Connecting with innerself. 5. Rejuvenation Techniques which can be used by students to distress themselves 6. To improve performance of students during various assignments, projects, elocutions, events, quiz, interviews.
Course outcomes	1. Students will become self dependent, more decisive and develop intuitive ability for their study and career related matter. 2. Student's ability to present their ideas will be developed. 3. Enhanced communication skills, public speaking & improved Presentation ability. 4. Students will be able to explore their inner potential and inner ability to become a successful researcher or technician & hence become more focused. 5. Students will observe significant reduction in stress level. 6. With the development of personal attributes like Empathy, Compassion, Service, Love &brotherhood , students will serve the society and industry in better way with teamwork and thus grow professionally.

Unit no.	Topics	Hours allotted 60hrs
1	**Spiritual Values for human excellence :** The value of human integration; Compassion, universal love and brotherhood (Universal Prayer) ; Heart based living ; Silence and its values, Peace and non-violence in thought, word and deed ; Ancient treasure of values - Shatsampatti , Patanjali'sAshtanga Yoga ,Vedic education - The role of the Acharya , values drawn from various cultures and religious practices - Ubuntu, Buddism, etc.; Why spirituality? Concept – significance ; Thought culture	**15 hrs**
2	**Ways and Means :** Correlation between the values and the subjects ;Different teaching techniques to impart value education; Introduction to Brighter Minds initiative; Principles of Communication; Inspiration from the lives of Masters for spiritual values - Role of the living Master	**15 hrs**
3	**Integrating spiritual values and life:** Relevance of VBSE (Value Based Spiritual Education) in contemporary life ; Significant spiritual values ; Spiritual destiny ; Principles of Self-management; Designing destiny	**15 hrs**
4	**Experiencing through the heart for self-transformation (Heartfulness Meditation):** Who am I? ; Introduction to Relaxation; Why, what and how HFN Meditation?; Journal writing for Self-Observation ; Why, what and how HFN Rejuvenation (Cleaning)? ; Why, what and how HFN connect to Self (Prayer)?; Pursuit of inner self excellence ; Collective Consciousness-concept of *egregore effect;*	**15 hrs**

Reference Books:

1. www.pdfdrive.net
2. www.khanacademy.org
3. www.acadeicearths.org
4. www.edx.org
5. www.open2study.com
6. www.academicjournals.org

Name of the Programme	**M. SC MEDICAL BIOTECHNOLOGY**
Course Code	**GE 002 T**
Name of the Course	**BIOETHICS, BIOSAFETY, IPR & TECHNOLOGY TRANSFER**

Course objective	The students will gain structural knowledge on: 1. To list the routes of exposure for a pathogen to a human being . 2. To demonstrate and assess the proper use of PPE, best practices,biological containment, and be prepared to safely conduct research 3. To identify the role of the Biosafety Professional inBiomedical Research Laboratories 4. To appreciate the importance of assertion in interpersonal communication and beintroduced to some key assertion strategies 5. To understand the interpersonal nature of giving feedback, receiving criticism and resolving conflicts. 6. To establish attentive listening as an assertion strategy
Course outcomes	Students will learn to: 1. Effectively manage the health and safety aspects of a biological laboratory. 2. Give reliable, professional and informed advice and information to colleagues and managers. 3. Help to ensure that their institution complies with relevant legislation, liaise effectively with enforcing authorities and be aware of the penalties for failing to comply. 4. Build a context of understanding through communication. 5. Mediate between other conflicting parties. 6. Exhibit de-escalatory behaviors in situations of conflict. 7. Demonstrate acknowledgment and validation of the feelings, opinions, andcontributions of others.

Unit no.	Topics	Hours allotted 60hrs
1	**Ethics***:* Benefits of Ethics, ELSI of Bioscience, recombinant therapeutic products for human health care, genetic modifications and food consumption, release of genetically engineered organisms, applications of human genetic rDNA research, human embryonic stem cell research.	**15 hrs**
2	**Patenting:** Patent and Trademark, Bioscience products and processes, Intellectual property rights, Plant breeders rights, trademarks, industrial designs, copyright biotechnology in developing countries. Biosafety and its implementation, Quality *control in* Biotechnology.	**15 hrs**
	Introduction to quality assurance, accreditation & SOP writing : Concept of ISO standards and certification , National regulatory body for accreditation, Quality parameters, GMP & GLP, Standard operating procedures, Application of QA in field of genetics, Data management of clinical and testing laboratory	**15 hrs**
3	**Funding of biotech business** (Financing alternatives, funding, funding for Bioscience/ Medical Health Sector in India, Exit strategy, licensing strategies, valuation), support mechanisms for entrepreneurship (Bio-entrepreneurship efforts in India, difficulties in India experienced, organizations supporting growth, areas of scope, funding agencies in India, policy initiatives), Role of knowledge centers and R&D (knowledge centers like universities and research institutions, role of technology and up gradation)	**15 hrs**

Reference Books:

1. www.pdfdrive.net
2. www.khanacademy.org
3. www.acadeicearths.org
4. www.edx.org
5. www.open2study.com
6. www.academicjournals.org

Name of the Programme	**M. SC MEDICAL BIOTECHNOLOGY**
Course Code	**GE 003 T**
Name of the Course	**DISASTER MANAGEMENT AND MITIGATION RESOURCES**

Course objective	The course will uplift about: 1. Understand and appreciate the specific contributions of the Red Cross/Red Crescent movement to the practice and conceptual understanding of disaster management and humanitarian response and their significance in the current context. 2. Recognize issues, debates and challenges arising from the nexus between paradigm of development and disasters. 3. Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives. 4. Respond to disaster risk reduction initiatives and disasters in an effective, humane and sustainable manner.
Course outcomes	At the successful completion of course the student will gain: 1. knowledge and understanding of the disaster phenomenon, its different contextual aspects, impacts and public health consequences. 2. Knowledge and understanding of the International Strategy for Disaster Reduction (UN-ISDR) and to increase skills and abilities for implementing the Disaster Risk Reduction (DRR) Strategy. 3. Ensure skills and abilities to analyse potential effects of disasters and of the strategies and methods to deliver public health response to avert these effects.

Unit no.	Topics	Hours allotted 60hrs
1	**Introduction:** Definition of Disaster, hazard, global and Indian scenario, general perspective, importance of study in human life, Direct and indirect effects of disasters, long term effects of disasters. Introduction to global warming and climate change.	**08 hrs**
2	**Natural Disaster and Manmade disasters:**Natural Disaster: Meaning and nature of natural disaster, Flood, Flash flood, drought, cloud burst, Earthquake, Landslides, Avalanches, Volcanic eruptions, Mudflow, Cyclone, Storm, Storm Surge, climate change, global warming, sea level rise, ozone depletion Manmade Disasters: Chemical, Industrial, Nuclear and Fire Hazards. Role of growing population and subsequent industrialization, urbanization and changing lifestyle of human beings in frequent occurrences of manmade disasters.	**15 hrs**
3	**Disaster Management, Policy and Administration:**Disaster management: meaning, concept, importance, objective of disaster management policy, disaster risks in India, Paradigm shift in disaster management. Policy and administration: Importance and principles of disaster management policies, command and co-ordination of in disaster management, rescue operations-how to start with and how to proceed in due course of time, study of flowchart showing the entire process.	**12 hrs**
4	**Financing Relief Measures:**Ways to raise finance for relief expenditure, role of government agencies and NGO's in this process, Legal aspects related to finance raising as well as overall management of disasters. Various NGO's and the works they have carried out in the past on the occurrence of various disasters, Ways to approach these teams. International relief aid agencies and their role in extreme events.	**13 hrs**
5	**Preventive and Mitigation Measures:**Pre-disaster, during disaster and post-disaster measures in some events in general structural mapping: Risk mapping, assessment and analysis, sea walls and embankments, Bio shield, shelters, early warning and communication Non Structural Mitigation: Community based disaster preparedness, risk transfer and risk financing, capacity development and training, awareness and education, contingency plans. Do's and don'ts in case of disasters and effective implementation of relief aids.	**12 hrs**

Reference Books:

1. ShailendraK.Singh : Safety & Risk Management, Mittal Publishers
2. J.H.Diwan : Safety, Security & Risk Management,APH
3. Stephen Ayers &Garmvik: Text Book of Critical Care, Holbook and Shoemaker
4. www.pdfdrive.net
5. www.khanacademy.org
6. www.acadeicearths.org
7. www.edx.org
8. www.open2study.com
9. www.academicjournals.org

Name of the Programme	**M. SC MEDICAL BIOTECHNOLOGY**
Course Code	**GE 004 T**
Name of the Course	**HUMAN RIGHTS**

Course objective	Students will comprehend on: 1. A branch of public international law, and relevant juridical mechanisms at global as well as regional levels, 2. Human rights as an object of study in history, philosophy and the social sciences, as well as a practical reality in national and international politics. 3. Different forms of promoting and implementing human rights, domestically as well as on the international level. 4. The role of human rights in contemporary issues relating to terrorism, religion, ethnicity, gender and development. 5. Cholarly values such as transparency, impartiality, clarity, reliance and the importance of sound reasoning and empirical inference.
Course outcomes	Student will be able to virtue: 1. identify, contextualise and use information about the human rights situation in a given country 2. critically appraise source material, including cases from human rights committees and tribunals and reports and summary records from treaty bodies 3. analyse a country's situation or an international situation in terms of human rights and formulate human rights-based initiatives and policies 4. Promote human rights through legal as well as non-legal means. 5. Participate in legal, political and other debates involving human rights in a knowledgeable and constructive way

Unit no.	Topics	Hours allotted 60hrs
1	*Background*: Introduction, Meaning, Nature and Scope, Development of Human Rights, Theories of Rights, Types of Rights	**08 hrs**
2	*Human rights at various level* : Human Rights at Global Level UNO, Human Rights – UDHR 1948 – UN Conventions on Human Rights: International Covenant on civil and Political Rights 1966, International Convent on Economic, Social and Cultural Right, Racial Discrimination -1966 International, Instruments: U.N. Commission for Human Rights, European Convention on Human Rights.	**15 hrs**
3	*Human rights in India* : Development of Human Rights in India, Human Rights and the Constitution of India, Protection of Human Rights Act 1993- National Human Rights Commission, State Human Rights Commission, Composition Powers and Functions, National Commission for Minorities, SC/ST and Woman	**12 hrs**
4	*Human Rights Violations*: Human Rights Violations against Women, Human Rights Violations against Children, 35 Human Rights Violations against Minorities SC/ST and Trans-genders, Preventive Measures.	**13 hrs**
5	*Political issues*: Political Economic and Health Issues, Poverty, Unemployment, Corruption and Human Rights, Terrorism and Human Rights, Environment and Human Rights, Health and Human Rights	**12 hrs**

Reference Books:

1. JagannathMohanty Teaching of Human sRights New Trends and Innovations Deep & Deep Publications Pvt. Ltd. New Delhi2009
2. Ram Ahuja: Violence Against Women Rawat Publications JewaharNager Jaipur.1998.
3. SivagamiParmasivam Human Rights Salem 2008
4. Hingorani R.C.: Human Rights in India: Oxford and IBA New Delhi.

Name of the Programme	**M. SC MEDICAL BIOTECHNOLOGY**
Course Code	**BT 113**
Name of the Course	**DISSERTATION / PROJECT WORK**

1. Dissertation/Project work should be carried out as an individual Dissertation and actual bench work.

2. The students will carry independent project work under the supervision of the staff of Department on an advanced topic assigned to him/her. Inhouse projects are encouraged. Students may be allowed to carry out the project work in other Departmental laboratories /Research institutes /Industries as per the availability of Infrastructure.

3. Co guides from the other institutions may be allowed.

4. The Dissertation/Project work will begin from 3rd Semester, and will continue through the 4th Semester.

5. The Dissertation/Project report (also work book shall be presented at the time of presentation and viva voce) will be submitted at the end of the 4th Semester and evaluated.

6. Five copies of the project report shall be submitted to the Director, SBS.

7. For the conduct of the End Semester Examination and evaluation of Dissertation/Project work the University will appoint External Examiners.

8. Since the dissertation is by research, Dissertation/Project work carries a total of 250 marks and evaluation will be carried out by both internal and external evaluators.

9. The student has to defend his/her Dissertation/Project Work in a seminar which will be evaluated by a internal and external experts appointed by the University.

10. The assignment of marks for Project/Dissertation is as follows:

    Part I-

    Topic Selection, Review of Literature, Novelty of works-50 marks

    Part-II-

    a. Continuous Internal Assessment, Novelty, Overall Lab Work Culture - 100 Marks

    b. Dissertation/Project work book: 50 Marks

    c. Viva-Voce: 50 Marks

d. However, a student in 4th semester will have to opt for general elective course from other related disciplines in addition to his Dissertation/Project work in the parent department.

Name of the Programme	**M. SC MEDICAL BIOTECHNOLOGY**
Course Code	**BT 115 P**
Name of the Course	**EDUCATIONAL TOUR/FIELD WORK/HOSPITAL VISIT/ INDUSTRIAL VISIT**

MONITORING LEARNING PROGRESS

It is essential to monitor the learning progress of each candidate through continuous appraisal and regular assessment. It not only also helps teachers to evaluate students, but also students to evaluate themselves. The monitoring be done by the staff of the department based on participation of students in various teaching / learning activities. It may be structured and assessment be done using checklists that assess various aspects. Model Checklists are attached

The learning out comes to be assessed should include:

i) **Journal Review Meeting (Journal Club):** The ability to do literature search, in depth study, presentation skills, and use of audio- visual aids are to be assessed. The assessment is made by faculty members and peers attending the meeting using a checklist (see Model Checklist – I)

ii) **Seminars / Symposia**: The topics should be assigned to the student well in advance to facilitate in depth study. The ability to do literature search, in depth study, presentation skills and use of audio- visual aids are to be assessed using a checklist (see Model Checklist-II)

iii) **Teaching skills**: Candidates should be encouraged to teach undergraduate medical students and paramedical students, if any. This performance should be based on assessment by the faculty members of the department and from feedback from the undergraduate students (See Model checklist III,)

iv) **Work diary / Log Book**- Every candidate shall maintain a work diary and record his/her participation in the training programmes conducted by the department such as journal, reviews, seminars, etc. Special mention may be made of the presentations by the candidate as well as details of experiments or laboratory procedures, if any conducted by the candidate.

v) **Records**: Records, log books and marks obtained in tests will be maintained by the Head of the Department.

Checklist - I

Model Checklist for Evaluation of Journal Review Presentations

Name of the student:_____ Date:_____

Name of the Faculty/ Observer:_____

S No.	Items for observation during presentation		Below average	Average	Good	Very Good
		0	1	2	3	4
1	Article chosen was					
2	Extent of understanding of scope & objectives of the paper by the candidate					
3	Whether cross- references have been consulted					
4	Whether other relevant references have been Consulted					
5	Ability to respond to questions on the paper /subject					
6	Audio-visuals aids used					
7	Ability to defend the paper					
8	Clarity of presentation					
9	Any other observation					
	Total score					

Checklist - II

Model Checklist for Evaluation of the Seminar Presentations

Name of the student:_____ Date:_____

Name of the Faculty/ Observer:_____

S No.	Items for observation during presentation		Below average	Average	Good	Very Good
		0	1	2	3	4
1	Article chosen was					
2	Extent of understanding of scope & objectives of the paper by the candidate					
3	Whether cross- references have been consulted					
4	Whether other relevant references have been Consulted					
5	Ability to respond to questions on the paper /subject					
6	Audio-visuals aids used					
7	Ability to defend the paper					
8	Clarity of presentation					
9	Any other observation					
	Total score					

Checklist - III
Model Checklist for Evaluation of Teaching Skill

Name of the student: _____ Date: _____

Name of the Faculty/ Observer: _____

S. No.		Strong Point	Weak point
1	Communication of the purpose of the talk		
2	Evokes audience interest in the subject		
3	The introduction		
4	The sequence of ideas		
5	The use of practical examples and /or illustrations		
6	Speaking style (enjoyable, monotonous, etc., specify)		
7	Summary of the main points at the end		
8	Ask questions		
9	Answer questions asked by the audience		
10	Rapport of speaker with his audience		
11	Effectiveness of the talk		
12	Uses of AV aids appropriately		

Checklist - IV

Model Check list for Dissertation / Project Work Presentations

Name of the student:_____ Date:_____

Name of the faculty/ Observer:_____

S No.	Points to be covered		Below average	Average	Good	Very Good
		0	1	2	3	4
1	Interest shown in selecting topic					
2	Appropriate review					
3	Discussion with guide and other faculty					
4	Quality of protocol					
5	Preparation of proforma					
	Total score					

Checklist - V

Continuous Evaluation of dissertation / project work by Guide/ Co-Guide

Name of the student:_____ Date:_____

Name of the faculty/ Observer:_____

S No.	Points to be covered		Below average	Average	Good	Very Good
		0	1	2	3	4
1	Interest shown in selecting topic					
2	Appropriate review					
3	Discussion with guide and other faculty					
4	Quality of protocol					
5	Preparation of proforma					
	Total score					