MGM INSTITUTE OF HEALTH SCIENCES

(Deemed to be University u/s 3 of UGC Act, 1956)
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CHOICE BASED CREDIT SYSTEM

(CBCS)

(with effect from 2018-19 Batches)

Curriculum for

M.Sc. Medical Genetics

Amended upto AC-49/2024, Dated 25/04/2024

Amended History

1. Approved as per BOM-53/2018 Dated 19/05/2018.
2. Approved as per BOM -55/2018 [Resolution No.4.13], [Resolution No.4.4.1.3]; Dated 27/11/2018.
3. As amended in BOM-57/2019, [Resolution No.3.1.4.2], Dated 26/04/2019.
4. As Amended in BOM -62/2020 [Resolution No.3.1.1.6], Dated 16/09/2020
5. As Amended in BOM-63/2021[Resolution No.4.3.1.2], [Resolution No.4.3.1.3.], [Resolution No.4.3.1.5]; Dated 17/02/2021.
6. As Amended in AC-41/2021 [Resolution No. 3.3], [Resolution No. 3.5]; dated 27/08/ 2021
7. As Amended in AC-42/2022 [Resolution No. 10.4.i], Dated 26/04/2022.
8. As Amended in AC-49/2024 [Resolution No. 3.10 ii], Dated 25/04/2024.

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 Genetics

AIMS OF THE PROGRAM

Innovative Geneticist 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 GENETICS sector.

Postgraduate qualification in Genetics 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 GENETICS 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 Genetics 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 GENETICS

1ST YEAR

Semester I							
	Syllabus Ref. No.	**Subject**	**Credits**	**Teaching hours**	**Marks**		
	Theory				**Internal Assessment**	**Semester Exam**	**Total**
	GEN 101 T	Cell Biology	4	4	20	80	100
	GEN 102 T	Immunology &Immunotechnology	4	4	20	80	100
	GEN 103 T	Analytical Instrumentation	4	4	20	80	100
	GEN 104 T	Basic Biochemistry &Inborn Errors of Metabolism)▲ (Multidisciplinary/Interdisciplinary)	4	4	20	80	100
	Practical						
	GEN 101 P	Cell Biology	2	4	10	40	50
	GEN 102 P	Immunology &Immunotechnology	2	4	10	40	50
	GEN 103 P	Analytical Instrumentation	2	4	10	40	50
	GEN 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**
	GEN 105 T	Molecular Biology & Genomics	4	4	20	80	100
	GEN 106 T	Recombinant DNA Technology	4	4	20	80	100
	GEN 107 T	Bioinformatics	4	4	20	80	100
	CC 001 T	Research Methodology & Biostatistics (Core Course)	4	4	20	80	100
	Practical						
	GEN 105 P	Molecular Biology & Genomics	2	4	10	40	50
	GEN 106 P	Recombinant DNA Technology	2	4	10	40	50
	GEN 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**
	GEN 108 T	Clinical Genetics& Genetic Counselling	4	4	20	80	100
	GEN 109 T	Developmental Genetics& Environment Genetics	4	4	20	80	100
		Core Elective course**	4	4	20	80	100
	GEN 110 T	Cancer genetics and Pharmacogenomics					
	GEN 111 T	Principles of Genetics&Population Genetics					
	GEN 112 T	Stem Cell					
	GEN 113	Dissertation/Project Proposal*	6	12	50	-	50
	Practical						
	GE108 P	Clinical Genetics	2	4	10	40	50
	GE 109 P	Developmental Genetics	2	4	10	40	50
	GE 110 P GE 111 P GE 112 P	**Core Elective Practical** Cancer Genetics and Pharmacogenomics Principles of Genetics & Population Genetics Stem Cell	1	2	10	40	50
	GEN 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
	GEN 001 T	Pursuit of Inner Self Excellence (POISE)					
	GEN 002 T	Bioethics, Biosafety, IPR & Technology Transfer					
	GEN 003 T	Disaster Management and Mitigation Resources					
	GEN 004 T	Human rights					
	GEN 113	Dissertation / Project*	18	36	50	200	200
	Practical						
	GEN 115 P	Educational Tour / Field Work/Industrial Visit/Hospital Visit*	2	0	50	-	50

		Total	24	40	200	200	400

*(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. GENETICS 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 , including gene cloning, sequencing and mapping. 3. The candidates of Genetics generally study the genetic variation, genes, and heredity in living organisms 4. Developments in genetics have opened new areas of study and provided powerful techniques that are revolutionizing the pharmaceutical, health, and agricultural industries 5. They have spawned new industries in genetics, and opened avenues for answering basic and applied questions in all of the life sciences. 6. Genetics students complete a comprehensive curriculum in the fundamentals of science and are prepared to address problems in the biochemical, biological and agricultural sciences. 7. The requirements of the molecular biology major assure competence in the broad scientific theory and application of genetics, 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 genetics. 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 SYLLABUSFOR SEMESTER-I

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

Course Objective	1. To apprehend the candidate withon 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 Outcome	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 GENETICS**
Course Code	**GEN 102T**
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 Outcome	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**
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**
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**
4.	**Disorders of Human Immune System**Primary and secondary immunodeficiency; Autoimmune disorders; Hypersensitive reactions; Cytokine related diseases	**15**

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 GENETICS**
Course Code	**GEN 103T**
Name of the Course	**ANALYTICAL INSTRUMENTATION (THEORY)**

Course Objective	To apprehend the candidate with: 1. Develop an understanding of the range and theories ofinstrumental 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**
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**
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**
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**
5.	**Flow cytometry** DNA sequencing, Micro array, 2d Gel Electrophoresis	**05**

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 GENETICS, Mousumi Debnath, 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 GENETICS**
Course Code	**GEN 104 T**
Name of the Course	**BASIC BIOCHEMISTRY & INBORN ERRORS OF METABOLISM**

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**
2	**Chemistry of carbohydrates:** Biomedical importance, Classification, chemistry and functions ,Monosaccharide, Disaccharides, Polysaccharides including glucosamine glycans, Glycoproteins	**08**
3	**Chemistry of Lipids:** Biomedical importance, classification, Chemistry and functions of tri-acyl glycerol Phospholipids glycolipids , Fatty acids, Prostaglandins ,Steroids and lipoproteins	**08**
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**
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**
6	**Vitamins:** Water soluble and Fat soluble vitamins, Chemistry and functions of Hb and Myo Hb.	**06**
7	**Inborn errors of metabolism:**Carbohydrate metabolism disorders, protein metabolism disorders, Lipid metabolism disorders, Lysosomal storage disorders	**06**

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 GENETICS**
Course Code	**GEN 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 GENETICS**
Course Code	**GEN 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 GENETICS**
Course Code	**GEN 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 GENETICS**
Course Code	**GEN 104 P**
Name of the Course	**BASIC BIOCHEMISTRY & INBORN ERRORS OF METABOLISM (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 GENETICS**
Course Code	**GEN105 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**
2	**DNA Replication:** Prokaryotic and eukaryotic DNA replication, Mechanism of DNA replication, Enzymes and accessory proteins involved in DNA replication. DNA Damage & Repair.	**8**
3	**DNA Recombination** Models of homologous recombination - Homologous recombination protein machinery - Homologous recombination in eukaryotes	**8**
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**
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**
6	**Translation** Prokaryotic and eukaryotic translation: Synthesis of aminoacyl tRNA synthesases, Mechanism of initiation, elongation and termination, Regulation of translation, co-and post-translational modifications of proteins	**8**
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**

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 GENETICS**
Course Code	**GEN106 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**
2	**DNA transactions in Microbes:** Transformation, transduction and conjugation. Cloning , Vectors – Plasmids, cosmids, λ, phagemids, yeast artificial chromosomes.	**10**
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**
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**
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**

Reference Books:

1. Recombinant DNA: Watson et. al.
2. Genetic engineering : Sandya Mitra
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 GENETICS**
Course Code	**GEN107 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 namesetc. 4. Use selected tools at NCBI and EBI to run simple analyses on genomic sequences.

Unit no.	Topics	Hours allotted 60hrs
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**
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**
3	**Secondary Structure predictions:** Protein secondary structure classification databases: HSSP, FSSP, CATH, and SCOP. Protein secondary structure prediction methods: GOR, Chou-Fasman, PHD, PSI- PRED, J-Pre	**10**
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**
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**

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 GENETICS**
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 GENETICS**
Course Code	**GEN 105 P**
Name 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

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

Name of the Programme	**M. SC MEDICAL GENETICS**
Course Code	**GEN106 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 GENETICS**
Course Code	**GEN107 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.**

Name of the Programme	**M. SC MEDICAL GENETICS**
Course Code	**CC 001 P**
Name of the Course	**RESEARCH METHODOLOGY & BIOSTATISTICS (PRACTICAL)**

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

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

ACADEMIC SYLLABUS FOR SEMESTER-III

Name of the Programme	**M. SC MEDICAL GENETICS**
Course Code	**GEN108 T**
Name of the Course	**CLINICAL GENETICS & GENETIC COUNSELLING**

Course objective	To inculcate candidate with: 1. Strategies in this program encompass cell biological and genomic approaches. 2. The ultimate aim is to translate basic findings into diagnostics, treatments and ultimate cures. The program applies a multidisciplinary approach toward these goals, with the full realization that cancers in different organs represent different diseases. 3. To facilitate the understanding application of multidisciplinary approaches to make cancer a disease of the past
Course outcomes	To apprehend the candidate with: 1. Understand chromatin as it relates to gene expression. 2. Understand epigenetics and somatic genetic changes in tumors. 3. Understand the cell cycle, angiogenesis and apoptosis. 4. Be familiar with basic principals and applications of cell culture and animal models to study cancer. 5. Understand how genetics contributes to predisposition and progression of cancer. 6. Understand how immunotherapy is, and can be, used to treat human illness: strategies, advantages, and hurdles to overcome to realize its potential.

Unit no.	Topics	Hours allotted 60hrs
1	**Chromosomal anomalies** Numerical, Structural, Meiosis in inversion and translocation heterozygotes; breakage-fusion-bridge cycles, Induced chromosomal aberrations in somatic cells, Sister chromatid exchanges and somatic crossing over	**7**
2	**Genetics in Medical Practice:** Genetic principles and their application in medical practice; Case studies (Interacting with patients, learning family history and drawing pedigree chart); Syndromes and disorders: Definition and their genetic basis Molecular pathology of monogenic diseases: Cystic fibrosis, taySach's Syndrome &Marfan Syndrome; Genetics of diseases due to inborn errors of metabolism: Phenylketonuria, Galactosemia&Mucopolysaccharidosis	**8**
3	**Genetics of Neurogenetic disorders:** Charcot-Marie tooth syndrome, Spino-muscular atrophy, Alzheimer's disease & Syndromes due to triplet nucleotide expansion; Genetic basis of muscle disorders: Dystrophies (Duchenne Muscular dystrophy and Becker Muscular Dystrophy), Myotonias& Myopathies; Genetic disorders of Haemopoitic systems: Overview of hematopoisis, Blood cell types and haemoglobin, Sickle cell anemia, Thalassemias&Hemophilias.	**9**
4.	**Genetic basis of eye disorders:**Colour Blindness, Retinitis pigmentosa, Glaucoma & Cataracts; Genetics of skeleton & skin disorders; Genetics of Syndromes & Genomic Imprinting: Neurofibromatosis I, Prader-Willi&Angelman syndromes, BeckwithWiedeman syndrome	**8**
5.	**Complex polygenic syndromes:** Hyperlipidemia, Atherosclerosis, Diabetes mellitus ; Mitochondrial syndromes; Management of genetic disorders;	**8**
6.	**Genetic counseling**: Historical overview (philosophy & ethos), Components of genetic counseling: Indications for and purpose; Information gathering and construction of pedigrees; Medical Genetic evaluation (Basic components of Medical History, Past medical history, social & family history). Components of Genetic Counselling: Physical examination (General and dys morphology examination, Documentation), Legal and ethical considerations; Patterns of inheritance, risk assessment and counselling in common Mendelian and multifactor syndromes.	**10**
7.	**Prenatal and Pre-implantation screening and diagnosis**: Indications for prenatal diagnosis, Indications for Prenatal Diagnosis Genetic testing: biochemical & molecular tests in children, Presymptomatic testing for late onset diseases (predictive medicine) Noninvasive methods (Ultrasound, Endoscopy, MRI, Maternal Serum Screening for Down's syndrome & Neural tube defect, Fetal Blood Sampling, etc.) Invasive methods; Amniocentesis, Chorionic Villi Sampling Ethical issues in pre-natal screening & diagnosis.	**10**

Reference Books:

1. A Handbook of Clinical Genetics,By J. S. Fitzsimmons
2. A Guide to Genetic Counseling, edited by Wendy R. Uhlmann, Jane L. Schuette, Beverly Yashar
3. Genetic Counseling: Ethical Challenges and Consequences By Dianne M. Bartels

Name of the Programme	**M. SC MEDICAL GENETICS**
Course Code	**GEN109 T**
Name of the Course	**DEVELOPMENTAL GENETICS &ENVIRONMENTAL GENETICS**

Course objective	The students will be inculcate with: 1. To intrepret the diferrent genetic disorder and to identify ita pathway. 2. To establish a mutually agreed upon genetic counseling agenda with the client.explain the technical and medical aspects of diagnostic and screening methods and reproductive options including associated risks, benefits, and limitations. 3. To educate in listening compentency, communicate, and manage a genetic counseling case in aculturally responsive manner. 4. To act in accordance with the ethical, legal, and philosophical principles and valuesof the profession 5. To introduce research options and issues to clients and families. 6. Experience cytogenetic technical methods and learn karayotyping
Course outcomes	Students will be able to: 1. Will be able to establish a mutually agreed upon genetic counseling agenda with the client. 2. Will be able to convey genetic, medical, and technical information including, but not limited to, diagnosis, etiology, natural history, prognosis, and treatment/management of genetic conditions and/or birth defects to clients with a variety of educational, socioeconomic, and ethnocultural backgrounds. 3.Will be able to explain the technical and medical aspects of diagnostic and screening methods and reproductive options including associated risks, benefits, and limitations. 4.organize, and conduct public and professional education programs on human genetics, patient care, and genetic counseling issues. 5.To analyse chromosomes after karyotyping and interpret the genetic disorder

Unit no.	Topics	Hours allotted 60hrs
1	**Spermatogenesis, Oogenesis** Fertilization Human embryonic development: Brief account of embryonic development: Blastulation, Gastrulation, formation of notochord and establishment of body axis; Organogenesis: Formation of embryonic germ layers and their derivatives; Fetal development and plancentation (development, structure and function); Fetal membrane in twins.	**15**
2	**Central Nervous System in vertebrates:** Neural tube formation; Tissue architecture of CNS; Limb development in vertebrates: Formation of limb Bud; Proximal Distal axis of the limb; Cell death and formation of digits and joints; Regeneration and Senescence: Epimorphic, morphallactic and compensatory regeneration; Ageing: causes and regulation; Pleuropotency of stem cells: Embryonic and adult stem cells, organization, characteristics and therapeutic applications	**15**
3	**Understanding Human Birth defects** through Model Organism Developmental malformation caused by Teratogens Induced Reproductive Problems; Gene-Teratogen; Environmental factors and Genetic Susceptibility; Genomic imprinting: Parent-of-origin effect; Gene silencing;	**15**
4.	**Cancer and environment:** physical, chemical and biological carcinogens, Mutagens and Teratogens, Carcinogenesis, Environmental modifications of Gene expression, Environmental Carcinogens, radiation Biology: Basics Effects of radiation on cells, Human beings Uses of radiation in Medical Technology	**15**

Reference Books:

1. Moore KL, Torchia MG, Persaud TV. The Developing Human: Clinically Oriented Embryology With STUDENT CONSULT Online Access, 9/e. Elsevier India; 2007.
2. England MA. The Developing Human: Clinically Oriented Embryology. Journal of anatomy. 1989 Oct;166:270.
3. Singh I. Human embryology. JP Medical Ltd; 2014 Sep 30.
4. Singh I. The prenatal development of enterochromaffin cells in the human gastro-intestinal tract. Journal of anatomy. 1963 Jul;97(Pt 3):377.
5. Singh I, Pal GP. Human Embryology in The Placenta.

CORE ELECTIVE COURSE**

Name of the Programme	**M. SC MEDICAL GENETICS**
Course Code	**GEN110 T**
Name of the Course	**CANCER GENETICS AND PHARMACOGENOMICS**

Course objective	The Students will be function intellectually on: 1. Strategies in this program encompass cell biological and genomic approaches. The ultimate aim is to translate basic findings into diagnostics, 2. treatments and ultimate cures. The program applies a multidisciplinary approach 3. toward these goals, with the full realization that cancers in different organsrepresent different diseases. 4. To facilitate the understanding application of multidisciplinary approaches to make cancer a disease of the past.
Course outcomes	After successfulcompletion of course students will mastery in: 1. Understand chromatin as it relates to gene expression. 2. Understand epigenetics and somatic genetic changes in tumors. 3. Understand the cell cycle, angiogenesis and apoptosis. 4. Be familiar with basic principals and applications of cell culture and animalmodels to study cancer. 5. Understand how genetics contributes to predisposition and progression of cancer. Understand how immunotherapy is, and can be, used to treat human illness: strategies, advantages, and hurdles to overcome to realize its potential.

Unit no.	Topics	Hours allotted 60hrs
1	**Introduction to Cancer:** An overview, Types of cancer, Cytology of cancer cells, Characteristics of cancer cells, Difference between normal and cancer cells, Contact inhibition , Malignancy as a loss of normal cellular affinities, Differential gene expression in normal vs transformed cells, The genetic basis of cancer, Cancer as hereditary change	**15**
2	**Cell transformation and tumourogenesis:** Cell cycle check point and cancer, Oncogenes Tumour suppressor genes, DNA repair genes and genetic instability, Epigenetic modifications, telomerase activity, centrosome malfunction, Genetic heterogeneity and clonal evolution	**12**
3	**Familial cancers:** Retinoblastoma, Wilms' tumour, Li-Fraumeni syndrome, colorectal, cancer, breast cancer, Epstein Barr virus and its relationship to Burkett's lymphoma, Papilloma virus and cervical carcinoma. Genetic predisposition to sporadic cancer	**10**
4.	**Tumour progression:** angiogenesis and metastasis Tumour specific markers	**08**
5.	**Pharmacokinetics:** Variation of enzymes in drug metabolism, Pharmacodynamics: Definition, drug metabolism, Biochemical modification, Kinetics of drug metabolism, detoxification system, Cytochrome P459, N Acetyltransferase, Scuccinylcholine sensitivity, G6PD, Debrisoquine metabolism, Alcohol metabolism, Hereditary disorders with altered drug response, Historical aspects of pharmacogenomics, Current status: Pharmacokinetics/Drug metabolites, Pharmacokinetics – receptors Pharmacokinetics of drug transpoters Interethnic difference in drug responses, Genomic variation and pharmacogenomics	**15**

Reference Books:

1. Concepts in Pharmacogenomics, By Martin M. Zdanowicz
2. Pharmacogenetics: Making cancer treatment safer and more effective, edited by William G. Newman
3. Cancer Genetics and Genomics for Personalized Medicine, edited by Il-Jin Kim

Name of the Programme	**M. SC MEDICAL GENETICS**
Course Code	**GEN111T**
Name of the Course	**PRINCIPLES OF GENETICS & POPULATION GENETICS**

Course objective	To kit the knowledge of population among the students on: 1. Intrepretation the diferrent genetic disorder and to identify ita pathway. 2. Establishment of a mutually agreed upon genetic counseling agenda with the client.explain the technical and medical aspects of diagnostic and screening methods and reproductive options including associated risks, benefits, and limitations. 3. Educate in listening compentency, communicate, and manage a genetic counseling case in aculturally responsive manner. 4. To act in accordance with the ethical, legal, and philosophical principles and valuesof the profession. 5. Introduce research options and issues to clients and families. 6. Experience cytogenetic technical methods and learn karayotyping
Course outcomes	Students will be able to: 1. Will be able to establish a mutually agreed upon genetic counseling agenda with the client. 2. Will be able to convey genetic, medical, and technical information including, but not limited to, diagnosis, etiology, natural history, prognosis, and treatment/management of genetic conditions and/or birth defects to clients with a variety of educational, socioeconomic, and ethnocultural backgrounds. 3. Will be able to explain the technical and medical aspects of diagnostic and screening methods and reproductive options including associated risks, benefits, and limitations. 4. organize, and conduct public and professional education programs on human genetics, patient care, and genetic counseling issues. 5. To analyse chromosomes after karyotyping and interpret the genetic disorder.

Unit no.	Topics	Hours allotted 60hrs
1	**Introduction to Mendelian Genetics:** Mendel and his experiments, Law of segregate, Law of independent assortment, Applications of laws of probability (product rule, sum rule), Chromosomal basis of segrartion and independent assortment. Chi-square test and its application in analysis of genetic data	**10**
2	**Extensions of Mendelism:** Allelic variation and gene function-Dominance relationships, basis of dominant and recessive mutations, Multiple alleles, allelic series Testing gene mutations for alleles: complementation test, intragenic complementation Genotypes & phenotypes: Effect of the environment on phenotype developmentPenetrance and expressivity, Visible, sterile and lethal mutations, Gene interactions and modifying genes, Pleiotropy, Pedigree analysis – Symbols of Pedigree, Pedigrees of Sex-linked & Autosomal (dominant & recessive)	**15**
3	**Microevolution in Mendelian population:** Hardy-Weinberg method & its applications – calculating allelic frequencies, assumptions of Hardy-Weinberg equilibrium, proof of Hardy-Weinberg equilibrium, Generation time, testing for fit to Hardy-Weinberg equilibrium Elemental forces of evolution; Mutation, Selection (Types of selection, selection coefficient, selection in natural populations), Genetic drift , Migration	**13**
4.	**Linkage & Crossing over** - Chromosome theory of Linkage, kinds of linkage, linkage groups, types of Crossing over, mechanism of Meiotic Crossing over, kinds of Crossing over, theories about the mechanism of Crossing over, cytological detection of Crossing over, significance of Crossing over.	**10**
5.	**Genetic mapping of Mendelian traits:** Identifying recombinants and non recombinants in pedigrees. Genetic and physical map distances, Genetic markers, Two-point mapping- LOD score analysis, Multipoint mapping, Homozygosity map	**12**

Reference Books:

1. Principles of Population Genetics, Daniel L. Hartl, Andrew G. Clark
2. Principles of Genetics, Binder Ready Version, By D. Peter Snustad, Michael J. Simmons
3. Principles of Behavioral Genetics, By Robert RH Anholt, Trudy F. C. Mackay

Name of the Programme	**M. SC MEDICAL GENETICS**
Course Code	**GEN112 T**
Name of the Course	**STEM CELL**

Course objective	Students will Explore knowledge in 1. How tumor stem cells give rise to metastases and treatment-resistant remnant cells that cause relapse, and how this impacts on the development of future cancer treatment strategie. 2. How epigenetic mechanisms encompassing various DNA modifications and histone dynamics are involved in regulating the potentiality and differentiation of stem cells. How microRNAs are involved in regulating stem cell differentiation. 3. Stem cells, undifferentiated cells that are capable of self-renewal and have the potential to develop into specialized cells types. Stem cells are important for development, reproduction, growth, healing, and homeostasis.
Course outcomes	At the end of the course Students will be able to capstone 1. The different types of stem cells, how they are derived and the extent of their plasticity. 2. Account for the use of the most important practical methods in stem cell biology, evaluate the methods critically and be able to account for application of these methods. 3. Compare andcontrast tissue-specific stem cell types (e.g., blood, skin), and the basic mechanisms that regulate them. 4. Compare and contrast invertebrate and vertebrate animal models of regeneration research

Unit no.	Topics	Hours allotted 60hrs
1	**Introduction to Stem Cells** Definition, Classification and Sources of stem cells.	**05**
2	Stem cell self-renewal and pluripotency.	**05**
3	**Embryonic Stem Cells** Blastocyst and inner cell mass cells; Organogenesis; Mammalian Nuclear Transfer Technology; Stem cell differentiation; stem cells cryopreservation.	**05**
4.	**Harmopoietic stem cell and differentiation**	**05**
5.	**Epigenetic controls of stem cells**	**05**
6.	**Induced pluripotent stem (iPS) cells**	**05**
7.	**Adult and fetal stem cells**	**05**
8.	**Cancer stem cells**	**05**
9.	**Application of stem Cells** Overview of embryonic and adult stem cells for therapy, Neurodegenerative diseases; Parkinson's, Alzheimer, Spinal Code Injuries and other brain Syndromes; Tissue system; Failures; Diabetes; Cardiomyopathy; Kidny failure; Liver failure; Cancer; Hemophilia etc.	**10**
10	**Human Embryonic Stem Cells and Society** Human stem cells research: Ethical consideration; Stem cell religion consideration; Stem cell based theories: Pre clinical regulatory consideration and Patient advocacy.	**10**

Reference Books:

1. Stem Cells: A Very Short Introduction, By Jonathan Slack
2. Essentials of Stem Cell Biology,edited by Robert Lanza, Anthony Atala
3. Stem Cells, By Cherian Eapen, Nandhini G, Kurian Anil

Name of the Programme	**M. SC MEDICAL GENETICS**
Course Code	**GEN113**
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 GENETICS**
Course Code	**GEN108P**
Name of the Course	**CLINICAL GENETICS & GENETIC COUNSELLING(PRACTICAL)**

Sr No	**Practical (60 Hrs.)**
1	Lymphocyte culture and chromosome analysis- • Culture set up • Harvesting • G-banding
2	Identification of chromosomal abnormalities using banding technique.
3	Preparation of pedigree on case based study
4	Case based genetic counseling
5	Case based genetic diagnosis(General laboratory organization of prenatal Diagnosis)
6	Identification of Trisomy 13, 18, 21

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

Name of the Programme	**M. SC MEDICAL GENETICS**
Course Code	**GEN109P**
Name of the Course	**DEVELOPMENTAL GENETICS &ENVIRONMENTAL GENETICS (PRACTICAL)**

Sr No	**Practical (60 Hrs.)**
1	Determination of Sex based on barr body analysis.
2	PCR Diagnostics IN RELATION TO Chromosomal abnormalities
3	Real Time PCR Technique
4	Spermatogenesis, Oogenesis
5	Sites of implantation
6	Development of germ layers
7	Identification of Trisomy 13, 18, 21

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

CORE ELECTIVE (Practical)

Name of the Programme	**M. SC MEDICAL GENETICS**
Course Code	**GEN 110P**
Name of the Course	**CANCER GENETICS AND PHARMACOGENOMICS (PRACTICALS)**

Sr No	**Practical (30 Hrs.)**
1	Bone Marrow culture and chromosome analysis- • Culture set up • Harvesting • G-banding
2	Identification of chromosomal abnormalities in relation to cancers using banding technique.
3	Visit to a flow cytometry laboratory.
4	Identification of Polyploidy'
5	Identification of Translocations

Name of the Programme	**M. SC MEDICAL GENETICS**
Course Code	**BT 111P**
Name of the Course	**PRINCIPLES OF GENETICS &POPULATION GENETICS (PRACTICAL)**

Sr No	**Practical (30 Hrs.)**
1	Problems based on linkage
2	Problems based on multiple alleles
3	Problems based on epitasis
4	Problems based on sex-linked inheritance
5	Pedigree case studies

Name of the Programme	**M. SC MEDICAL GENETICS**
Course Code	**GEN112P**
Name of the Course	**STEM CELL (PRACTICAL)**

Sr No	**Practical (30 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.

Name of the Programme	**M. SC MEDICAL GENETICS**
Course Code	**GEN114**
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 GENETICS**
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. Students 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's Ashtanga 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**
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**
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**
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**

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 GENETICS**
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**
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**
	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**
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**

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 GENETICS**
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**
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**
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**
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**
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**

Reference Books:

1. Shailendra K.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

Name of the Programme	**M. SC MEDICAL GENETICS**
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**
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**
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**
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**
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**

Reference Books:

1. Jagannath Mohanty Teaching of Human s Rights New Trends and Innovations Deep & Deep Publications Pvt. Ltd. New Delhi2009
2. Ram Ahuja: Violence Against Women Rawat Publications Jewahar Nager Jaipur.1998.
3. Sivagami Parmasivam Human Rights Salem 2008
4. Hingorani R.C.: Human Rights in India: Oxford and IBA New Delhi.

Name of the Programme	**M. SC MEDICAL GENETICS**
Course Code	**GEN 113**
Name of the Course	**DISSERTATION / PROJECT**

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 GENETICS**
Course Code	**GEN 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 60/86					

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					

Resolution No. 4.4.1.3 of BOM-55/2018: Resolved to approve the revised syllabus of 'Research Methodology and Biostatistics" subject for all the PG courses (including 3 years) and to shift it in 2nd semester with effective from the batch admitted in the Academic Year 2018-19 onwards under MGM School of Biomedical Sciences. **[Annexure-13]**

Gmail

Mansee Thakur <mansibiotech79@gmail.com>

Annexure-13

To compulsorily include in the BOS agenda

1 message

Registrar <registrar@mgmuhs.com> 6 September 2018 at 14:17
To: drravindrai@gmail.com, inamdar123456@gmail.com, ipseetamohanty@yahoo.co.in, jaishreeghanekar@gmail.com, drspravin22@gmail.com, dr_spravin@hotmail.com, sudhirkul1979@gmail.com, mansibiotech79@gmail.com, sbsnm@mgmuhs.com, rajani.kanade@gmail.com, mgmschoolofphysiotherapy@gmail.com, prabhadasila@gmail.com, mgmnewbombaycollegeofnursing@gmail.com, gashroff2006@gmail.com, rupalgshroff@yahoo.com, manjushreeb@yahoo.com, drshobhasalve@gmail.com, spdubhashi@gmail.com, jayantkarbhase@gmail.com, veenashatolkar@gmail.com, sharathcrisp@gmail.com, mgmlpth@themgmgroup.com, anuradhamhaske@hotmail.com, principalconabad@gmail.com
Cc: registrarmgmihs@gmail.com, mgmihsaurangabad@gmail.com, dr.rajeshkadam07@gmail.com, aradmin@mgmuhs.com

Dear Sir/Madam,

Please find attached herewith request from Dr. Rita Abbi, Professor, Biostatistics regarding Modification in the syllabus of 'Research Methodology and Biostatistics' subject and Proposal to make this subject compulsory in all the PG courses. You are requested go through this and include it in your agenda for forthcoming BOS in September, 2018.

Thanks and regards,

Dr. Rajesh B. Goel

Registrar

MGM Institute of Health Sciences, Navi Mumbai

(Deemed University u/s 3 of UGC act, 1956)

3rd Floor, MGM Educational Campus,

Plot No. 1 & 2, Sector -1, Kamothe,

Navi Mumbai - 410 209

Tel.: 022 - 27432471 / 27432994

Fax: 022 - 27431094

Email: registrar@mgmuhs.com

Website: www.mgmuhs.com

Modification in the syllabus of Research Methodology and Biosta.pdf
2261K

MGM SCHOOL OF BIOMEDICAL SCIENCES, NAVI MUMBAI

(A constituent unit of MGM INSTITUTE OF HEALTH SCIENCES)
(Deemed University u/s 3 of UGC Act 1956)
Grade "A" Accredited by NAAC
Sector 1, Kamothe Navi Mumbai-410209, Tel.No.:022-27437631,27432890
Email. sbsnm@mgmuhs.com / Website : www.mgmsbsnm.edu.in

To,
The Director
MGM School of Biomedical Sciences
Kamothe,
Navi Mumbai – 410 209

7-6-2018

Subject: Modification in the syllabus of 'Research Methodology and Biostatistics' Subject and Proposal to make this subject compulsory in all the PG courses

Dear Madam,

Research Methodology and Biostatistics subject is a significant tool for academic research. It has been observed that majority of post graduate courses have this subject as a part of their course work. There is a need to modify the curriculum of 'Research Methodology and Biostatistics subject' due to the following reasons:

1. While going through the Research Methodology and Biostatistics syllabus it was found that in some courses more weightage was given to computer hardware e.g. History and development of computers(old pattern) which may not be needed now as we have witnessed the revolution in Information Technology. Students should be taught latest technology and software.
2. Secondly, in most of the syllabi 'Vital Statistic' is missing which is an important topic for healthcare field. Some of the essential topics like 'Normal distribution' etc are missing.
3. By streamlining the syllabus it will save teacher's teaching time, paper setting time. Moreover, Exam section need not call multiple examiners for the same subject, this will be economical for exam section.

This subject is well recognized as an essential tool in medical research, clinical decision making, and health management. It is recommended to streamline the syllabus and make **Research Methodology and Biostatistics' compulsory in all the post graduate courses of School Biomedical Sciences.** The modified syllabus is enclosed.
This is for your kind perusal and necessary action please.

With regards,

Dr. Rita Abbi
Professor, Biostatistics

Copy for information to
Registrar MGMIHS Navi Mumbai;
Hon'ble Vice Chancellor, MGMIHS Navi Mumbai
Hon'ble Medical Director, MGM Medical College

BOS → Faculty → Academic Council.

MGM Institute Of Health Sciences
INWARD NO. 5720
DATE: 25/6/18
REF:

MGM INSTITUTE OF HEALTH SCIENCES

M. Sc. Students

Syllabus for Research Methodology and Biostatistics

		No. of Hours	
	I. Research Methodology:	Theory	Practical
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
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
5	**Methods of Data Collection:** Types of data, Collection of Primary Data, Observation Method, Interview Method, Collection of Primary Data	5	3
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	3
	II. Biostatistics		
1	**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	4
2	**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	4

3	**Testing of Hypotheses**: Definition, Basic Concepts, Procedure for Hypothesis Testing, Measuring the Power of a Hypothesis Test, Normal distribution, data transformationImportant 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	
4	**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	2
5	**Measures of Relationship**: Need and meaning, Correlation and Simple Regression Analysis	2	3
6	**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	4
7	**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	4
8	**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	6
9	**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	6
	Total hours	60	60

Resolution No. 4.13 of BOM-55/2018: Resolved as follows:-

(i) Slow learners must be re-designated as potential learners.

(ii) Students scoring less than 35% marks in a particular subjects/course in the 1st formative exam are to be listed as potential learners. These learners must be constantly encouraged to perform better with the help of various remedial measures.

(iii) Students scoring more than 75% marks in a particular subjects/course in the 1st formative exam are to be listed as advanced learners. These learners must be constantly encouraged to participate in various scholarly activities.

Resolution No. 3.1.4.2 of BOM-57/2019:

i. Resolved to include "Gender Sensitization" into UG (from new batch 2019-2020) and PG (from existing batches) curricula. **[Annexure-21]**

ii. Resolved to align the module of "Gender Sensitization" with MCI CBME pattern for MBBS students.

iii. Resolved that Dr. Swati Shiradkar, Prof., Dept. of OBGY., MGM Medical College, Aurangabad will coordinate this activity at both campuses.

Annexure - 21

Gender sensitization for UG (2nd , 3rd , 8th semesters) and PG (3 hours)

INCLUSION OF " GENDER SENSATIZATION" IN CURRICULUM

Introduction :

The health care provider should have a healthy gender attitude, so that discrimination, stigmatization, bias while providing health care will be avoided. The health care provider should also be aware of certain medico legal issues related with sex & gender.

Society particularly youth & adolescents need medically accurate, culturally & agewise appropriate knowledge about sex, gender & sexuality. So we can train the trainers for the same. It is need of the hour to prevent sexual harassment & abuse .

To fulfill these objectives, some suggestions are there for approval of BOS.

Outline

1)For undergraduates :- Three sessions of two hours each, one in 2nd term, one in 3rd term & one in 8th term.

2)For Faculties and postgraduates :- One session of two hrs .

3)For those want to be trainers or interested for their ownself, value added course, which is optional about sex, gender, sexuality & related issues.

Responsibility

ICC of MGM, MCHA , with necessary support from IQAC & respective departments.

Details of undergraduate sessions

1)First session in 2nd term

Aim – To make Students aware about the concept of sexuality & gender**.**

To check accuracy of knowledge they have,

To make them comfortable with their own gender identify & related issues.

To make them aware about ICC & it is functioning.

Mode – Brain storming , Interactive power point presentation experience sharing.

Duration – Around two hours

Evaluation – Feedback from participants.

2)Second session in 3rd / 4th term

Aim – To ensure healthy gender attitude in these students as now they start interacting with patients.

To ensure that the maintain dignity privacy while interacting with patients and relatives, particularly gender related.

To make them aware about importance of confidentiality related with gender issues.

To encourage them to note gender related issues affecting health care & seek solutions.

Mode – focused group discussions on case studies, Role plays & discussion.

Duration – Around two hours.

Evaluation – Feedback from participants.

Third session in 8th term.

Aim – To understand effect of gender attitudes on health care in various subjects.

To develop healthy gender attitude while dealing with these issues.

Mode – Suggested PBL by departments individually. (In collaboration with ICC till faculty sensitization is complete)

Evaluation – Feedback

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FOR POSTGRADUATES

Session of 2-3 hrs preferably in induction program.

Aim – To introduce medically accurate concept of gender, sex, gender role & sex role.

To ensure healthy gender attitude at workplace.

To understand gender associated concepts on health related issues & avoid such bias wile providing health care.

To make them aware about ICC & it's functioning.

Mode – Interactive PPT

Role plays & discussion

Duration – 2 to 3 hrs

Evaluation – Feedback.

FOR FACULTIES

Session of 2 hours may be during combined activities.

Aim – To ensure clarity of concept abut gender & sex.

To discuss effect of these concept on health related issues.

To identify such gender & sex related issues in indivual subject specialties.

To discuss methodology like PBL for under graduate students when whey are in 7^{th}-8^{th} semester.

Mode – Role play

Focused group discussion

Case studies

Evaluation – Feed back.

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Sdp-Pimple/joshi-obgy

Resolution No. 3.1.1.6 of BOM-62/2020: Resolved to include the following Textbooks in the respective syllabus:

a) Clinical Embryology[Annexure-11A]

b) Biotechnology/Genetics/Molecular Biology[Annexure-11B]

Annexure-11B of BOM-62/2020

List of Books for M.Sc. Medical Biotechnology / Medical Genetics /Molecular Biology

Sr No.	Books	Author
1	Cancer Cytogenetics : Chromison and Genetic Abberation Of Tumer Cell	Felix Meitelman and Sverre Heim
2	Genetic Counselling Ethical Challenges and Consequences	Dianne M Bortels
3	Concept Of Pharmacogenomics	Martin M. Zadanowicz
4	Principle Of Population Genetics	Danial L. Harth & Andrew G. Clark
5	Nanotechnology in Agriculture and Food Science	Edited by Monique Axelos and Mascel Van De vroode
6	Nanotechnology "Risk, Ethics & Law"	Geaffroy Hunt and Michacl Mehta
7	Research Methodology	C.R. Kothari Second Edition

Resolution No. 4.3.1.2 of BOM-63/2021: Resolved to include topics related to COVID 19 in UG {B.Sc. AT & OT (BOTAT 108L), B.Sc. MLT(BMLT 108 L), B.Sc. MRIT (BMRIT 108L), B.Sc. MDT-(BMDT 108L), B.Sc. CCT (BCCT 108L), B.Sc.PT (BPT 108L), B. Optometry (BOPTOM 108L) Programs for Batch AY 2020-21 (Semester II)} & B.Sc. Medical Laboratory Technology SEMESTER-VI in subject of Medical Microbiology-II (BMLT 125 L) & Medical Microbiology-II (BMLT 125 P) for Batch AY 2020-21. **[Annexure-7]**
Further Dr. N.N. Kadam, Hon'ble Pro Vice Chancellor suggested to add topics under "Newer Infectious Diseases" as the main topic.

Annexure-07 of BOM-63/2021 dt 17.02.2021

To include Covid-19 topics in health professional curriculum as per the BOM Resolution No. 3.7 of BOM-62/2020

a) M.Sc. (PG Program), (M.Sc. Medical Biotechnology, M.Sc. Medical Genetics, M.Sc. Biostatistics, M.Sc. Molecular Biology, M.Sc. MRIT, M.Sc. CCT, M.Sc. Clinical

Nutrition, M.Sc. Clinical Embryology, Master in Hospital Administration, Master of Public Health, and M.Optometry)

Approved syllabus	**Name of the subject**	**Existing content**	**Proposed changes**
Common Syllabus for Semester IV – 2 year M.Sc. programs (M.Sc. Medical Biotechnology, M.Sc. Medical Genetics, M.Sc. Biostatistics, M.Sc. Molecular Biology, M.Sc. MRIT, M.Sc. CCT, M.Sc. Clinical Nutrition, M.Sc. Clinical Embryology, Master in Hospital Administration, Master of Public Health, and M.Optometry)	**BIOETHICS, BIOSAFETY, IPR & TECHNOLOGY TRANSFER** **GE 002 L**	**Sr. no. 2** 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	**Sr. no. 2** 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, **WHO & CDC, ICMR guidelines for Biosafety and Vaccines with regards COVID 19**

Resolution No. 4.3.1.3 of BOM-63/2021: Accorded post facto approval for changes in the index of UG (B.Sc. AT & OT, B.Sc. MLT, B.Sc. MRIT, B.Sc. MDT, B.Sc. CCT, B.Sc.PT, B. Optometry) and PG 2 year (M.Sc. Medical Biotechnology, M.Sc. Medical Genetics, M.Sc. Biostatistics, M.Sc. Molecular Biology, M.Sc. MRIT, M.Sc. CCT, M.Sc. Clinical Nutrition, M.Sc. Clinical Embryology, Master in Hospital Administration, Master of Public Health, and M.Optometry). **[Annexure-8A, 8B]**

CURRICULUM FOR M.Sc. MEDICAL GENETICS

FIRST YEAR

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

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

SECOND YEAR

Semester III						
Syllabus Ref. No.	**Subject**	**Credits (C)**	**Teaching (hrs.)**	**Marks**		
Theory				**Internal Assessment (IA)**	**University Semester Exam (UEX) / Internal Semester Exam (INT)**	**Total**
GEN 108 T	Clinical Genetics & Genetic Counselling	4	4	20	80 (UEX)	100
GEN 109 T	Developmental Genetics & Environment Genetics	4	4	20	80 (UEX)	100
Core Elective course**						
GEN 110 T	Cancer genetics and Pharmacogenomics	4	4	20	80 (UEX)	100
GEN 111 T	Principles of Genetics & Population Genetics					
GEN 112 T	Stem Cell					
GEN 113	Dissertation/Project Proposal*	6	12	-	50 (INT)	50
Practical						
GE 108 P	Clinical Genetics & Genetic Counselling	2	4	10	40 (UEX)	50
GE 109 P	Developmental Genetics & Environment Genetics	2	4	10	40 (UEX)	50
	Core Elective Practical	1	2	10	40 (UEX)	50

GE 110 P GE 111 P GE 112 P	Cancer Genetics and Pharmacogenomics Principles of Genetics & Population Genetics Stem Cell					
GEN 114	Seminar*	1	2	-	50 (INT)	50
Total		**24**	**36**	**90**	**460**	**550**

Semester IV

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

Resolution No. 4.3.1.5 of BOM-63/2021: Resolved to approve the changes in 3rd semester M.Sc. Medical Genetics syllabus. **[Annexure-9]**

Annexure-09 of BOM-63/2021 dt 17.02.2021

~~Annex-III~~

Approved syllabus	Name of the subject	Existing content	Proposed changes
M.Sc Medical Genetics	**DEVELOPMENTAL GENETICS & ENVIRONMENTAL GENETICS** **Course code- GEN 109 T (3rd semester)**	**Unit 1** **Spermatogenesis, Oogenesis** Fertilization Human embryonic development: Brief account of embryonic development: Blastulation, Gastrulation, formation of notochord and establishment of body axis; Organogenesis: Formation of embryonic germ layers and their derivatives; Fetal development and plancentation (development, structure and function); Fetal membrane in twins.	**Unit 1** **Spermatogenesis, Oogenesis** Fertilization Human embryonic development: Brief account of embryonic development: Blastulation, Gastrulation, formation of notochord and establishment of body axis; Organogenesis: Formation of embryonic germ layers and their derivatives; Fetal development and plancentation (development, structure and function); Fetal membrane in twins; **Development of CVS, CNS, EYE, EAR, GUS with their anomalies;** **Twin Pregnancy**
		Unit 2 **Central Nervous System in vertebrates:** Neural tube formation; Tissue architecture of CNS; Limb development in vertebrates: Formation of limb Bud; Proximal Distal axis of the limb; Cell death and formation of digits and joints; Regeneration and	**Unit 2** **Central Nervous System in vertebrates:** Neural tube formation; Tissue architecture of CNS; Limb development in vertebrates: Formation of limb Bud; Proximal Distal axis of the limb; Cell death and formation of digits and joints;

		Senescence: Epimorphic, morphallactic and compensatory regeneration; Ageing: causes and regulation; Pleuropotency of stem cells: Embryonic and adult stem cells, organization, characteristics and therapeutic applications	Regeneration and Senescence: Epimorphic, morphallactic and compensatory regeneration; Ageing: causes and regulation; Pleuropotency of stem cells: Embryonic and adult stem cells, organization, characteristics and therapeutic applications; A**ging and genetics; Progeria syndrome**
		Unit 3 **Understanding Human Birth defects** through Model Organism **Developmental malformation caused by Teratogens** Induced Reproductive Problems; Gene-Teratogen; Environmental factors and Genetic Susceptibility; **Genomic imprinting**: Parent-of-origin effect; Gene silencing	**Unit 3** **Understanding Human Birth defects** through Model Organism , Induced Reproductive Problems; Gene-Teratogen; Environmental factors and Genetic Susceptibility; Parent-of-origin effect; Gene silencing
	Clinical Genetics **Course code- GEN 108 T (Sem 3)**	**Chromosomal anomalies** Numerical, Structural, Meiosis in inversion and translocation heterozygotes; breakage-fusion-bridge cycles, Induced chromosomal aberrations in somatic cells, Sister chromatid exchanges and somatic crossing over	**Chromosomal anomalies** Numerical, Structural, Meiosis in inversion and translocation heterozygotes; breakage-fusion-bridge cycles, Induced chromosomal aberrations in somatic cells, Sister chromatid exchanges and somatic crossing over **Downs syndrome & its variant , Patau syndrome , Edward syndrome, Turner syndrome and its**

			variant, Klinefelter syndrome, Cri-du-chat syndrome, Fragile X syndrome , Terminologies used in clinical genetics
		Genetics in Medical Practice: Genetic principles and their application in medical practice; Case studies (Interacting with patients, learning family history and drawing pedigree chart); Syndromes and disorders: Definition and their genetic basis Molecular pathology of monogenic diseases: Cystic fibrosis, taySach's Syndrome & Marfan Syndrome; Genetics of diseases due to inborn errors of metabolism: Phenylketonuria, Galactosemia & Mucopolysaccharidosis	**Genetics in Medical Practice:** Genetic principles and their application in medical practice; Case studies (Interacting with patients, learning family history and drawing pedigree chart); Syndromes and disorders: Definition and their genetic basis Molecular pathology of monogenic diseases: Cystic fibrosis, taySach's Syndrome & Marfan Syndrome; **Genetic basis of IEM and endocrinological disorders** - Phenylketonuria, Galactosemia & Mucopolysaccharidosis **Disorders of carbohydrate, lipid, fatty acid, amino acids, lysosomal and other disorders. Congenital adrenal hyperplasia, diabetes mellitus, autoimmune polyendocrinopathies**
		Genetics of Neurogenetic disorders: Charcot-Marie tooth syndrome, Spino-muscular atrophy, Alzheimer's disease & Syndromes due to triplet nucleotide expansion; Genetic basis of muscle disorders: Dystrophies (Duchenne Muscular	**Genetics of Neurogenetic disorders:** Charcot-Marie tooth syndrome, Spino-muscular atrophy, Alzheimer's disease & Syndromes due to triplet nucleotide expansion; Genetic basis of muscle disorders: Dystrophies (Duchenne Muscular

		dystrophy and Becker Muscular Dystrophy), Myotonias& Myopathies; Genetic disorders of Haemopoitic systems: Overview of hematopoisis, Blood cell types and haemoglobin, Sickle cell anemia, Thalassemias & Hemophilias.	dystrophy and Becker Muscular Dystrophy), Myotonias& Myopathies; Genetic disorders of Haemopoitic systems: Overview of hematopoisis, Blood cell types and haemoglobin, Sickle cell anemia, Thalassemias & Hemophilias. **Syndromes and disorders: Definition and their genetic basis Molecular pathology of monogenic diseases: Cystic fibrosis, taySach's Syndrome & Marfan Syndrome;**
		Genetic basis of eye disorders: Colour Blindness, Retinitis pigmentosa, Glaucoma & Cataracts; Genetics of skeleton & skin disorders; Genetics of Syndromes & Genomic Imprinting: Neurofibromatosis I, Prader-Willi & Angelman syndromes, BeckwithWiedeman syndrome	**Genetic basis of eye disorders:** Colour Blindness, Retinitis pigmentosa, Glaucoma & Cataracts; Genetics of skeleton & skin disorders; Genetics of Syndromes & Genomic Imprinting: Neurofibromatosis I, Prader-Willi & Angelman syndromes, BeckwithWiedeman syndrome **Complex polygenic syndromes : Hyperlipidemia, Atherosclerosis, Mitochondrial syndromes;**
		Complex polygenic syndromes: Hyperlipidemia, Atherosclerosis, Diabetes mellitus ; Mitochondrial syndromes; Management of genetic disorders;	**Complex polygenic syndromes:** Management of genetic disorders; **Diagnostic approach for a child with multiple anomalies, dysmorphic features, Disorders of**

			sexual differentiation, Methods for laboratory diagnosis in genetics, cytogenetics, molecular cytogenetics, DNA array analysis, molecular genetics
		Prenatal and Pre-implantation screening and diagnosis: Indications for prenatal diagnosis, Indications for Prenatal Diagnosis Genetic testing: biochemical & molecular tests in children, Presymptomatic testing for late onset diseases (predictive medicine) Noninvasive methods (Ultrasound, Endoscopy, MRI, Maternal Serum Screening for Down's syndrome & Neural tube defect, Fetal Blood Sampling, etc.) Invasive methods; Amniocentesis, Chorionic Villi Sampling Ethical issues in pre-natal screening & diagnosis.	**New born screening**, Prenatal and Pre-implantation screening and diagnosis: Indications for prenatal diagnosis, Indications for Prenatal Diagnosis Genetic testing: biochemical & molecular tests in children, Presymptomatic testing for late onset diseases (predictive medicine) Noninvasive methods (Ultrasound, Endoscopy, MRI, Maternal Serum Screening for Down's syndrome & Neural tube defect, Fetal Blood Sampling, etc.) Invasive methods; Amniocentesis, Chorionic Villi Sampling Ethical issues in pre-natal screening & diagnosis.

Resolution No. 3.3 of AC-41/2021 : It is resolved to approve the changes in the 3rd semester M.Sc. Medical Genetics in Development genetics & Environmental Genetics for Practical syllabus . academic Council further decided that changes as per Resolution No. 4.3.1.5 of BOM-63/2021 in 3rd semester M.Sc. Medical Genetics syllabus (Theory) to be implemented alongwith above practical changes from the batch admitted in acadmic year 2021-22, so as to have clarity on the change of syllabus

Annexure-5 of AC-41-2021

Approved syllabus	Name of the subject	Existing content	Proposed changes
M.Sc Medical Genetics	**DEVELOPMENTAL GENETICS &ENVIRONMENTAL GENETICS Course code- GEN 109 T (3rd semester)**	**Unit 1** **Spermatogenesis, Oogenesis** Fertilization Human embryonic development: Brief account of embryonic development: Blastulation, Gastrulation, formation of notochord and establishment of body axis; Organogenesis: Formation of embryonic germ layers and their derivatives; Fetal development and plancentation (development, structure and function); Fetal membrane in twins.	**Unit 1** **Spermatogenesis, Oogenesis** Fertilization Human embryonic development: Brief account of embryonic development: Blastulation, Gastrulation, formation of notochord and establishment of body axis; Organogenesis: Formation of embryonic germ layers and their derivatives; Fetal development and plancentation (development, structure and function); Fetal membrane in twins; **Development of CVS, CNS, EYE,EAR, GUS with their anomalies; Twin Pregnancy**
		Unit 2 **Central Nervous System in vertebrates:** Neural tube formation; Tissue architecture of CNS; Limb development in vertebrates: Formation of limb Bud; Proximal Distal axis of the limb; Cell death and formation of digits and joints; Regeneration and Senescence: Epimorphic, morphallactic and compensatory regeneration; Ageing: causes and regulation; Pleuropotency of stem cells: Embryonic and adult stem cells, organization, characteristics and therapeutic applications	**Unit 2** **Central Nervous System in vertebrates:** Neural tube formation; Tissue architecture of CNS; Limb development in vertebrates: Formation of limb Bud; Proximal Distal axis of the limb; Cell death and formation of digits and joints; Regeneration and Senescence: Epimorphic, morphallactic and compensatory regeneration; Ageing: causes and regulation; Pleuropotency of stem cells: Embryonic and adult stem cells, organization, characteristics and therapeutic applications; A**ging and genetics;Progeria syndrome**
		Unit 3 **Understanding Human Birth defects** through Model Organism **Developmental malformation caused by Teratogens** Induced Reproductive Problems; Gene-Teratogen; Environmental factors and Genetic Susceptibility; **Genomic imprinting**: Parent-of-origin effect; Gene silencing	**Unit 3** **Understanding Human Birth defects** through Model Organism , Induced Reproductive Problems; Gene-Teratogen; Environmental factors and Genetic Susceptibility; Parent-of-origin effect; Gene silencing
	Clinical Genetics **Course code- GEN 108 T (Sem 3)**	**Chromosomal anomalies** Numerical, Structural, Meiosis in inversion and translocation heterozygotes; breakage-fusion-bridge cycles, Induced chromosomal aberrations in somatic cells, Sister chromatid	**Chromosomal anomalies** Numerical, Structural, Meiosis in inversion and translocation heterozygotes; breakage-fusion-bridge cycles, Induced chromosomal aberrations in somatic cells, Sister chromatid exchanges and somatic crossing over

		exchanges and somatic crossing over	**Downs syndrome & its variant , Patau syndrome , Edward syndrome, Turner syndrome and its variant, Klinefelter syndrome, Cri-du-chat syndrome, Fragile X syndrome , Terminologies used in clinical genetics**
		Genetics in Medical Practice: Genetic principles and their application in medical practice; Case studies (Interacting with patients, learning family history and drawing pedigree chart); Syndromes and disorders: Definition and their genetic basis Molecular pathology of monogenic diseases: Cystic fibrosis, taySach's Syndrome &Marfan Syndrome; Genetics of diseases due to inborn errors of metabolism: Phenylketonuria, Galactosemia&Mucopolysaccharidosis	**Genetics in Medical Practice:** Genetic principles and their application in medical practice; Case studies (Interacting with patients, learning family history and drawing pedigree chart); Syndromes and disorders: Definition and their genetic basis Molecular pathology of monogenic diseases: Cystic fibrosis, taySach's Syndrome &Marfan Syndrome; **Genetic basis of IEM and endocrinological disorders** - Phenylketonuria,Galactosemia&Mucopolysaccharidosis **Disorders of carbohydrate, lipid, fatty acid, amino acids, lysosomal and other disorders. Congenital adrenal hyperplasia, diabetes mellitus, autoimmune polyendocrinopathies**
		Genetics of Neurogenetic disorders: Charcot-Marie tooth syndrome, Spino-muscular atrophy, Alzheimer's disease & Syndromes due to triplet nucleotide expansion; Genetic basis of muscle disorders: Dystrophies (Duchenne Muscular dystrophy and Becker Muscular Dystrophy), Myotonias& Myopathies; Genetic disorders of Haemopoitic systems: Overview of hematopoisis, Blood cell types and haemoglobin, Sickle cell anemia, Thalassemias&Hemophilias.	**Genetics of Neurogenetic disorders:** Charcot-Marie tooth syndrome, Spino-muscular atrophy, Alzheimer's disease & Syndromes due to triplet nucleotide expansion; Genetic basis of muscle disorders: Dystrophies (Duchenne Muscular dystrophy and Becker Muscular Dystrophy), Myotonias& Myopathies; Genetic disorders of Haemopoitic systems: Overview of hematopoisis, Blood cell types and haemoglobin, Sickle cell anemia, Thalassemias&Hemophilias. **Syndromes and disorders: Definition and their genetic basis Molecular pathology of monogenic diseases: Cystic fibrosis, taySach's Syndrome &Marfan Syndrome;**
		Genetic basis of eye disorders: Colour Blindness, Retinitis pigmentosa, Glaucoma & Cataracts; Genetics of skeleton & skin disorders; Genetics of Syndromes & Genomic Imprinting: Neurofibromatosis I, Prader-Willi&Angelman syndromes,	**Genetic basis of eye disorders:** Colour Blindness, Retinitis pigmentosa, Glaucoma & Cataracts; Genetics of skeleton & skin disorders; Genetics of Syndromes & Genomic Imprinting: Neurofibromatosis I, Prader-Willi&Angelman syndromes, BeckwithWiedeman syndrome **Complex polygenic syndromes : Hyperlipidemia, Atherosclerosis,**

		BeckwithWiedeman syndrome	**Mitochondrial syndromes;**
		Complex polygenic syndromes: Hyperlipidemia, Atherosclerosis, Diabetes mellitus ; Mitochondrial syndromes; Management of genetic disorders;	**Complex polygenic syndromes:** Management of genetic disorders; **Diagnostic approach for a child with multiple anomalies, dysmorphic features, Disorders of sexual differentiation,Methods for laboratory diagnosis in genetics, cytogenetics, molecular cytogenetics, DNA array analysis, molecular genetics**
		Prenatal and Pre-implantation screening and diagnosis: Indications for prenatal diagnosis, Indications for Prenatal Diagnosis Genetic testing: biochemical & molecular tests in children, Presymptomatic testing for late onset diseases (predictive medicine) Noninvasive methods (Ultrasound, Endoscopy, MRI, Maternal Serum Screening for Down's syndrome & Neural tube defect, Fetal Blood Sampling, etc.) Invasive methods; Amniocentesis, Chorionic Villi Sampling Ethical issues in pre-natal screening & diagnosis.	**New born screening**, Prenatal and Pre-implantation screening and diagnosis: Indications for prenatal diagnosis, Indications for Prenatal Diagnosis Genetic testing: biochemical & molecular tests in children, Presymptomatic testing for late onset diseases (predictive medicine) Noninvasive methods (Ultrasound, Endoscopy, MRI, Maternal Serum Screening for Down's syndrome & Neural tube defect, Fetal Blood Sampling, etc.) Invasive methods; Amniocentesis, Chorionic Villi Sampling Ethical issues in pre-natal screening & diagnosis.

Name of the Programme – M.Sc Medical Genetics Name of the Course **- Developmental Genetics &Environmental Genetics** Course code- GEN 109 P (3rd semester) No of Hours- 60				
	Topics in existing syllabus	Addition in topics	Deletion of topics	Justification
1	Determination of Sex based on Barr body analysis.		Determination of Sex based on Barr body analysis.	Barr body, PCR, RTPCR topics will be covered in clinical genetics
2	PCR Diagnostics IN RELATION TO Chromosomal abnormalities		PCR Diagnostics IN RELATION TO Chromosomal abnormalities	
3	Real Time PCR Technique		Real Time PCR Technique	
4	Spermatogenesis, Oogenesis	Models on development of CVS, CNS, EYE, EAR, GUS, Fertilization, placenta, fetal membranes, neural tube formation		Systemic development is added in theory, the same topics will be incorporated in practical
5	Sites of implantation	Radiation biology-charts		
6	Development of germ layers	Teratogens charts		
7	Identification of Trisomy 13, 18, 21		Identification of Trisomy 13, 18, 21	Will be covered in clinical genetics

Name of the Programme – M.Sc Medical Genetics **Name of the Course-Clinical Genetics and genetic counseling** Course code- GEN 108 P (Sem 3)No of Hours- 60			
Topics in existing syllabus	Addition in topics	Deletion of topics	Justification
Lymphocyte culture and chromosome analysis- • Culture set up • Harvesting • G-banding	Determination of Sex based on Barr body analysis.		Topics which are in addition column are more related to clinical genetics.
Identification of chromosomal abnormalities using banding technique.	PCR Diagnostics in relation to Chromosomal abnormalities		
Preparation of pedigree on case based study	Real Time PCR Technique Identify and describe mutations from photographs		
Case based genetic counseling			
Case based genetic diagnosis(General laboratory organization of prenatal Diagnosis)			
Identification of Trisomy 13, 18, 21			

Resolution No. 3.5 of AC-41/2021: Resolved to incorporate the changes as per the decision of the CBCS committee in PG M.Sc Medical Genetics with effect from the batch admitted in 2020-21 onwards

12.1 : Minutes of CBCS meeting held on 3.02.2021 I. Courses titled as elective, seminar, clinical posting etc. will be evaluated at university level, only:	**Decision taken by CBCS Committee:** Members agreed that all courses (core, elective, seminar, clinical posting etc) in all programs with CBCS curriculum under MGM School of Biomedical Sciences (MGMSBS-UG & PG), MSc Medical Programme under MGM Medical College and MGM School of Physiotherapy (MGMSOP) (BPT & MPT) will be evaluated at the level of the University at the end during semester examination. (Detailed included as 1, 2,3,4 points)
1. Courses which were evaluated at constituent units titled as elective, seminar, clinical posting etc. will be evaluated at university level for UG & PG of MGMSBS, Navi Mumbai:	MGM School of Biomedical Sciences (MGMSBS-UG) :First year B.Sc. (Semester I & Semester II) (core-1.1 & 1.2) and (elective-1.3) common for all seven programs **(B.Sc. DT, B.Sc. AT & OT, B.Sc. CCT, B.Optometry, B.Sc. PT, B.Sc. MRIT, B.Sc. MLT)** which were having 100 marks previously will be changed to 50 marks (40 marks university Semester End Exam-(SEE) and 10 marks Internal Assessment – (IA) as per below format - 1.4) w.e.f AY 20-21. (**Annexure 1**) Clinical Directed posting allotted 50 marks will be assessed as university end semester exam w.e.f AY 20-21. **(Annexure 1.1)** **(request to add** **a) evaluation pattern of seminar - 50 marks– BSc Dialysis- sem IV** **b) Boptometrysem III – course : geometrical optics and visual optics I/II** **sem IV – optometric instrumentation** **10 IA + 40 SEE – format submitted)**
	2.1 Courses which were evaluated at constituent units titled as elective, seminar, clinical posting etc. will be evaluated at university level. Members agreed that all courses (core, elective, seminar, clinical posting etc) in all programs with CBCS curriculum under MGM School of Biomedical Sciences (MGMSBS- PG), will be evaluated at the level of the University end semester examination w.e.f. AY 2020-21. ***** For PG program (M.Sc. 2 year including allied program, MHA, MPH) having courses like seminar/education tour & Industrial visit which were allotted **50 marks** will be assessed as university end semester exam. a. Amended 10 marks in seminar **(Annexure-2.1A)** b. Amended 20 marks for Educational Tour/Field Work/Hospital Visit/ Industrial Visit **(Annexure-2.1B)** c. 50 marks for Clinical Directed Posting (no change) **(Annexure-2.1C)** **(request to add the evaluation pattern for MPH – sem I,II, III)** **MOptometry – Sem I – evaluation pattern to be added)** **2.2** PG Courses which were evaluated at constituent units titled as elective carrying 100 marks as only similar to that of core courses, will be evaluated at university level. Similar pattern which is being followed for core Subjects (IA - 20 Marks + university exam - 80 marks) will be followed.**(Annexure-2.2)**

Resolution No. 10.4 of Academic Council (AC-42/2022):

i) "Resolved to accept "50% eligibility in internal assessment" pattern for all the CBCS programs (UG & PG) running under the constituent units of MGMIHS.(MGM School of Biomedical Sciences, MGM School of Physiotherapy, MGM Medical College (M.Sc. Medical 3 year courses).

This will be applicable to all existing batches (for remaining regular examinations) and forthcoming batches from June 2022 onwards"

Resolution No. 3.10 of Academic Council (AC-49/2024):

Resolved and approved to collect the Dissertations/Projects 60 days before the University examination for all 2-year M.Sc. programs under MGM School of Biomedical Sciences to fulfil the credit allotted for project work, to be effective from batch 2023-24 onwards.

MGM INSTITUTE OF HEALTH SCIENCES

(Deemed to be University u/s 3 of UGC Act, 1956)

Grade 'A' Accredited by NAAC

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