गोंय विद्यापीठ
ताळगांव पठार,
गोंय – ४०३ २०६
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(Accredited by NAAC)

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GU/Acad –PG/BoS -NEP/2024/251 Date: 26.06.2024

CIRCULAR

The approved Syllabus of Semester I and II of **Post Graduate Diploma in Clinical Genetics and Medical Laboratory Techniques (PGDCG & MLT)** Programme is enclosed.

The Dean/ Vice-Deans of the School of Biological Sciences and Biotechnology and Dean of the Affiliated College offering the **Post Graduate Diploma in Clinical Genetics and Medical Laboratory Techniques (PGDCG & MLT)** Programme are requested to take note of the above and bring the contents of the Circular to the notice of all concerned.

ASHWIN VYAS LAWANDE
Digitally signed by ASHWIN VYAS LAWANDE
Date: 2024.06.26 16:55:22 +05'30'

(Ashwin Lawande)
Assistant Registrar – Academic-PG

To,
1. The Dean, School of Biological Sciences and Biotechnology, Goa University.
2. The Vice-Deans, School of Biological Sciences and Biotechnology, Goa University.
3. The Dean, Faculty of Medicine, Goa University.
4. The Dean, Goa Medical College, Bambolim - Goa

Copy to:
1. The Chairperson, BOS in Clinical Genetics & Medical Laboratory Techniques.
2. The Controller of Examinations, Goa University.
3. The Assistant Registrar, PG Examinations, Goa University.
4. Directorate of Internal Quality Assurance, Goa University for uploading the Syllabus on the University website.

Post Graduate Diploma in Clinical Genetics and Medical Laboratory Techniques (PGDCG & MLT) (for the Academic year 2024-25)

A brief description of the course:

Purpose: Skilled development of students in Clinical Genetics and Medical Laboratory techniques.

Prerequisite: Science graduate with either Zoology, Microbiology, Biotechnology, Biochemistry. Candidates should compulsorily obtain a minimum of 55% marks in the PGDCG&MLT GU-ART conducted by Goa University.

Duration: This Postgraduate diploma shall consist of two semesters with four courses in Semesters I and II, each followed by compulsory one-month hands-on training in each of the laboratories viz. Biochemistry, Blood Bank and Central Laboratory, Pathology and Microbiology in Goa Medical College/ Govt. Hospital.

Course Fee: The course fees will be decided by Goa University.

Special Feature: A collaborative teaching programme between the Department of Biochemistry, Pathology, Microbiology of Goa Medical College and Zoology, School of Biological Sciences and Biotechnology, Goa University.

Programme Structure: A learner should earn a minimum of 40 Credit Courses to receive Postgraduate diploma in clinical Genetics and Medical laboratory techniques. Out of 40 credits, 32 credits shall be of Programme Core Courses to be earned during Semesters I and II, and 8 credits are discipline-specific electives to be earned during Semesters I and II.

After the successful completion of 40 credits, the student will be entitled to a compulsory six-month internship at Goa Medical College/ Govt. Hospital laboratories.

Timeline for completion of various credits over four Semesters:

Courses	**Sem I**	**Sem II**
Discipline Specific Core Courses	16	16
Discipline Specific Elective Course	04	04
Internship: Six months post completion of Semester I & II		

Programme Structure

Semester I		
Course Code	**Title of the Course**	**No. of Credits**
Discipline-Specific Core (DSC) Courses (16 Credits)		
MLT-500	Clinical Genetics I	**03**
MLT-501	Laboratory course on Clinical Genetics I	**01**
MLT-502	Clinical Biochemistry I	**03**
MLT-503	Laboratory course on Clinical Biochemistry I	**01**
MLT-504	Clinical Microbiology (General & Systematic)	**03**
MLT-505	Laboratory course on Clinical Microbiology (General & Systematic)	**01**
MLT-506	Clinical Pathology & Histology	**03**
MLT-507	Laboratory course on Clinical Pathology & Histology	**01**
Discipline-Specific Elective (DSE) Course (4 Credits)		
MLT-521	Laboratory Safety and Biosecurity	**02**
MLT-522	Biostatistics for Laboratory Professionals	**02**
Swayam course	Basic Course in Biomedical Research offered by ICMR-National Institute of Epidemiology (ICMR-NIE), Chennai	**04**
Swayam course	Introduction to Biomedical Imaging Systems By Prof. Arun K. Thittai | IIT Madras	**03**
Swayam course	Biomedical nanotechnology By Prof. P. Gopinath | IIT Roorkee	**01**
Swayam course	Biomedical Ultrasound: Fundamentals of Imaging and Micromachined Transducers By Prof. Karla P. Mercado-Shekhar, Prof. Himanshu Shekhar, Prof. Hardik Jeetendra Pandya | IIT Gandhinagar, IISc Bangalore	**04**

Semester II		
Course Code	**Title of the Course**	**No. of Credits**
Discipline-Specific Core (DSC) Courses (16 Credits)		
MLT-508	Clinical Genetics II	**03**
MLT-509	Laboratory course on Clinical Genetics II	**01**
MLT-510	Clinical Biochemistry II	**03**
MLT-511	Laboratory course on Clinical Biochemistry II	**01**
MLT-512	Clinical Parasitology, Mycology and Virology	**03**
MLT-513	Laboratory course on Clinical Parasitology, Mycology & Virology	**01**
MLT-514	Hematology and Transfusion Medicine	**03**
MLT-515	Laboratory course on Hematology and Transfusion Medicine	**01**
Discipline-Specific Elective (DSE) Course (04 Credits)		
MLT-523	Clinical Laboratory Management and Quality Assurance	**02**
MLT-524	Immunology	**02**
Swayam course	Swayam course: Biomolecules: Structure Function in Health and Disease By Dr. Ashok Sharma | All India Institute of Medical Sciences (AIIMS), New Delhi	**04**
Swayam course	Biomedical Instrumentation & Sensors By Dr. Piyush Lotia and Mr. Thaneshwar Kumar Sahu | Chhattisgarh Swami Vivekanand Technical University, Bhilai	**04**
Swayam course	Biomedical Signal Processing By Prof. Sudipta Mukhopadhyay | IIT Kharagpur	**04**
Swayam course	Food Microbiology and Food Safety By Dr. Tejpal Dhewa | Central University of Haryana	**04**

Note:

Each theory credit will be for 15 contact hours and will account for 25 marks.

Each practical credit will be for 30 contact hours and will account for 25 marks.

Name of the Programme : PGDCG & MLT
Course Code : MLT-500
Title of the Course : Clinical genetics-I
Number of Credits : 03
Effective from AY : 2024 -2025

Prerequisite for the Course:	Basic knowledge of Cell Biology and Genetics	
Course Objectives:	1. Establish foundational knowledge of genetics to support understanding of clinical genetics. 2. Comprehend molecular mechanisms of inheritance for insight into genetic disorders. 3. Recognize genetic variations and mutations' impacts on gene function in disease development. 4. Analyze pedigrees to interpret inheritance modes for clinical risk assessment.	
Content:	**Module I: Basics of Genetics** Introduction to Genetics: Historical overview, key concepts, and terminology. Mendelian Genetics: Laws of segregation and independent assortment, inheritance patterns (autosomal dominant, autosomal recessive, X-linked). Molecular Basis of Inheritance: Review on Structure and function of DNA and RNA, DNA replication, transcription, and translation. Genetic Variation and Mutation: Types of mutations, mutagenic agents, and their effects on gene function.	**15 hours**
	Module II: Genetic Disorders Single-Gene Disorders: Types of single-gene disorders (monogenic), including examples and inheritance patterns. Example: Exploring the genetic basis of sickle cell anemia and cystic fibrosis. Chromosomal Disorders: Types of chromosomal disorders (e.g., Down syndrome, Turner syndrome) and their genetic mechanisms. Example: Understanding the chromosomal basis of Turner syndrome and its clinical manifestations. Multifactorial and Polygenic Disorders: Genetic and environmental factors contributing to multifactorial disorders (e.g., diabetes, heart disease). Example: Analysing the inheritance pattern of polygenic traits such as height or skin colour.	**15 hours**
	Module III: Pedigree Analysis Introduction to Pedigree Analysis: Definition of pedigrees and their significance in clinical genetics. Basic pedigree symbols and terminology: squares for males, circles for females, lines connecting parents and offspring, etc. Inheritance patterns depicted in	**15 hours**

	pedigrees: autosomal dominant, autosomal recessive, X-linked recessive, X-linked dominant, etc. Constructing and Interpreting Pedigrees: Methods for collecting family history information and constructing pedigrees. Recognizing patterns of inheritance and identifying affected individuals in pedigrees. Pedigree analysis software and online tools for pedigree construction and analysis. Inheritance Patterns and Genetic Diseases**:** Autosomal dominant disorders: characteristics, inheritance pattern, and examples (e.g., Huntington's disease, Marfan syndrome). Autosomal recessive disorders: characteristics, inheritance pattern, and examples (e.g., cystic fibrosis, phenylketonuria). X-linked disorders: characteristics, inheritance pattern, and examples (e.g., hemophilia, Duchenne muscular dystrophy).	
Pedagogy:	Lectures, interactive discussions, case studies, laboratory demonstrations, multimedia presentations, and recorded lectures from experts.	
References/ Readings:	1. N. Arumugam and R. P. Meyyan. Advances in Genetics Volume 1. Nagercoil, Tamil Nadu: Saras Publication, 2016. 2. B. J. Conner and R. E. Pyeritz. Genetics of Cardiovascular Disease (2nd ed.). Springer, 2014. 3. E. D. P. De Robertis and E. M. F. De Robertis. Cell and Molecular Biology. Philadelphia: Wolter Kluwer, 2012. 4. A. Gardner and T. Davies. Human Genetics. Delhi: Viva Books, 2010. 5. E. J. Gardner, M. J. Simmons, and D. P. Snustad. Principles of Genetics. Singapore: John Wiley, 2013. 6. GeneReviews. National Center for Biotechnology Information (NCBI). Retrieved from https://www.ncbi.nlm.nih.gov/books/NBK1116/ 7. A. J. F. Griffiths, J. H. Miller, D. T. Suzuki, et al. An Introduction to Genetic Analysis (11th ed.). W. H. Freeman, 2015. 8. L. Jorde, J. Carey, and M. Bamshad. Medical Genetics (5th ed.). Elsevier, 2016. 9. R. L. Nussbaum, R. R. McInnes, and H. F. Willard. Thompson & Thompson Genetics in Medicine (8th ed.). Elsevier, 2016. 10. Online Mendelian Inheritance in Man (OMIM). Johns Hopkins University. Retrieved from https://www.omim.org/ 11. S. D. Singh. Fundamentals of Genetics (2nd ed.). New Delhi: Kalyani Publishers, 2014. 12. T. Strachan and A. P. Read. Human Molecular Genetics (4th ed.). Garland Science, 2011.	
Course Outcome:	By the end of this course, students will be able to 1. Apply foundational genetic principles to interpret inheritance patterns in genetic disorders and molecular mechanisms of inheritance. 2. Equipped to comprehensively evaluate various genetic disorders, discerning their etiology, inheritance patterns, and clinical manifestations.	

	3. Demonstrate proficiency in constructing pedigrees, recognizing inheritance patterns, and interpreting their clinical significance. 4. Critically analyze complex genetic problems and contribute to advancements in the field of genetics and genomics.

Name of the Programme : PGDCG & MLT
Course Code : MLT-501
Title of the Course : Laboratory course on Clinical genetics-I
Number of Credits : 01
Effective from AY : 2024 -2025

Prerequisite for the Course:	Basic knowledge of Laboratory setup and procedures.	
Course Objectives:	1. Construct pedigrees from provided familial data, identifying relationships and phenotypic traits crucial for genetic analysis. 2. Analyze pedigree charts to discern patterns of inheritance, distinguishing between them. 3. Acquire foundational knowledge and practical skills essential for safe and effective operation. 4. Gain hands-on experience in isolating DNA from human blood samples and separating DNA fragments using agarose gel electrophoresis.	
Content:	**Practical Module:** 1. Introduction to molecular genetic lab: general rules, handling of chemicals, equipment, and biological materials; waste disposal. 2. Specimen procurement and logging for cytogenetic procedure. 3. Pedigree construction from provided data. 4. Analysis of pedigree charts to determine the mode of inheritance from provided data. 5. Isolation of DNA from human blood. 6. Separation of DNA fragments using agarose gel electrophoresis and visualization of the results under UV light. 7. Analysis of DNA fingerprints and FISH images (Printed material)	**30 hours**
Pedagogy:	Interactive discussions, case studies, hands-on training, demonstrations.	
References/ Readings:	1. S. Carson. Molecular Biology Techniques: A Classroom Laboratory Manual. Academic Press, 2019. 2. D. A. Micklos and G. A. Freyer. Laboratory DNA Science: An Introduction to Recombinant DNA Techniques and Methods of Genome Analysis. Benjamin/Cummings Publishing Company, 1996. 3. B. E. Tropp. Principles of Molecular Biology. Jones & Bartlett Learning, 2013. 4. G. M. Malacinski and D. Freifelder. Essentials of Molecular Biology. Jones and Bartlett Publishers, 1998.	
Course Outcome:	By the end of this course, students will be able to 1. demonstrate proficiency in constructing pedigrees and interpreting inheritance patterns, enabling accurate genetic analysis and counselling. 2. theoretical knowledge of molecular genetics lab procedures to practical settings, ensuring safe and efficient laboratory practices.	

	3. exhibit competence in isolating DNA from biological samples and conducting agarose gel electrophoresis, culminating in the visualization and analysis of DNA fragments. 4. critically analyze DNA fingerprints and FISH images, extracting relevant genetic information and drawing conclusions, thereby enhancing their ability to interpret complex genetic data.

Name of the Programme : PGDCG & MLT
Course Code : MLT-502
Title of the Course : Clinical Biochemistry I
Number of Credits : 03 Credits
Effective from AY : 2024 -2025

Prerequisite for the Course:	Basic knowledge of cell biology and biochemistry	
Course Objectives:	1. Understand the fundamental concepts of cell structure and function. 2. Grasp the principles of physical chemistry relevant to biological systems. 3. Comprehend the biochemical significance of carbohydrates, lipids, and proteins. 4. Learn about the roles and importance of enzymes, vitamins, and minerals in metabolism.	
Content:	**Module 1: Cell and Physical Chemistry** Cell: Cell definition, Eukaryotic cell, cell organelles and their functions, Subcellular fractionation, cell markers, cell membrane Physical Chemistry: Define pH, Hydrogen ion concentration and buffers, blood buffers, Regulation of blood pH, and Acid-Base metabolism.	**15 Hours**
	Module 2: Carbohydrate, Lipid, Proteins (Chemistry) Carbohydrate chemistry: Definition, Classification, (Mono/Di/ Polysaccharides/MPS) sources, functions and its Biomedical Importance. Lipid chemistry with Prostaglandins: Lipids: Definition, Classification, Functions of Phospholipids, lipoproteins, cholesterol, Prostaglandins, and Essential fatty acids. Protein chemistry: Definition, Classification of proteins & amino acids, essential amino acids, biologically important amino acids and peptides, Structure of proteins, Functions and importance of plasma proteins. Haemoglobin & Hb Metabolism: Structure & Functions of Hb, Heme synthesis, Hb breakdown and Abnormal Hb.	**15 Hours**
	Module 3: Enzymes, Vitamins and Minerals Enzymes: Definition, Classification, factors affecting enzyme action, Coenzymes, enzyme inhibition, Isoenzymes, Diagnostic enzymes Vitamins: Definition, Classification, Vitamins, RDA, dietary sources, functions, deficiency manifestations of Vitamin A, D, E, K, C, B1, B6, B12 & Folic Acid Mineral Metabolism: Digestion, Absorption, Transport, Excretion, Functions, Disorders; Dietary sources of Ca, P, Mg, Cu, Fe, I, Zinc	**15 hours**

	Viva/Tutorial/ Small Group Discussion: Above all topics	
Pedagogy:	Lectures/tutorials/assignments/ Presentations/Discussions	
References/ Readings:	1. M. A. Lieberman and R. Ricer, BRS Biochemistry, Molecular Biology, and Genetics. Wolter Kulver Publication, 2019. 2. D. L. Nelson and M. M. Cox, Lehninger's Principles of Biochemistry. Wiki publications, 2019. 3. R. S. Panini, Medical biochemistry–an illustrated review. Thieme Medical Publishers, New York, 2013. 4. D. M. Vasudevan, Textbook of Biochemistry for medical students. Jaypee Brothers Medical Publishers, New Delhi, 2015. 5. P. Naik, Medical Biochemistry. Jaypee Brothers Medical Publishers, New Delhi, 2019. 6. R. Sood, Medical Laboratory Technology, Jaypee Brothers Medical Publishers Pvt Ltd, New Delhi, 2015 7. Sood R(1985) first edition: Medical Laboratory Technology, Jaypee Brothers Medical Publishers Pvt Ltd, New Delhi. 8. K. L. Mukherjee, Volume II: Medical Laboratory Technology. Tata McGraw-Hill Publishing Company Ltd. New Delhi, 2017. 9. G. Kamat, Practical manual of Hematology. Jaypee Brothers Medical Publishers Pvt Ltd, New Delhi, 2011.	
Course Outcome:	By the end of this course, students will be able to 1. Explain the structure and functions of eukaryotic cells and their organelles. 2. Describe the biochemical properties and significance of carbohydrates, lipids, and proteins. 3. Identify and discuss the roles of enzymes, vitamins, and minerals in human health. 4. Apply knowledge of biochemical principles to understanding metabolic processes and disorders.	

Name of the Programme : **PGDCG & MLT**
Course Code : **MLT-503**
Title of the Course : **Laboratory Course on Clinical Biochemistry I**
Number of Credits : **01 Credit**
Effective from AY : **2024 -2025**

Prerequisite for the Course:	Basic knowledge of cell biology and biochemistry	
Course Objectives:	1. Understand the principles and techniques used in biochemical laboratory analyses. 2. Develop proficiency in the qualitative and quantitative analysis of biomolecules. 3. Learn to operate and interpret results from key laboratory instruments. 4. Apply theoretical knowledge to practical biochemical assays and procedures.	
Content:	**Practical Module:** 1. Demonstration: Estimation of pH. Use of pH meter Qualitative Carbohydrate chemistry –Monosaccharides	**30 hours**
	2. Qualitative Carbohydrate chemistry- Disaccharides & Polysaccharides	
	3. Qualitative Protein chemistry -Colour Reactions & Precipitation	
	4. Qualitative Protein chemistry -Albumin/ Globulin, Casein & Gelatin	
	5. Qualitative Lipid chemistry & Estimation of Cholesterol	
	6. Estimation of Serum Proteins, A/G ratio	
	7. Estimation of Chloride in serum	
	8. Estimation of serum Calcium	
	9. Estimation of serum Inorganic Phosphorus	
	10. Demonstration: Chromatography	
	11. Demonstration: Electrophoresis	
	12. Demonstration: Colorimeter	
	13. Demonstration: Autoanalyser	
	14. Revision	
Pedagogy:	Practicals/ demonstrations/ Discussion/viva-voce	
References/Readings:	1. M. A. Lieberman and R. Ricer, BRS Biochemistry, Molecular Biology,and Genetics. Wolter Kulver Publication, 2019. 2. D. L. Nelson and M. M. Cox, Lehninger's Principles of Biochemistry. Wiki publications, 2019. 3. R. S. Panini, Medical biochemistry–an illustrated review. Thieme Medical Publishers, New York, 2013. 4. D. M. Vasudevan, Textbook of Biochemistry for medical students. Jaypee Brothers Medical Publishers, New Delhi, 2015. 5. P. Naik, Medical Biochemistry. Jaypee Brothers Medical Publishers, New Delhi, 2019. 6. R. Sood, Medical LaboratoryTechnology, Jaypee Brothers Medical	

	Publishers Pvt Ltd, New Delhi, 2015 7. Sood R(1985) first edition: Medical Laboratory Technology, Jaypee Brothers Medical Publishers Pvt Ltd, New Delhi. 8. K. L. Mukherjee, Volume II: Medical Laboratory Technology. Tata McGraw-Hll Publishing Company Ltd. New Delhi, 2017. 9. G. Kamat, Practical manual of Hematology. Jaypee Brothers Medical Publishers Pvt Ltd, New Delhi, 2011.
Course Outcome:	By the end of this course, students will be able to 1. Accurately estimate pH and perform qualitative tests for carbohydrates, proteins, and lipids. 2. Conduct quantitative assays for serum proteins, cholesterol, chloride, calcium, and inorganic phosphorus. 3. Demonstrate the use and interpretation of chromatography, electrophoresis, colorimetry, and autoanalyzers. 4. Synthesize theoretical and practical knowledge to troubleshoot and optimize biochemical experiments.

Name of the Programme : **PGDCG & MLT**
Course Code : **MLT-504**
Title of the Course : **Clinical Microbiology (General & Systematic)**
Number of Credits : **03**
Effective from AY : **2024--2025**

Prerequisite for the Course:	Basic knowledge of cell biology and microbiology	
Course Objectives:	1. Understand the fundamental principles and techniques of clinical microbiology. 2. Gain proficiency in serological methods and bacterial identification techniques. 3. Learn to manage hospital-acquired infections and biomedical waste. 4. Develop skills in diagnosing bacterial infections through various laboratory methods.	
Content:	**Module 1: Introduction to Microbiology** Historical perspective, the principle of microbiology, microscopes (types and uses), Bacteria: Classification, anatomy, reproduction, growth and nutrition, Sterilization: - methods employed, both physical and chemical, Media used in Microbiology: - Classification, types, constituents, methods of preparation, adjustment of pH, sterilization, Culture methods and antimicrobial sensitivity testing, Hospital-acquired infections, Biomedical Waste Management, Inventory and stock, Quality control in Microbiology.	**15 Hours**
	Module 2: Serology Serology: Antigen, antibody, antigen-antibody reaction including flow cytometry, Methods for identification of bacteria (morphology), Methods for identification of bacteria (biochemical), Molecular methods (PCR, Biofire Film Array, LAMP), Automated systems for bacterial identification (MALDI-TOF, VITEK 2), Automated culture techniques, Standard precautions.	**15 Hours**
	Module 3: Systemic (Individual Bacteria) Systemic (Individual Bacteria): Diagnosis features (morphology, cultured characters, biochemical reaction, antigenic characters, pathogenicity and laboratory diagnosis) of Staphylococcus, Streptococcus, Pneumococcus, Neisseria, Corynebacteria, Clostridia, Escherichia coli, Klebsiella species, Salmonella, Shigella, Proteus, Pseudomonas, *Mycobacterium tuberculosis*, *Treponema pallidum*.	**15 Hours**
Pedagogy:	Lectures/tutorials/assignments/ Presentations	
References/ Readings:	1. R. Kanungo and S. Saxena (Ed), Ananthanarayan and Paniker's Textbook of Microbiology. Universities Press (India), 2022. 2. A. S. Sastry and S. Bhat, Essential of Medical Microbiology. Jaypee Brothers Medical Publishers, 2019. 3. C. P. Baveja and V. Baveja, Complete microbiology. Avichal Publishing Company; 2021.	
Course Outcome:	By the end of this course, students will be able to 1. Demonstrate knowledge of microbiological principles and sterilization	

	methods. 2. Perform serological tests and utilize molecular methods for bacterial identification. 3. Implement protocols for hospital infection control and biomedical waste management. 4. Accurately diagnose bacterial infections using cultural, morphological, and biochemical techniques.

Name of the Programme : PGDCG & MLT
Course Code : MLT-505
Title of the Course : Laboratory Course on Clinical Microbiology (General & Systematic)
Number of Credits : 01
Effective from AY : 2024 -2025

Prerequisite for the Course:	Basic knowledge of cell biology and microbiology	
Course Objectives:	1. Understand and apply various microbiological staining techniques for clinical samples. 2. Develop proficiency in preparing and using culture media and culture techniques. 3. Perform antimicrobial sensitivity testing and interpret the results accurately. 4. Implement standard precautions and biomedical waste management in a clinical laboratory setting.	
Content:	**Practical Module:** 1. Preparation of smears for staining and fixation from samples and culture media (both liquid and solid media). 2. Care and use of microscopes (including fluorescent microscope). 3. Staining techniques (Gram staining, Zeihl Nelson, Fluorescent method): preparation of satins, procedure, reporting of smears, principle involved. 4. Equipment used in sterilization: Description (structure), the working principle involved, articles sterilized, advantages and disadvantages. 5. Culture media: types, constituents of each media, method of preparation, adjustment of pH, sterilization, uses. 6. Culture techniques: different methods of inoculation from clinical samples and bacterial growth from media. 7. Antimicrobial sensitivity testing. 8. Preparation of wet mount and motility of organisms. 9. Identification of bacteria: morphology and biochemical. 10. Antigen-antibody reactions. 11. Biomedical waste management. 12. Standard precautions. 13. Systemic bacteriology: Practical demonstration of diagnostic features of Gram-positive organisms, Gram-negative organisms, Anaerobes, spirochetes, and Mycobacteria.	**30 Hours**
Pedagogy:	Practicals/ demonstrations/ Discussion/ Viva-voce	
References/Readings:	1. P. R. Murray, K. S. Rosenthal, and M. A. Pfaller, Eds., Manual of Clinical Microbiology. ASM Press, 2015. 2. L. S. Garcia, Ed., Clinical Microbiology Procedures Handbook. ASM Press, 2010. 3. B. A. Forbes, D. F. Sahm, and A. S. Weissfeld, Eds., Bailey & Scott's	

	Diagnostic Microbiology. Elsevier, 2017. 4. J. G. Collee, A. G. Fraser, B. P. Marmion, and A. Simmons, Eds., Mackie & McCartney Practical Medical Microbiology. Churchill Livingstone, 1996. 5. P. Gunasekaran, Microbial Techniques: Techniques in Microbiology: A Student's Handbook. New Age International, 2007. 6. A. S. S. Apurba and B. Sandhya, Essentials of Medical Microbiology. Jaypee Brothers Medical Publishers, 2020. 7. D. H. Larone, Fundamentals of Diagnostic Mycology. W.B. Saunders, 1995.
Course Outcome:	By the end of this course, students will be able to 1. Prepare and stain clinical samples for microscopic examination using various staining techniques. 2. Demonstrate the preparation and use of different culture media and inoculation methods. 3. Conduct antimicrobial sensitivity tests and analyze the results to guide clinical treatment. 4. Practice standard laboratory precautions and effectively manage biomedical waste.

Name of the Programme : **PGDCG & MLT**
Course Code : **MLT-506**
Title of the Course : **Clinical Pathology & Histology**
Number of Credits : **03**
Effective from AY : **2024 -2025**

Prerequisite for the Course:	Basic knowledge of Anatomy and Physiology.	
Course Objectives:	1. Understand and apply various histopathological techniques for tissue preparation and staining. 2. Develop skills in examining and analyzing body fluids using standard laboratory methods. 3. Gain proficiency in cytological techniques including exfoliative cytology and FNAC. 4. Implement quality control and automation techniques in a clinical pathology laboratory setting.	
Content:	**Module 1: Histopathological techniques** Fixatives and fixation, Preparation of fixatives, Neutral formalin, buffered formalin, mercuric Zenker's sol. Schaudinns sol, k-dichromate- orth's solution Regaud's sol picric acid – Bouins sol: Hollande's sol. clearing, embedding, microtome knives, section cutting, errors, decalcification, Decalcifying fluids, formic acid, Gooding & Stewarts fluid, nitric acid, aqueous nitric acid. frozen section, mounting media, automation. Staining: Theory of staining, dyes and stains, mordants, differentiation, haematoxylin and eosin staining- principles and procedures, Hematoxylin stains: composition and techniques preparations & application of , iron hematoxylins, Wiegert's iron hematoxylin, Heidenheim's iron hematoxylin. Tungsten Hematoxylins, PTAH, Molybdenum Hematoxylin, phophomdybdic acid hematoxylin. special stains, carbohydrate stains, and glycoconjugates, P.A.S. alcian blue techniques combine alcian blue – PAS, muciccarmine, colloidal iron, and high iron diamine. Lipid stations, oil red o, sudden black b., pigments and minerals perls Persian blue for ferric iron, Masson Fontana method for melanin, von kossa for calcium.elastic tissue stains, Wiegert method, Verhoff's method, Connective tissue stains, history of connective tissue composition preparation and application of Masson's trichrome, Von Giessons, Reticulin stain Gomoris silver methanamine. fat stains, and other stains. Microorganism, Grams method & modified method, Z N stains for mycobacteria, fluorescent method for mycobacteria, modified fite method for mycobacteria leprac, cresyl violet stains for helicobacter, Growcott methamine silver for fungi, Mc manus PAS method for glycogen & fungal wall, Amyloid Congo red techniques.	**15 Hours**

	Module 2: Examination of body fluids Sample collection, physical and chemical tests, principles and methods, reagent strip method, microscopic examination- crystals, casts, sediments, pregnancy tests. Stool examination, semen analysis, sputum examination. Cytocentrifugation and application Lab diagnosis/ urine/ blood/ findings in kidney disorders.	**15 Hours**
	Module 3: Cytological techniques Exfoliative cytology, fixation, pap staining, cytological processing of fluids. Fine needle aspiration cytology (FNAC): procedure, staining of slides, automation, H & E, and MGG staining. Examination of CSF and other body fluids: pleural, peritoneal, synovial fluid. Quality control in clinical pathology lab, automation in clinical pathology lab. enzyme histochemistry and its diagnostic application, Immuno histochemical techniques, tissue microarray, molecular pathology techniques, In situ hybridization/ F.I.S.H**.**	**15 Hours**
Pedagogy:	Lectures/tutorials/assignments/ Presentations	
References/Readings:	1. M. A. Lieberman and R. Ricer, BRS Biochemistry, Molecular Biology and Genetics. Lippincott Williams and Wilkins, 2019. 2. S. M. Kawthalkar, Essential of Clinical Pathology. Jaypee Medical Publishers, New Delhi, 2018. 3. D. M. Vasudev, Textbook of Biochemistry for medical students. Jaypee Brothers Medical Publishers Pvt Ltd, New Delhi, 2013. 4. R. Sood, Medical Laboratory Technology. Jaypee Brothers Medical Publishers, New Delhi, 2009. 5. P. Chakraborty, A text book of microbiology, New Central Book Agency, Calcutta, 2009. 6. A. C. Dereck and I. R. Cameron, Histopathology Specimens: Clinical, Pathological and Laboratory Aspects. Springer publication, 2019. 7. H. Mohan, Practical pathology. Jaypee Medical Publishers, New Delhi, 2017. 8. K. L. Mukherjee, Medical Laboratory Technology, Tata McGraw-Hill Publishing Company Ltd. New Delhi, 2017. 9. M. N. Chatterjee, Textbook of Medical Biochemistry eight edition: Jaypee Brothers Medical Publishers, New Delhi, 2013.	
Course Outcome:	By the end of this course, students will be able to 1. Prepare and stain tissue samples using various histopathological techniques. 2. Collect, test, and analyze body fluids for diagnostic purposes. 3. Perform cytological techniques, including processing and staining of fluids. 4. Apply quality control measures and utilize automation in clinical pathology laboratories.	

Name of the Programme : **PGDCG & MLT**
Course Code : **MLT-507**
Title of the Course : **Laboratory Course on Clinical Pathology & Histology**
Number of Credits : **01**
Effective from AY : **2024 -2025**

Prerequisite for the Course:	Basic knowledge of Anatomy and Physiology.	
Course Objectives:	1. Master histopathological techniques including fixation, dehydration, clearing, and embedding. 2. Develop proficiency in using and maintaining various types of microtomes and microtome knives. 3. Understand and apply routine and special staining techniques for tissue samples. 4. Conduct comprehensive examinations of bodily fluids using various analytical methods.	
Content:	**Practical Module:** 1. Histopathological techniques: fixation, dehydration, clearing, impregnation, embedding, decalcification. microtome, base sled, rocking type, rotary, sliding microtome, autotechnicon automated tissue processor, principle, working, paraffin embedding bath, etc. 2. Microtome knives and their sharpening, automated knives sharpeners section cutting, errors in section cutting, refrigerated microtome, freezing microtome, cryostat, etc., frozen sectioning, mounting media. 3. Routine staining techniques: routine staining, hematoxylin, and eosin (H &E) staining. 4. Special staining demonstration: P.A.S., Verhoeff's, Massons trichrome, Von Giessons, fat stains and other stains. 5. Grossing and Museum techniques. 6. Examination of urine: Physical and chemical. 7. Examination of urine: multiple reagent strips methods, microscopic Urinometer, ESbach's Albuminometer, automated urine analyser, dipstick readers etc. 8. Pregnancy tests. 9. C.S.F. examination 10. Examination of body cavity fluids: pleural, peritoneal, and synovial. 11. Sputum examination 12. Stool examination 13. Semen analysis. 14. Exfoliative cytology: principles, Papanicolaou staining procedure. 15. Fine needle aspiration cytology (F.N.A.C): hematoxylin and eosin (H &E), MGG staining. 16. Needles lumbar puncture needle, vim Silverman needle,	**30 hours**

	bone marrow aspiration biopsy needle, trephine biopsy needle etc. 17. Microscopes, compound, dark ground illumination, phase contrast, fluorescent microscopy, polarizing microscopy.	
Pedagogy:	Practicals/ demonstrations/ Discussion/ Viva-voce	
References/ Readings:	1. M. A. Lieberman and R. Ricer, BRS Biochemistry, Molecular Biology and Genetics. Lippincott Williams and Wilkins, 2019. 2. S. M. Kawthalkar, Essential of Clinical Pathology. Jaypee Medical Publishers, New Delhi, 2018. 3. D. M. Vasudev, Textbook of Biochemistry for medical students. Jaypee Brothers Medical Publishers Pvt Ltd, New Delhi, 2013. 4. R. Sood, Medical Laboratory Technology. Jaypee Brothers Medical Publishers, New Delhi, 2009. 5. P. Chakraborty, A text book of microbiology, New Central Book Agency, Calcutta, 2009. 6. A. C. Dereck and I. R. Cameron, Histopathology Specimens: Clinical, Pathological and Laboratory Aspects. Springer publication, 2019. 7. H. Mohan, Practical pathology. Jaypee Medical Publishers, New Delhi, 2017. 8. K. L. Mukherjee, Medical Laboratory Technology, Tata McGraw-Hill Publishing Company Ltd. New Delhi, 2017. 9. M. N. Chatterjee, Textbook of Medical Biochemistry eight edition: Jaypee Brothers Medical Publishers, New Delhi, 2013.	
Course Outcome:	By the end of this course, students will be able to 1. Perform histopathological procedures including fixation, dehydration, and embedding accurately. 2. Skillfully use microtomes and handle microtome knives for precise section cutting. 3. Apply routine and special staining techniques effectively in a laboratory setting. 4. Analyze urine, CSF, body cavity fluids, sputum, stool, and semen samples using appropriate methods.	

Name of the Programme : PGDCG & MLT
Course Code : MLT-508
Course Title : Clinical genetics-II
Number of Credits : 03
Effective from AY : 2024 -2025

Prerequisite for the Course:	Basic knowledge of Cell Biology and Genetics.	
Course Objectives:	1. Introduce molecular genetic techniques for genetic diagnosis, including blotting, PCR/RFLP, FISH, and DNA sequencing. 2. Explain the genetic basis, characteristics, and environmental factors of cancer, along with diagnosis and treatment. 3. Describe karyotyping principles, procedures, and chromosome staining methods for clinical genetics. 4. Discuss the Human Genome Project, genetic diagnosis procedures, and stages of genetic counselling.	
Content:	**Module I: Molecular Genetics, Genetics of Cancer and Dermatoglyphics** Molecular genetic techniques used in genetic diagnosis: Blotting techniques – Southern, Northern, and Western, PCR/ RFLP, FISH, DNA sequencing & DNA fingerprinting. Genetics of Cancer: introduction, characteristics of cancer cells, origin of cancer cells, genes associated with cancer, environmental causes of cancer, human genome data tailor diagnosis and treatment. Dermatoglyphics: Introduction, classification, Flexion creases. Dermatoglyphics in clinical disorders, Clinical application & its advantages and limitations.	**15 Hours**
	Module II: Karyotyping in Clinical Genetics Introduction to Karyotyping: Definition and purpose of karyotyping in clinical genetics. Classification of Chromosomes and Nomenclature. Procedure of Karyotyping: Sample collection and preparation (blood, tissue, amniotic fluid, etc.), Cell culture techniques for obtaining metaphase chromosomes, Chromosome staining methods (Giemsa, Q-banding, C-banding, etc.) Types of Chromosomal Banding: G-banding: Principles and applications in identifying chromosomal abnormalities, R-banding: Reverse banding technique and its utility in diagnosing genetic disorders. C-banding: Detection of constitutive heterochromatin regions on chromosomes. Other specialized banding techniques (NOR-banding, T-banding, etc.)	**15 hours**

	Module 3: Human genome project, Genetic diagnosis and Counselling: Human Genome Project: Historical background, Goals and objectives of the project. Preimplantation genetic diagnosis: definition and various procedures. Prenatal Diagnosis: Definition and Various procedures - Amniocentesis, Chorionic villus sampling, Ultrasonography and Fetoscopy. Genetic Counselling (Stage 1: History and Pedigree Construction; Stage 2: Examination; Stage 3: Diagnosis; Stage 4: Counselling; and Stage 5: Follow up).	**15 Hours**
Pedagogy:	Lecture/tutorials/Interactive discussions/ case studies/hands-on training, and demonstrations.	
References/ Readings:	1. B. Alberts, A. Johnson, J. Lewis, D. Morgan, M. Raff, K. Roberts, & P. Walter. Molecular Biology of the Cell (6th ed.). Garland Science, 2014. 2. R. A. Weinberg. The Biology of Cancer (2nd ed.). Garland Science, 2014. 3. H. Cummins & C. Midlo. Fingerprints, Palms, and Soles: An Introduction to Dermatoglyphics. Dover Publications, 1961. 4. D. E. Rooney & B. H. Czepulkowski. Human Cytogenetics: Constitutional Analysis (3rd ed.). Oxford University Press, 2001.	
Course Outcome:	By the end of this course, students will be able to 1. Apply molecular genetic techniques like blotting, PCR/RFLP, FISH, and DNA sequencing in genetic diagnosis. 2. Identify genetic and environmental factors in cancer and evaluate diagnostic and treatment strategies. 3. Perform karyotyping procedures to identify chromosomal abnormalities. 4. To help conduct genetic diagnosis, and provide comprehensive genetic counselling.	

Name of the Programme : **PGDCG & MLT**
Course Code : **MLT-509**
Course Title : **Laboratory Course on Clinical genetics-II**
Number of Credits : **01**
Effective from AY : **2024 -2025**

Prerequisite for the Course:	Basic knowledge of Cell Biology and Genetics	
Course Objectives:	1. Master culture media preparation for blood cell culture and chromosome identification. 2. Develop skills in inoculating lymphocyte cultures and harvesting metaphase plates. 3. Acquire proficiency in chromosomal banding techniques and karyotyping. 4. Learn image processing and analysis using karyotyping software.	
Content:	**Practical Module:** 1. Culture media preparation for Blood cell culture. 2. Identification of Chromosomes. 3. Inoculation of Lymphocyte culture/peripheral blood culture. 4. Harvesting of Lymphocyte culture to obtain metaphase plates. 5. Chromosomal banding technique: GTG Banding. 6. Karyotyping of Human chromosomes from printed material. 7. Demonstration of freely available Karyotyping software 8. Microphotography, Image capturing, image processing, and analysis	**30 hours**
Pedagogy:	Practicals/ demonstrations/ Discussion/ Viva-voce	
References/ Readings:	1. D. E. Rooney and B. H. Czepulkowski. Human Cytogenetics: Constitutional Analysis. Oxford University Press, 2001. 2. L. G. Shaffer and M. L. Slovak. An International System for Human Cytogenetic Nomenclature. S. Karger AG, 2013. 3. M. J. Barch, T. Knutsen, and J. L. Spurbeck. The AGT Cytogenetics Laboratory Manual (3rd ed.). Lippincott Williams & Wilkins, 1997. 4. R. Sanders and R. Wilson. Chromosomal Variation in Man: A Catalog of Chromosomal Variants and Anomalies. Wiley-Liss, 2004. 5. A. Simons and L. G. Shaffer (Eds.). Molecular Cytogenetics: Protocols and Applications (Methods in Molecular Biology). Humana Press, 2014.	
Course Outcome:	By the end of this course, students will be able to 1. Independently prepare culture media and identify chromosomes accurately. 2. Perform contamination-free inoculation and efficient harvesting of lymphocyte cultures. 3. Apply chromosomal banding techniques effectively for karyotyping. 4. Competently utilize karyotyping software for image processing and analysis.	

Name of the Programme : PGDCG & MLT
Course Code : MLT-510
Course Title : Clinical Biochemistry II
Number of Credits : 03
Effective from AY : 2024 -2025

Prerequisite for the Course:	Basic knowledge of cell biology and biochemistry.	
Course Objectives:	1. Understand the metabolic pathways of carbohydrates, lipids, and proteins, and their regulatory mechanisms. 2. Analyze the digestion, absorption, and metabolic processes of macronutrients and their associated disorders. 3. Learn the principles and applications of various function tests to assess the health of vital organs. 4. Evaluate the balance and imbalance of water and electrolytes in the human body.	
Content:	**Module 1: Carbohydrate, Protein, Lipid Metabolism** Carbohydrate Digestion, Absorption & Metabolism: Digestion & Absorption of Carbohydrates, Glycolysis, TCA cycle, Gluconeogenesis, Glycogen Metabolism, DM, Ketosis, Blood Glucose and its regulation; Hypoglycemia Lipid Digestion, Absorption & Metabolism: Digestion & Absorption of Lipids, ketone body metabolism, lipoprotein metabolism, Atherosclerosis, Normal Lipid profile Protein Digestion, Absorption & Metabolism: Digestion & Absorption of Proteins, Transamination, Deamination, Urea cycle, Functions of Glycine Phenylalanine, Tyrosine, Tryptophan, Phenylketonuria, Alkaptonuria, Albinism, Maple syrup urine disease, Kwashiorkor & Marasmus Water & Electrolyte Balance: Electrolyte balance (Na, K & Cl) and Imbalance	**15 Hours**
	Module 2: Function Tests 1 Cardiac Function Tests: Cardiac Markers, tests used to estimate the risk of CVD Gastric Function Tests: Gastric function and HCL secretion, Gastric juice analysis	**15 Hours**

	Module 3: Function Tests 2 Liver Function Tests: Tests based on excretory, detoxification, synthetic functions of the liver, and Enzymes in the diagnosis of liver diseases Pancreatic Function Tests: Pancreatic juice, functions, Assessment of Pancreatic functions Thyroid Function Tests: Thyroid gland functions, Classification of thyroid function tests Kidney Function Tests: Glomerular and Tubular functions, Normal and Abnormal constituents of Urine, Renal clearance tests, Tests for tubular functions Viva/Tutorial/ Small Group Discussion: All above topics	**15 Hours**
Pedagogy:	Lectures/tutorials/assignments/ Presentations/Discussion.	
References/Readings:	1. M. A. Lieberman and R. Ricer, BRS Biochemistry, Molecular Biology, and Genetics. Wolter Kulver Publication, 2019. 2. D. L. Nelson and M. M. Cox, Lehninger's Principles of Biochemistry. Wiki publications, 2019. 3. R. S. Panini, Medical biochemistry–an illustrated review. Thieme Medical Publishers, New York, 2013. 4. D. M. Vasudevan, Textbook of Biochemistry for medical students. Jaypee Brothers Medical Publishers, New Delhi, 2015. 5. P. Naik, Medical Biochemistry. Jaypee Brothers Medical Publishers, New Delhi, 2019. 6. R. Sood, Medical Laboratory Technology, Jaypee Brothers Medical Publishers Pvt Ltd, New Delhi, 2015 7. K. L. Mukherjee, Volume II: Medical Laboratory Technology. Tata McGraw-Hll Publishing Company Ltd. New Delhi, 2017. 8. G. Kamat, Practical manual of Hematology. Jaypee Brothers Medical Publishers Pvt Ltd, New Delhi, 2011.	
Course Outcome:	By the end of this course, students will be able to 1. Understand the metabolic pathways of carbohydrates, lipids, and proteins, and their regulatory mechanisms. 2. Analyze the digestion, absorption, and metabolic processes of macronutrients and their associated disorders. 3. Learn the principles and applications of various function tests to assess the health of vital organs. 4. Evaluate the balance and imbalance of water and electrolytes in the human body.	

Name of the Programme : **PGDCG & MLT**
Course Code : **MLT-511**
Course Title : **Laboratory Course on Clinical Biochemistry II**
Number of Credits : **01**
Effective from AY : **2024 -2025**

Prerequisite for the Course:	Basic knowledge of cell biology and biochemistry.	
Course Objectives:	1. Develop proficiency in laboratory techniques for analyzing various biochemical constituents in clinical samples. 2. Understand the principles and procedures for performing routine and specialized biochemical tests. 3. Gain practical experience in quality control measures in a clinical biochemistry laboratory. 4. Learn to interpret the results of biochemical tests to diagnose and monitor health conditions.	
Content:	**Practical Module:** 1. Chemistry of gastric juice 2. Demonstration: Quality Control 3. Estimation of bilirubin 4. Estimation of glucose in blood 5. Estimation of serum proteins 6. Estimation of blood urea 7. Estimation of creatinine in blood 8. Estimation of uric acid in blood 9. Normal urine 10. Full urine report 11. Demonstration: Kidney function tests, Thyroid function tests 12. Demonstration: Liver function tests, Cardiac function tests 13. Demonstration: Lipid Profile 14. Demonstration: C. S. F. Examination 15. Revision	**30 Hours**
Pedagogy:	Practicals/ demonstrations/ Discussion/ Viva-voce	
References/Readings:	1. D. L. Nelson and M. M. Cox, Lehninger's Principles of Biochemistry. Wiki publications, 2019. 2. D. M. Vasudevan, Textbook of Biochemistry for medical students. Jaypee Brothers Medical Publishers, New Delhi, 2015. 3. G. Kamat, Practical manual of Hematology. Jaypee Brothers Medical Publishers Pvt Ltd, New Delhi, 2011. 4. K. L. Mukherjee, Volume II: Medical Laboratory Technology. Tata McGraw-Hll Publishing Company Ltd. New Delhi, 2017. 5. M. A. Lieberman and R. Ricer, BRS Biochemistry, Molecular Biology, and Genetics. Wolter Kulver Publication, 2019. 6. P. Naik, Medical Biochemistry. Jaypee Brothers Medical Publishers, New Delhi, 2019. 7. R. S. Panini, Medical biochemistry–an illustrated review. Thieme Medical Publishers, New York, 2013.	

	8. R. Sood, Medical Laboratory Technology, Jaypee Brothers Medical Publishers Pvt Ltd, New Delhi, 2015
Course Outcome:	By the end of this course, students will be able to 1. Perform accurate estimations of biochemical constituents such as bilirubin, glucose, and serum proteins. 2. Demonstrate competence in conducting kidney, liver, thyroid, and cardiac function tests. 3. Apply quality control protocols to ensure the reliability of biochemical test results. 4. Analyze and interpret biochemical test data to provide meaningful clinical insights.

Name of the Programme : **PGDCG & MLT**
Course Code : **MLT-512**
Title of the Course : **Clinical Parasitology, Mycology and Virology**
Number of Credits : **03**
Effective from AY : **2024 -2025**

Prerequisite for the Course:	Basic knowledge of pathogens and their characteristics.	
Course Objectives:	1. Understand the fundamental concepts and terminologies of parasitology, mycology, and virology. 2. Gain knowledge of the life cycles, morphology, and pathogenicity of key protozoan, helminthic, fungal, and viral pathogens. 3. Develop proficiency in the laboratory diagnosis of parasitic, fungal, and viral infections. 4. Learn to classify and identify various pathogens and understand their clinical significance.	
Content:	**Module 1: Parasitology** Introduction to parasitology, terminologies, definitions, and relationships. Protozoa: geographic distribution, habitat, morphology, life cycle, pathologenecity, laboratory diagnosis of the following parasites: *Entamoeba histolytica, Giardia lamblia, Trichomonas vaginalis, Leishmania donovani, Plasmodium* and Cocoidian parasites causing diarrhea Cestodes: On the same line as protozoan parasites for the following: *Taenia sagenata, Taenia solium* and *Echinococcus granulosus.* Helminths: On the same line as protozoan parasites for the following: *Trichuris trichiura, Ankylostoma duodenale, Ascaris lumbricularis, Enterobius vermicularis,* and *Wuchereria bancrofti*	**15 hours**
	Module 2: Mycology Introduction to mycology, Classification of fungi and fungal diseases, Laboratory diagnosis of fungal infections, *Candida albicans* and other candida species Dermatophytes, Cryptococcus, Opportunistic fungi (Aspergillus, Pencillium, Mucor), Subcutaneus mycoses (Mycetoma, Sporotrichosis, Rhinosporidiosis), Histoplasmosis, Fungal toxins.	**15 Hours**
	Module 3: Virology General virology: Defination, classification, properties of viruses, viral replication, cultivation, laboratory diagnosis. Systemic virology: On the basis of structure, cultivation, pathogenicity, Laboratory diagnosis of the following viruses: Bacteriophage, Picomaviruses (Polio viruses), Rhabdoviruses (Rabies virus), Arboviruses(Dengue, Chikungunya, JE), Influenza virus, Hepatitis virus, HIV and Herpes virus.	**15 hours**
Pedagogy:	Lectures/tutorials/assignments/ Presentations/ demonstrations.	
References/Readings:	1. R. Kanungo and S. Saxena (Ed), Ananthanarayan and Paniker's Textbookj of Microbiology. Universities Press (India), 2022.	

	2. A. S. Sastry and S. Bhat, Essential of Medical Microbiology. Jaypee Brothers Medical Publishers, 2019. 3. B. Detrick, R. G. Hamilton, & J. D. Folds (Eds.). Manual of Molecular and Clinical Laboratory Immunology (7th ed.). ASM Press, 2006. 4. C. P. Baveja and V. Baveja, Complete microbiology. Avichal Publishing Company; 2021. 5. E. J. Baron, & S. M. Finegold (Eds.). Bailey & Scott's Diagnostic Microbiology (8th ed.). Mosby, 1990. 6. L. S. Garcia (Ed.). Diagnostic Medical Parasitology (5th ed.). ASM Press, 2007. 7. P. R. Murray, E. J. Baron, M. A. Pfaller, F. C. Tenover, & R. H. Yolken (Eds.). Manual of Clinical Microbiology (8th ed.). ASM Press, 2003. 8. P. R. Murray, K. S. Rosenthal, & M. A. Pfaller. Medical Microbiology (7th ed.). Elsevier Saunders, 2012.
Course Outcome:	By the end of this course, students will be able to 1. Explain the life cycles and pathogenic mechanisms of major protozoan, helminthic, fungal, and viral pathogens. 2. Perform laboratory techniques to diagnose infections caused by parasites, fungi, and viruses. 3. Identify the clinical features and laboratory findings associated with key parasitic, fungal, and viral infections. 4. Demonstrate an understanding of the classification and properties of viruses, fungi, and parasites.

Name of the Programme : **PGDCG & MLT**
Course Code : **MLT-513**
Title of the Course : **Laboratory Course on Clinical Parasitology, Mycology and Virology**
Number of Credits : **01**
Effective from AY : **2024 -2025**

Prerequisite for the Course:	Basic knowledge of pathogens and their characteristics.	
Course Objectives:	1. Develop skills in the microscopic and gross examination of parasitic, fungal, and viral specimens. 2. Learn and apply laboratory diagnostic techniques for identifying parasitic, fungal, and viral infections. 3. Understand the diagnostic features and laboratory procedures for a variety of pathogens. 4. Gain practical experience in handling and preparing clinical samples for diagnostic purposes.	
Content:	**Practical Module:** 1. Stool examination: gross, microscopic, for the adult parasite, a segment of Taenia, ova, cysts, and larvae of the parasite. 2. Gross and microscopic features *(whenever applicable)* of intestinal/ vaginal protozoa. 3. Laboratory diagnosis of malaria: demonstration of whole parasite, parasite antigen, enzymes, and serology. 4. Gross and microscopic features of cestodes include adult worms, segments, larvae, and eggs. 5. Gross and microscopic features of Helminthes include adult worms, eggs, and larvae. 6. Diagnostic features: Practical demonstration of gross and microscopic features (wet mount, slide culture) and other tests whenever applicable for following: Candida, Cryptococcus, Dermatophyte, Opportunistic fungi. 7. General virology: types of symmetry, the morphology of virus models, cultivation in embryonated egg. 8. Laboratory diagnosis of the following viruses: Poliovirus, Rhabdovirus, HIV, Hepatitis, Herpes, Influenza, Arboviruses. 9. Bacteriophage—structure using a model.	**30 Hours**
Pedagogy:	Practicals/ demonstrations/ Discussion/ Viva-voce	
References/Readings:	1. R. Kanungo and S. Saxena (Ed), Ananthanarayan and Paniker's Textbookj of Microbiology. Universities Press (India), 2022. 2. A. S. Sastry and S. Bhat, Essential of Medical Microbiology. Jaypee Brothers Medical Publishers, 2019. 3. B. Detrick, R. G. Hamilton, & J. D. Folds (Eds.). Manual of Molecular and Clinical Laboratory Immunology (7th ed.). ASM Press, 2006. 4. C. P. Baveja and V. Baveja, Complete microbiology. Avichal	

	Publishing Company; 2021. 5. E. J. Baron, & S. M. Finegold (Eds.). Bailey & Scott's Diagnostic Microbiology (8th ed.). Mosby, 1990. 6. L. S. Garcia (Ed.). Diagnostic Medical Parasitology (5th ed.). ASM Press, 2007. 7. P. R. Murray, E. J. Baron, M. A. Pfaller, F. C. Tenover, & R. H. Yolken (Eds.). Manual of Clinical Microbiology (8th ed.). ASM Press, 2003. 8. P. R. Murray, K. S. Rosenthal, & M. A. Pfaller. Medical Microbiology (7th ed.). Elsevier Saunders, 2012.
Course Outcome:	By the end of this course, students will be able to 1. Demonstrate proficiency in examining and identifying parasites in stool samples. 2. Perform laboratory diagnostic procedures for malaria and identify key diagnostic features. 3. Identify and differentiate between various fungi through gross and microscopic examination. 4. Conduct laboratory diagnostics for major viral infections and understand the cultivation methods.

Name of the Programme : **PGDCG & MLT**
Course Code : **MLT-514**
Course Title : **Hematology and Transfusion Medicine**
Number of Credits : **03**
Effective from AY : **2024 -2025**

Prerequisite for the Course:	Basic knowledge of blood components and their applications	
Course Objectives:	1. Understand the composition of blood, including hemopoiesis and hemoglobin synthesis. 2. Learn the diagnostic techniques for various hemolytic disorders and anemias. 3. Gain knowledge about white blood cells, platelets, and their related disorders. 4. Acquire an understanding of transfusion medicine, including blood group systems and transfusion procedures.	
Content:	**Module 1: Hematology–Blood composition and Hemolytic disorders** Blood: composition, haemopoesis, RBC'S- structure-function, synthesis: Hemoglobin- structure, function, abnormal haemoglobin, reticulocytes, blood indices, peripheral blood smear, parasites in the blood. Hemolytic disorders: investigations, screening tests, sickling, osmotic fragility, Heinz bodies, G-6-P-D screening, Hb electrophoresis, Hb-F estimation. Applied pathology, lab diagnosis of anemia, lab diagnosis and CSF picture in different types of meningitis, lab diagnosis of hemorrhage disorders, lab diagnosis and LFT findings in different types of jaundice, lab diagnosis	**15 Hours**
	Module 2: WBCs and Platelets White blood corpuscles: Description, morphology, leucocyte counts, leucopenia, leukocytosis, leukemia, leukemoid reaction, absolute count, differential count, bone marrow iron staining, special stains for leukemias. Platelet structure and function: Bleeding disorders and investigations, coagulation process and theory, disorders. Flow cytometry and application.	**15 Hours**
	Module 3: Transfusion medicine Blood groups: ABO and subgroups, antigen and antibodies, Rh blood grouping, other blood group systems, compatibility testing, antihuman globulin test. Blood transfusion: Selection of blood donors, blood transfusion procedures, Complications of blood transfusion, Blood component therapy, organization and administration of blood bank, blood safety. Equipment for blood component separation in the blood bank, refrigerated centrifuge, plasma expresser, refrigerated water bath, laminar air flow bench, etc., Administration and medico-legal aspects,	**15 Hours**

	accreditation of laboratory.	
Pedagogy:	Lectures/tutorials/assignments/ Presentations	
References/Readings:	1. G. H. Rao, T. Eastlund and L. Jagannath, Handbook Of Blood Banking & Transfusion Medicine. Jaypee Medical Publishers, New Delhi, 2006. 2. A.B. Dutta, Blood Banking and Transfusion. CBS Publishers, New Delhi, 2006. 3. S. V. Rudmann, Textbook of Blood Banking and Transfusion Medicine. Second Edition. Elsevier Saunders Publication, 2005. 4. K. Bharadwaj, Transfusion Update. Indian Society of Blood Transfusion and Immunohaematology. Jaypee Medical Publishers, New Delhi, 2005. 5. K. L. Mukherjee, Volume II: Medical Laboratory Technology, Tata McGraw-Hll Publishing Company Ltd. New Delhi, 2007. 6. G. Kamat, Practical manual of Hematology. Jaypee Brothers Medical Publishers, New Delhi, 2011.	
Course Outcome:	By the end of this course, students will be able to 1. Identify the components of blood and describe their functions and abnormalities. 2. Perform and interpret diagnostic tests for hemolytic disorders and anemias. 3. Differentiate between various white blood cell disorders and bleeding disorders. 4. Conduct blood transfusion procedures and ensure compliance with safety and legal standards.	

Name of the Programme : PGDCG & MLT
Course Code : MLT-515
Course Title : Laboratory course on Hematology and Transfusion medicine
Number of Credits : 01
Effective from AY : 2024 -2025

Prerequisite for the Course:	Basic knowledge of blood components and their applications	
Course Objectives:	1. Learn the proper use and maintenance of hematology laboratory equipment. 2. Understand the principles and techniques of various blood tests and their diagnostic applications. 3. Acquire practical skills in preparing and analyzing blood smears and hematology assays. 4. Develop proficiency in performing blood grouping, Rh typing, and compatibility testing.	
Content:	**Practical Module:** 1. Use and care of microscopes, study of improved Neubauer chamber 2. Anticoagulants and blood collection 3. Haemoglobinometry: Sahli's method, Cyanmethemoglobin method. colori meter/ spectrophotometer, principles part workings 4. Coagulometer 5. Haemoglogin electrophoresis, agar gel, CAM, HPLC, capillary electrophoresis, etc. 6. Hematology analyser , 3 part/5 part differential counters (cell counter, semi-automated, fully automated) 7. Haemocytometry: Erythrocyte count , RBC pipette 8. Haemocytometry: Total WBC count, WBC pipette 9. Blood smear preparations: Staining, differential WBC count 10. Peripheral blood smear examination and morphological abnormalities 11. Hemolytic work-up osmotic fragility test, Heinz bodies, sickling, G-6-P-D estimation, Hb-electrophoresis, Hb-F estimation. 12. Reticulocyte count- absolute eosinophil count 13. E.S.R, P.C.V, Blood indices (02 Practicals) 14. Platelet count, BT, CT, CRT 15. Prothrombin time, A.P.P.T, FDP estimation 16. Bone marrow examination- staining of smear, special stains- PAS, Sudan black, Myeloperoxidase 17. ABO grouping and Rh typing. 18. Demonstration of Coombs test and compatibility testing.	**30 Hours**
Pedagogy:	Practicals/ demonstrations/ Discussion/ Viva-voce	
References/Readings:	1. G. H. Rao, T. Eastlund and L. Jagannath, Handbook of Blood Banking & Transfusion Medicine. Jaypee Medical Publishers, New	

	Delhi, 2006. 2. A.B. Dutta, Blood Banking and Transfusion. CBS Publishers, New Delhi, 2006. 3. S. V. Rudmann, Textbook of Blood Banking and Transfusion Medicine. Second Edition. Elsevier Saunders Publication, 2005. 4. K. Bharadwaj, Transfusion Update. Indian Society of Blood Transfusion and Immunohaematology. Jaypee Medical Publishers, New Delhi, 2005. 5. K. L. Mukherjee, Volume II: Medical Laboratory Technology, Tata McGraw-Hll Publishing Company Ltd. New Delhi, 2007. 6. G. Kamat, Practical manual of Hematology. Jaypee Brothers Medical Publishers, New Delhi, 2011.
Course Outcome:	By the end of this course, students will be able to 1. Use and maintain microscopes and hematology analyzers effectively. 2. Perform blood collection, anticoagulation, and various hematological assays accurately. 3. Prepare and analyze blood smears to identify morphological abnormalities and perform differential WBC counts. 4. Conduct blood grouping, Rh typing, Coombs tests, and compatibility testing to ensure safe transfusions.

Name of the Programme : **PGDCG & MLT**
Course Code : **MLT-521**
Course Title : **Laboratory Safety and Biosecurity**
Number of Credits : **02**
Effective from AY : **2024 -2025**

Prerequisite for the Course:	Basic knowledge of Laboratory setup and procedures.	
Course Objectives:	1. Understand the principles and importance of laboratory safety. 2. Identify and mitigate potential hazards in laboratory settings. 3. Comprehend the concept of biosecurity and its application in laboratory practices. 4. Develop skills in emergency response and incident management in laboratory environments.	
	Module I: Laboratory Safety Introduction to Laboratory Safety: Overview of laboratory safety principles, Good laboratory practices (GLP), Importance of safety in the medical laboratory, Understanding potential hazards and risks Hazard Identification and Risk Assessment: Classification of laboratory hazards: biological, chemical, physical. Risk assessment methodologies. Strategies for hazard mitigation and management. Personal Protective Equipment (PPE): Selection, proper use, and maintenance of PPE. Types of PPE: gloves, lab coats, goggles, face masks. PPE protocols for different laboratory activities. Safe Laboratory Practices: Specimen handling and transportation procedures. Safe operation of laboratory equipment and instruments. Emergency Response and Preparedness: Emergency response plans and procedures, First aid techniques for laboratory-related injuries. Chemical Safety and Management: Safe handling, storage, and disposal of chemicals. Hazardous chemical identification and labelling. Chemical spill response and cleanup procedures. Biological Safety Measures: Handling of biological specimens and infectious materials. Biosafety levels and containment practices. Procedures for decontamination and sterilization. Laboratory Waste Management: Proper disposal of	**15 hours**

	biohazardous and chemical waste. Waste segregation, labelling, and storage requirements. Environmental impact and regulatory compliance.	
Content:	**Module II: Biosecurity** Introduction to Biosecurity: Definition and significance of biosecurity in laboratory settings. Understanding biosecurity risks and vulnerabilities. National Biosecurity Guidelines: Overview of biosecurity laws, regulations, and standards. Biosecurity Measures for Laboratory Personnel: Access control protocols for restricted laboratory areas. Background checks and security clearances for personnel. Training requirements for handling biohazardous materials. Incident Response and Reporting: Protocols for responding to biosecurity incidents and breaches. Importance of timely reporting and documentation. Measures for containment and recovery after a security breach. Physical Security and Access Control: Designing secure laboratory facilities and access points. Surveillance systems and monitoring mechanisms. Security protocols for safeguarding laboratory assets and information. Transport Security for Biological Materials: Packaging and shipping requirements for biohazardous materials. Chain of custody procedures and documentation. Compliance with transportation regulations and permits.	**15 hours**
Pedagogy:	Lectures/tutorials/assignments/ Presentations/ demonstrations.	
References/Readings:	1. R. N. Burnette (Ed.). Applied Biosecurity: Global Health, Biodefense, and Developing Technologies. 2021. 2. Frontiers Media SA. Frontiers Books in Biosafety and Biosecurity. Lausanne: Frontiers Media SA. (n.d.). 3. M. G. Reynolds, & N. A. Hynes. Laboratory Biosecurity Handbook. Boca Raton: CRC Press, 2007. 4. D. E. Wilson, & L. C. Chosewood. Biological Safety: Principles and Practices, 5th Edition. Wiley, 2017. 5. World Health Organization. Laboratory Biosecurity Guidance. Geneva: World Health Organization, 2006. 6. World Health Organization. Laboratory Biosafety Manual, Fourth Edition. Geneva: World Health Organization, 2021.	
Course Outcome:	By the end of this course, students will be able to 1. Understand key principles of lab safety and biosecurity, identifying and mitigating potential risks.	

	2. Demonstrate proper use of PPE, specimen handling, and emergency response procedures. 3. Apply risk assessment methods to manage lab hazards effectively. 4. Adhere to regulatory guidelines and ethical standards in professional lab environments.

Name of the Programme : **PGDCG & MLT**
Course Code : **MLT-522**
Course Title : **Biostatistics for Laboratory Professionals**
Number of Credits : **02**
Effective from AY : **2024 -2025**

Prerequisite for the Course:	A basic understanding of mathematics and familiarity with laboratory procedures	
Course Objectives:	1. Understand the Role of Biostatistics. 2. Develop Statistical Skills. 3. Apply Statistical Methods in Laboratory Practice. 4. Enhance Decision-Making Skills based on statistical evidence and data analysis.	
Content:	**Module I: Basic Concepts in Biostatistics** Introduction to Biostatistics: Definition and scope of biostatistics in laboratory practice. Importance of statistical analysis in medical research and clinical diagnostics. Examples: Analysing the effectiveness of a new diagnostic test and assessing the prevalence of a disease in a population. Types of Data: Categorical vs. continuous data: Definition and examples. Measurement scales: Nominal, ordinal, interval, and ratio scales. Examples: Classifying patients into disease categories (categorical data) and measuring blood pressure (continuous data). Descriptive Statistics: Measures of central tendency: Mean, median, mode. Measures of dispersion: Range, variance, standard deviation. Examples: Calculating the average blood glucose level in diabetic patients and assessing the variability of test results in a laboratory assay. Probability Distributions: Normal distribution: Characteristics and properties. Binomial distribution: Definition and application in laboratory experiments. Examples: Modeling the distribution of heights in a population (normal distribution), predicting the probability of success in a series of independent trials (binomial distribution). Sampling Techniques: Simple random sampling, Stratified sampling, Systematic sampling. Examples: Collecting blood samples from randomly selected patients (simple random sampling), stratifying patients based on age groups for a clinical trial (stratified sampling), selecting every 10th sample for quality control testing (systematic sampling).	**15 hours**

	Module II: Statistical Analysis in Laboratory Practice Parametric and Nonparametric Tests: T-tests: Independent and paired samples t-tests. Chi-square tests: Goodness-of-fit and independence tests. Mann-Whitney U test: Nonparametric test for independent samples. Examples: Comparing mean cholesterol levels between two treatment groups (t-tests), analysing the association between smoking status and lung cancer (chi-square test), comparing the median survival times of two treatment regimens (Mann-Whitney U test). Correlation and Regression Analysis: Pearson correlation coefficient: Strength and direction of linear relationships. Linear regression: Modeling the relationship between two continuous variables. Examples: Assessing the correlation between blood pressure and heart rate, predicting the relationship between age and cholesterol levels using regression analysis. Analysis of Variance (ANOVA): One-way ANOVA: Comparing means across multiple groups. Two-way ANOVA: Analysing the effects of two categorical factors on a continuous outcome. Examples: Comparing the efficacy of three different drug treatments for hypertension (one-way ANOVA), examining the interaction between genotype and treatment in a genetic study (two-way ANOVA). Survival Analysis: Kaplan-Meier method: Estimating survival probabilities over time. Log-rank test: Comparing survival curves between two or more groups. Examples: Analysing the survival rates of cancer patients following different treatment regimens and comparing the survival times of patients with different genetic mutations.	**15 Hours**
Pedagogy:	Lectures/tutorials/assignments/ Presentations/ demonstrations.	
References/Readings:	1. W. W. Daniel. Biostatistics: A Foundation for Analysis in the Health Sciences. Wiley, 2018. 2. B. Dawson, & R. G. Trapp. Basic & Clinical Biostatistics. Lange Medical Books/McGraw-Hill, 2004. 3. S. A. Glantz. Primer of Biostatistics. McGraw-Hill Education, 2012. 4. B. R. Kirkwood, & J. A. C. Sterne. Essential Medical Statistics. Blackwell Science, 2003. 5. D. Machin, M. J. Campbell, & S. J. Walters. Medical Statistics: A Textbook for the Health Sciences. Wiley-Blackwell, 2018. 6. M. Pagano, & K. Gauvreau. Principles of Biostatistics. Cengage Learning, 2018.	
Course Outcome:	By the end of this course, students will be able to 1. Demonstrate understanding of Biostatistical principles.	

	2. Apply statistical techniques to laboratory data. 3. Critically evaluate research findings. 4. Communicate statistical results effectively.

Name of the Programme : **PGDCG & MLT**
Course Code : **MLT-523**
Course Title : **Clinical Laboratory Management and Quality Assurance**
Number of Credits : **02**
Effective from AY : **2024 -2025**

Prerequisite for the Course:	Basic knowledge of Laboratory setup and procedures.	
Course Objectives:	1. Provide students with an understanding of the organizational structure and roles within clinical laboratory management. 2. Equip students with the knowledge and skills necessary for effective laboratory planning, budgeting, and administration. 3. Familiarize students with inventory management techniques, procurement procedures, and supplier management strategies relevant to clinical laboratory operations. 4. Introduce students to quality management systems (QMS) principles and accreditation standards applicable to clinical laboratories.	
	Module I: Clinical Laboratory Management **Introduction to Laboratory Management:** Organizational structure of clinical laboratories. Example: Understanding the hierarchical structure from laboratory assistants to laboratory directors. Roles and responsibilities of laboratory personnel, Example: Differentiating between the duties of a laboratory technician and a laboratory manager. **Laboratory Planning and Administration**: Strategic planning for laboratory services. Example: Developing a long-term plan to expand laboratory services to accommodate increasing patient volumes. Budgeting and financial management, Example: Allocating funds for the purchase of a new automated analyzer based on budget constraints. **Inventory Management:** Procurement procedures for laboratory supplies and reagents, Example: Negotiating contracts with suppliers to obtain competitive pricing for high-volume consumables. Storage and inventory control systems, Example: Implementing a barcode system to track the movement of reagents and prevent stockouts. Supplier management and contract negotiations, Example: Reviewing service agreements with equipment vendors to ensure compliance with maintenance schedules. **Quality Management Systems (QMS):** Principles of QMS implementation, Example: Establishing a quality policy statement outlining the laboratory's commitment to meeting regulatory standards. Accreditation and certification standards (e.g., ISO 15189), Example: Preparing for an ISO	**15 Hours**

	15189 accreditation audit by conducting internal audits and addressing non-conformities. Development of quality manuals and standard operating procedures (SOPs). Example: Creating an SOP for specimen collection and processing to standardize procedures and minimize pre-analytical errors.	
Content:	**Module II: Quality Assurance in Clinical Laboratories** **Introduction to Quality Assurance (QA):** Definition and importance of QA in laboratory medicine, Example: Highlighting the role of QA in ensuring the accuracy and reliability of test results for patient care. QA frameworks: PDCA (Plan-Do-Check-Act), Six Sigma, Lean principles, Example: Applying the PDCA cycle to continuously improve the analytical process for a specific test. Regulatory requirements and accreditation standards, Example: Familiarizing with CLIA regulations and CAP accreditation requirements for clinical laboratories. **Quality Control (QC) Procedures**: Designing QC protocols for different laboratory tests, Example: Establishing QC rules for hematology analyzers to monitor precision and accuracy. Calibration and validation of laboratory instruments, Example: Calibrating a spectrophotometer using certified reference materials to ensure accurate absorbance measurements. Monitoring of analytical performance using control charts, Example: Creating Levey-Jennings charts to visualize trends and detect shifts in QC data for blood glucose testing. **Error Management and Corrective Actions:** Identification and documentation of laboratory errors, Example: Documenting a mislabelled specimen incident and conducting a root cause analysis to prevent future occurrences. Root cause analysis techniques (e.g., Fishbone diagram), Example: Using a Fishbone diagram to identify contributing factors to a calibration error in the analyzer. Implementation of corrective and preventive actions (CAPA). Example: Implementing new staff training procedures to address recurrent errors identified during quality audits. Ethical consideration in laboratory management.	**15 hours**
Pedagogy:	Lectures, case studies, group discussions, and hands-on exercises.	
References/Readings:	1. A. Brady, & G. Sharp. Managing People in the Laboratory: 5 Principles for the Laboratory Supervisor. American Society for Clinical Laboratory Science, 2017. 2. Clinical and Laboratory Standards Institute (CLSI). Quality Management System: A Model for Laboratory Services; Approved Guideline. CLSI, 2020. 3. D. Garza, & K. Becan-McBride. Laboratory Management: Principles and Processes. Elsevier, 2019.	

	4. International Organization for Standardization (ISO). ISO 15189:2012 Medical Laboratories – Requirements for Quality and Competence. ISO, 2012. 5. R. A. McPherson, & M. R. Pincus. Henry's Clinical Diagnosis and Management by Laboratory Methods. Elsevier, 2017. 6. O. Sonntag, & M. Laposata. Managing the Laboratory: 12 Principles of Quality Management. Oxford University Press, 2015. 7. C. Watson. Good Clinical, Laboratory and Manufacturing Practices: Techniques for the QA Professional. Woodhead Publishing, 2007. 8. J. O. Westgard. Basic QC Practices: Training in Statistical Quality Control for Healthcare Laboratories. Westgard QC, 2017. 9. J. O. Westgard, & S. A. Westgard. Quality Management in the Medical Laboratory: A Practical Guide. AACC Press, 2016. 10. World Health Organization. Laboratory Quality Management System: Handbook. World Health Organization, 2011.
Course Outcome:	By the end of this course, students will be able to 1. Analyze and explain the hierarchical structure and responsibilities of personnel within clinical laboratory settings. 2. Demonstrate the ability to develop strategic plans, manage budgets, and administer laboratory services effectively. 3. Acquire proficiency in inventory management, including procurement, storage, and supplier management practices. 4. Implement quality management systems, adhere to accreditation standards, and develop quality manuals and standard operating procedures (SOPs) for clinical laboratories.

Name of the Programme : PGDCG & MLT
Course Code : MLT-524
Course Title: Immunology : Principles and Applications
Number of Credits : 02
Effective from AY : 2024 -2025

Prerequisite for the Course:	Basic knowledge of Laboratory setup and procedures.	
Course Objectives:	1. Provide students with a comprehensive understanding of the basic principles and components of the immune system. 2. Familiarize students with the mechanisms of immune responses and the role of various immune cells and molecules in health and disease. 3. Equip students with practical skills in performing and interpreting immunological techniques commonly used in laboratory and clinical settings. 4. Enable students to critically evaluate and apply immunological knowledge to diagnose, treat, and prevent immune-related disorders and diseases.	
Content:	**Module I: Basic Concepts of Immunology** Introduction to Immunology: Definition of immunology, Historical developments in immunology and Importance of immunology in healthcare Cells and Organs of the Immune System: Overview of immune cell types, Primary lymphoid organs (e.g., bone marrow, thymus), Secondary lymphoid organs (e.g., lymph nodes, spleen, mucosa-associated lymphoid tissue). Innate Immunity: Physical and chemical barriers (e.g., skin, mucous membranes), Cellular components (e.g., macrophages, neutrophils), Inflammatory response (e.g., cytokines, acute-phase proteins), Complement system and its role in innate immunity. Adaptive Immunity: Antigen recognition by lymphocytes, Major histocompatibility complex (MHC) molecules, T cell activation and differentiation (e.g., helper T cells, cytotoxic T cells), B cell activation and antibody production. Antibody Structure and Function: Structure of immunoglobulins (IgG, IgM, IgA, IgD, IgE), Antigen-antibody interactions (e.g., neutralization, opsonization) and Antibody effector functions (e.g., complement activation, antibody-dependent cellular cytotoxicity)	**15 Hours**
	Module II: Clinical Immunology and Laboratory Diagnostics Immune Disorders and Diseases: Overview of immunodeficiency disorders (e.g., primary	**15 hours**

	immunodeficiencies), Autoimmune diseases (e.g., rheumatoid arthritis, systemic lupus erythematosus), Hypersensitivity reactions (e.g., type I, type II, type III, type IV), Transplantation immunology and graft rejection. Immunological Techniques: Enzyme-linked immunosorbent assay (ELISA), Immunofluorescence microscopy, Flow cytometry and cell sorting, Western blotting and immunoblot analysis. Serological Testing: Interpretation of serological tests for infectious diseases (e.g., HIV, hepatitis), Autoimmune serology (e.g., antinuclear antibodies, rheumatoid factor), Immunodeficiency screening (e.g., immunoglobulin levels, lymphocyte subsets). Immunohematology: Blood group systems (e.g., ABO, Rh), Blood typing techniques (e.g., agglutination tests, gel electrophoresis), Blood transfusion compatibility testing (e.g., crossmatching, antibody screening). Immunotherapy: Overview of immunotherapeutic approaches (e.g., monoclonal antibodies, cytokine therapy), Cancer immunotherapy (e.g., immune checkpoint inhibitors, CAR-T cell therapy), Immunomodulatory drugs and their clinical applications Emerging Trends in Immunology: Advances in immunogenetics and personalized medicine, Novel vaccination strategies (e.g., mRNA vaccines), and Immunological aspects of infectious disease outbreaks (e.g., COVID-19).	
Pedagogy:	Lectures, interactive discussions, case studies, laboratory demonstrations, multimedia presentations, and recorded lectures from immunology experts.	
References/Readings:	1. A. K. Abbas, A. H. Lichtman, & S. Pillai. Cellular and Molecular Immunology (9th ed.). Elsevier, 2020. 2. B. Alberts, A. Johnson, J. Lewis, M. Raff, K. Roberts, & P. Walter. Molecular Biology of the Cell (6th ed.). Garland Science, 2014. 3. R. Coico, & G. Sunshine. Immunology: A Short Course (7th ed.). Wiley-Blackwell, 2015. 4. B. Detrick, J. L. Schmitz, & R. G. Hamilton (Eds.). Manual of Molecular and Clinical Laboratory Immunology (8th ed.). ASM Press, 2016. 5. C. A. Janeway, P. Travers, M. Walport, & M. J. Shlomchik. Immunobiology: The Immune System in Health and Disease (9th ed.). Garland Science, 2017.	

	6. D. Male, J. Brostoff, D. B. Roth, & I. M. Roitt. Immunology (9th ed.). Elsevier, 2019. 7. R. A. McPherson, & M. R. Pincus. Henry's Clinical Diagnosis and Management by Laboratory Methods (24th ed.). Elsevier, 2017. 8. K. Murphy, & C. Weaver. Janeway's Immunobiology (9th ed.). Garland Science, 2016. 9. P. Parham. The Immune System (4th ed.). Garland Science, 2014. 10. J. B. Zabriskie (Ed.). Essential Clinical Immunology. Cambridge University Press, 2009.
Course Outcome:	By the end of this course, students will be able to 1. Understand the fundamental principles of immunology, including the components and functions of the immune system. 2. Apply immunological concepts to explain the mechanisms underlying immune responses and diseases. 3. Perform and interpret basic immunological techniques used in clinical and research settings. 4. Evaluate the clinical relevance of immunological tests and therapies in the diagnosis and treatment of immune-related disorders.