

SHRI GURU RAM RAI UNIVERSITY

[Estd. by Govt. of Uttarakhand, vide Shri Guru Ram Rai University Act no. 03 of 2017 & recognized by UGC u/s (2f) of UGC Act 1956]



SYLLABUS FOR

Master of Medical Lab Technology

With CO And PO Mapping

School of Paramedical Sciences

(W.E.F 2021-2022)

Master of Science in MLT
OUTCOME BASED EDUCATION
Programme outcome (POs)

Students will be able to

1.	PO 1	Develop an understanding to perform routine clinical laboratory procedures within acceptable quality control parameters in Hematology, Biochemistry, Enzymology, Immunohematology, Cytopathology, Histopathology, Blood transfusion and Microbiology.
2.	PO 2	Demonstrate the application abilities regarding the structures and functions of biomolecules, enzyme kinetics. Their relations to implement the understanding of the concept and research related to them.
3.	PO 3	Development of basic skills on aseptic techniques, sterilization technique. Perform various staining techniques, Cultivate bacteria with different cultivation techniques and the conceptual knowledge of HAI.
4.	PO 4	Extend the concepts of immune system and their determination of immunomodulatory strategies that can be used to enhance immune responses or to suppress undesired immune responses as mandatory in hypersensitivity reactions, transplantations or autoimmune diseases.
5.	PO5	Demonstrate an understanding of essential basic pathological processes including cell death and injury, inflammation, thrombosis and neoplasia.
6.	PO6	Develop an understanding of the patterns of inheritance, clinical manifestations of genetic diseases, molecular basis of human diseases.
7.	PO7	Gain information on concepts of Biostatistics, an essential part of research and its methodologies.
8.	PO8	Demonstrate the application abilities regarding biochemical tests to determine the health problems and explain their clinical significance and pathophysiology.
9.	PO9	Identification of common pathogenic bacterial agents and the associated diseases, their specific mechanisms by which bacteria cause disease, their epidemiology of infectious agents including how infectious diseases are transmitted and explain interventions employed to prevent bacterial, Viral and Fungal diseases including infection control measures and course of treatment.
10.	PO10	Application of advanced blood bank and blood transfusion technical skills to make appropriate and effective on-the-job professional decisions. Performance and interpretation of commonly employed procedures in the blood bank. Interpreting normal and abnormal test results and correlation of the data with appropriate pathologic conditions to accurately advise health care providers.
11.	PO11	Work effectively in teams to collect and clinical samples for analysis. Storage or transportation of samples for analysis using appropriate preservation

		methods. Implementation as per prescribed procedures, and with adequate orientation, perform routine testing in immunology, Immunohematology, hematology, hemostasis, blood bank and molecular diagnostics. Manage laboratory operations and human resources to ensure cost-effective, high-quality laboratory services.
12.	PO12	Exhibit the ability to perform histopathological and cytological laboratory testing techniques to gain knowledge and become laboratory efficient.

**REGULATION OF THE UNIVERSITY FOR THE AWARD OF THE
DEGREE OF**

MASTER OF SCIENCE – MEDICAL LAB. TECHNOLOGY

An exercise of the powers conferred by section of S.G.R.R University Act no.3 of 2017.Academic Council of the Shri Guru Ram Rai University Dehradun hereby makes the following regulations:-

SHORT TITLE AND COMMENCEMENT

These regulations shall be called “THE REGULATIONS FOR THE MASTER OF SCIENCE – MEDICAL LABORATORY TECHNOLOGY OF THE SHRI GURU RAM RAI UNIVERSITY, DEHRADUN, UTTARAKHAND”

- I. These Regulations and the syllabus shall come into force from the 2017-2018 academic session onwards.
- II. The regulations framed are subject to modification from time to time by the standing Academic Board of the University.

OBJECTIVES

To provide an extensive training in the fields of Biochemistry, Microbiology and Pathology to the students to enable them to supervise the entire laboratory.

ELIGIBILITY CRITERIA:-

Candidates have a degree in B.Sc. Medical Laboratory Technology (MLT), B.Sc., Biochemistry, and B.Sc. Microbiology.

ELIGIBILITY CERTIFICATE:

Candidates who have passed any qualifying examination, as specified in Regulation No.3 above from any other Universities other than the Shri Guru Ram Rai University before seeking admission to the affiliated institutions shall obtain an Eligibility Certificate from the University by remitting the prescribed fees along with the application form which shall be downloaded from the University website (www.sgrru.ac.in).

DURATION OF THE COURSE: - Two years

Each academic year shall consist of not less than 270 working days (including Examination period)

PHYSICAL FITNESS

Every student prior to admission to the course should submit to the Head of the Institution, a certificate of Medical fitness that the candidate is physically fit to undergo the course.

MIGRATION/TRANSFER OF CANDIDATES

Request for Migration/ Transfer of candidates during the course of study from one recognized Institution to another recognized Institution of this or from other University of shall not be granted under any circumstances.

POSTING AND TRAINING IN OUTSIDE CENTRES:

The head of the postgraduate Department shall make necessary arrangements for the postgraduate candidates to undergo training in various skills in other centres.

ATTENDANCE REQUIREMENT FOR ADMISSION TO EXAMINATION

- a) No candidate shall be permitted to appear in any one of the parts of M.Sc (Medical Laboratory Technology) Course Examinations, unless he / she has attended the course in all the subjects for the prescribed period in an affiliated Institution recognized by this University and has to produce the necessary certificates of study, attendance,

satisfactory conduct and progress from the Head of the Institution.

- b) A candidate is required to put in a minimum of 80% of attendance (of 270 days) each in theory and practical classes in each subject before admission to the examination.
- c) A candidate lacking in the prescribed attendance and progress in any one subject in theory and practical classes, wherever necessary in the first appearance, shall not be permitted for admission to the entire examination.

EXAMINATION REGULATIONS:

Compartments / Supplementary/ Back Paper:

- (I) A student who obtain 50% of the marks individually but has failed in two

Papers shall be permitted to appear in those papers only at the two consecutive examinations and if he/she passes at either of those examinations he/she will be deemed to have passed the examination and will be promoted to higher class. (Aggregate marks should be 50%).

- (II) A student (s) appearing in back paper/ supplementary shall be

Eligible to join the next higher Class.

There shall be one main examination in a year and a supplementary to be held not less than 6 months after publication of its results.

MEDIUM OF INSTRUCTION:

The medium of instruction for all subjects shall be English.

AWARD OF DEGREE:-

The degree shall be awarded by the University only after the successful completion of the course.

AWARD OF MEDALS / PRIZES:-

The University shall award at its Convocation, medals and prizes to Outstanding candidates as and when instituted by the Donors as per the schedule prescribed for the award.

PASSING MINIMUM:

A candidate shall be declared to have passed in each paper/subject if he / she secure NOT LESS THAN 50% of the marks prescribed for the examinations.

NUMBER OF APPEARANCE/COMPLETION OF THE COURSE OF STUDY

The duration for completion of the course is double the duration of the course i.e. 4 years to pass the examination, from the date of joining the course. Otherwise he / she has to be discharged from the course.

CURRICULUM: - FIRST YEAR

SL. No	Paper Number	Subject
1	Paper 1	General Biochemistry, Medical Laboratory Technology
2	Paper 2	General Bacteriology, Immunology and Parasitology
3	Paper 3	Haematology and Clinical Pathology
4	Paper 4	General Pathology
5	Paper 5	Epidemiology & Biostatistics

CURRICULUM: - SECOND YEAR

SL. No	Paper Number	Subject
1	Paper 1	Clinical Biochemistry, Endocrinology and Nutritional Biochemistry
2	Paper 2	Systematic Bacteriology, Virology and Mycology
3	Paper 3	Advances Haematology and Immuno Haematology
4	Paper 4	Techniques in Histopathology and Cytology

SCHEME OF EXAMINATION**IST YEAR**

Course code	Course title	Marks for Theory			Marks for Practical			Total Marks
		IA*	EE*	Total	IA*	EE*	Total	
MMLT 101	General Biochemistry, Medical Laboratory Technology	30	70	100	30	70	100	200
MMLT 102	General Bacteriology, Immunology and Parasitology	30	70	100	30	70	100	200
MMLT 103	Haematology and Clinical Pathology	30	70	100	30	70	100	200
MMLT 104	General Pathology	30	70	100	30	70	100	200
MMLT 105	Epidemiology & Biostatistics	30	70	100	-	-	-	100
	TOTAL	150	350	500	120	280	400	900

IIND YEAR

Course code	Course title	Marks for Theory			Marks for Practical			Total Marks
		IA*	EE*	Total	IA*	EE*	Total	
MMLT 201	Clinical Biochemistry, Endocrinology and Nutritional Biochemistry	30	70	100	30	70	100	200
MMLT 202	Systematic Bacteriology, Virology and Mycology	30	70	100	30	70	100	200
MMLT 203	Advances Haematology and Immuno Haematology	30	70	100	30	70	100	200
MMLT 204	Techniques in Histopathology and Cytology	30	70	100	30	70	100	200
	TOTAL	120	280	400	120	280	400	800

SUBMISSION OF PRACTICAL RECORD BOOKS:-

At the time of Practical Examination, each candidate shall submit to the Examiners his / her Practical Record Books duly certified by the Head of the Department as a bonafide record of the work done by the candidate.

The concerned Head of the Department shall evaluate and award the marks for the Practical Record Note Book and Log Book (Internal Assessment) and the Practical Record shall be presented to the Examiner at the time of examinations at the end of each year.

Examination Scheme:

Components	Internal Examination (Average of Ist Internal exam & IInd Internal Exam)	External Examination Yearly
Weightage (%)	Out of 30 Marks	70 Marks

M.Sc MLT

Course code	: MMLT 101
Course Name	: General Biochemistry, Medical Laboratory Technology
Semester /Year	: 1 st year

	L	T	P	C
	02		01	03

L - Lecture T – Tutorial P – Practical C – Credit

Course Contents**2hrs/Week****General Biochemistry, Medical Laboratory Technology****Unit-1 Structure of Cell and Intracellular Organelles**

Carbohydrates, Lipids, Proteins and nucleic acids- structure, Classification, Membrane structure, glycoproteins

Unit-2 Enzymes: Classification, factors that alter enzymes catalyzed reaction, Michaelis-Menton. Equation, Competitive and non-competitive inhibition of enzyme reactions, regulations enzyme activity, Isoenzymes – separation and identification, plasma enzymes in clinical diagnosis, Coenzymes.

Unit-3 Bioenergetics and oxidative phosphorylation; free energy-exergonic and endergonic reaction, high energy phosphates, components of electron transport chain-mechanism of ATP production, chemiosmotic theory, inhibitor of respiratory chain.

Unit-4 Carbohydrate Metabolism; glycolysis, TCA cycle, glycogen, gluconeogenesis, blood glucose regulation, diabetes mellitus. Lipid Metabolism: Synthesis and breakdown of fatty acids, Ketone bodies DKA, Cholesterol, bile acids, lipoproteins, atherosclerosis.

Unit-5 Protein Metabolism: Synthesis and breakdown of amino acids, urea cycle, specialized products from amino acids.

Unit-6 Molecular Biology: Structure and function DNA, Organization and replication transcription, Protein synthesis. Recombinant DNA Technology PCR Fish

Unit-7 Vitamins, Water and mineral Metabolism: Functions and deficiency manifestations of Vitamin A, D E, K, C, B complex. Water and electrolytes, Calcium, Phosphorous, magnesium, Iron, lead, copper, trace elements (iodine, selenium, zinc).

Practicals:

General Experiments:

1. Preparation of buffers and determination of pH
2. Absorption spectra of aromatic amino acids
3. Colour reactions of Aminoacids
4. Normal and abnormal constituents of Urine

5. Body fluid examination
6. Qualitative analysis and identification of sugars
7. Separation of sugars by paper chromatography
8. Qualitative analysis and identification of amino acids
9. Separation of aminoacids by paper chromatography, TLC
10. Separation of Lipids by TLC
11. Agarose gel electrophoresis
12. SDS_Page and quantitation using densitometers
13. Separation of Proteins, hemoglobin, lipoproteins b electrophoresis using agarose gel
14. Studies on enzymes kinetics using enzyme sources such as acid phosphatase from potatoes, alkaline phosphatase from liver – effect of pH, Temperature and substrate concentrations
15. Assessment of antioxidant status: Vitamin C and E, glutathione, MDA, Paraoxanose in serum
16. PCR
17. ELISA
18. Western blot
19. Chemiluminascence
20. Blood Gas analysis
21. Karyotyping
22. Molecular weight determination by PAGE
23. Cell fractionation
24. Protein purification by
25. NH₄SO₄ precipitation

Medical Laboratory Technology

Unit-1 General Laboratory Techniques and procedures: Chemicals and related substance, general laboratory supplies, volumetric equipments and its calibration, centrifuges, balances and weighing, concept of solute and solvent, buffer solutions and their actions, physical and chemical units, units of measurements, safety measures.

Unit-2 Specimen collection and processing: Collection and preservation of blood and urine, source of biological variations, pre-analytical variables.

Analytical Techniques:

- a. Spectrophotometry, flame emission spectrophotometry, atomic absorption spectrophotometry, fluorimetry, nephelometry, turbidimetry, flow Cytometry
- b. Electrochemistry-potentiometry, biosensors
- c. Chromatography- Theory, description of techniques of various types of chromatography, paper chromatography, HPLC
- d. Electrophoresis- Theory, description of techniques of various types of electrophoresis, technical considerations.
- e. Immunochemical techniques-basic concepts, antigen-antibody binding qualitative methods, quantitative methods.
- f. Centrifuge purification
- g. Recombinant DNA technology-PCR, western blotting, northern blotting and southern blotting

Automation: Concepts, automation of analytical processes, integrated automation for clinical laboratory, automation of point of care analyzers.

Unit-3 Laboratory Operation:

- a. Selection and evaluation of methods: Basic concepts, accuracy – reference methodology, systematic error, analytical range, sensitivity and speciality, detection limit, interferences within run-precision, recovery.

Assessing method acceptability:

- b. Establishment and user of reference value
- c. Clinical laboratory information-computer system, micro-computer applications laboratory information systems, future use of computers.

Unit-4 Laboratory Management and safety: Health care delivery and financial strategies for managed care, financial management, human resource management and space and facility management. . Lab safety-safety program, safety equipments, chemical hygiene plan. Hazards in the laboratory- identification of hazards chemical hazards, clinical hazards, electrical hazards, biological hazards, prevention hazards. Quality management: Fundamentals, total quality management, total testing process, control of preanalytical and analytical variables, control of analytical quality using stable control materials, external quality assessment, documentation of reports, proficiency testing new quality initiatives.

Text Books:

1. Satyanarayan and Chakrapani, 2021. *Text Book Of Biochemistry*. 6 edition. Elsevier.
2. Vasudevan and Sree kumari, 1995. *Text Book of Biochemistry for Medical Students*. Edition 1, Jaypee Brothers, New Delhi.

Reference Books:

1. Styrer. *Biochemistry*. 9th edition. MacMillan
2. Harper. *Illustrated Biochemistry*. 32nd Edition. McGraw Hill.

Course outcomes (COs):**Upon successful completion of the course, a student will be able to**

CO1	To define concepts and principles of biochemistry, correlations of biomolecules: carbohydrates, proteins, lipids, Nucleic acids with cellular and molecular processes involved in health and in disease states for clinical problem solving and research.
CO2	To estimate fundamental aspects of enzymology and clinical application wherein regulation of enzymatic activity is altered.
CO3	To integrate biochemical pathways of the intermediary metabolism along with their individual and integrated regulation and apply that in understanding the functioning of body with respect to energy liberating process.
CO4	To estimate the normal ranges and abnormal ranges of biochemical components and hormones. Interpreting of principle of biochemical Clinical biochemistry tests, finish tasks with speed as well as with accuracy, handle stress; make an analytical judgment, interpreting technical/scientific data, knowledge of laboratory instrumentation
CO5	To validate special emphasis on Laboratory Management and safety with Health care delivery and financial strategies for managed care, financial management, human resource management and space and facility management
CO6	To build Quality management: Fundamentals, total quality management, total testing process, control of pre-analytical and analytical variables, control of analytical quality using stable control materials, external quality assessment, documentation of reports

CO-PO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C01	2	3	-	-	-	-	-	-	-	-	-	-
C02	2	3	-	-	-	-	-	-	-	-	-	-
C03	1	-	-	-	-	-	-	-	-	-	-	-
C04	-	-	-	-	-	-	-	3	-	-	-	-
C05	-	-	-	-	-	-	-	-	-	-	3	-
C06	-	-	-	-	-	-	-	-	-	-	-	-

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

M.Sc MLT

Course code	: MMLT 102
Course Name	: General Bacteriology, Immunology and Parasitology
Semester /Year	: 1 st year

	L	T	P	C
	02		01	03

L - Lecture T – Tutorial P – Practical C – Credit

Course Contents

2 hours/Week
<p><u>General Bacteriology</u></p> <p>Unit – 1 Brief history of microbiology with special reference to the contributions of Louis Pasteur, Robert Koch and others. Morphology and physiology of Bacteria Classification and growth requirement of Bacteria Principles and uses of different kinds of Microscopes</p> <p>Unit- 2 Sterilization and disinfection procedures. Basic principles of Bacterial genetics. Cultivation methods. Antibiotic –antibiotic susceptibility testing.</p> <p>Unit – 3 Sources and modes of transmission of infection with prevention of hospital-acquired infection. Definition of Epidemic, Endemic, Pandemic and the sporadic outbreak of diseases Virulence factors of Bacteria.</p> <p>Practicals i) Handling of microscope, staining methods. ii) Preparation of media, inoculation methods. iii) Preservation of cultures, anaerobic cultivation methods. iv) Washing and sterilization of glassware, handling of equipment. V) Techniques of filtration, maintenance of quality control antibiotic susceptibility testing Molecular techniques.</p>
<p><u>Immunology</u></p> <p>Unit – 1 Antigen, antibody definition, examples. Antigen-antibody reaction – principles and their application in the diagnosis of infectious diseases.</p> <p>Unit- 2 Immunity- classification, active immunity, passive immunity, innate immunity, humoral and cell-mediated immunity, immunization schedule</p> <p>Unit- 3 Hypersensitivity classification, mechanism and example autoimmunity – mechanism and example tumour and transplantation immunology.</p> <p>Practicals i) Demonstration of agglutination precipitation, neutralization, fluorescent Antibody technique, immune blot technique, ELISA etc. ii) Test to demonstrate CMI Test to demonstrate hypersensitivity. iii) Detection of ANA, Ds DNA etc.,</p>
<p><u>Parasitology</u></p> <p>Unit – 1 Classification – protozoa-amoeba, flagellates, sporozoa, ciliates. Opportunistic parasitic infections.</p> <p>Unit – 2 Helminthes – cestodes, trematodes.</p>

Unit -3 Helminthes- nematodes and diagnostic methods in parasitology.
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Practicals i) Stool examination for ova and cysts. ii) Concentration methods. iii) Peripheral blood smear examination. iv) Special staining methods.

Text Books:

1. Sastry and Bhat, 2021. *Essentials of Medical Microbiology*. Third Edition. Jaypee publishers.
2. Baweja, 2018. *Textbook of Microbiology*. Sixth Edition. Arya Publications.

Reference Books:

1. Ananthanarayan and Paniker's. *Textbook of Microbiology*. Twelvth Edition. Orient Blackswan.
2. Greenwood, *Medical Microbiology*. Eighteenth Edition. Churchill Livingstone Elsevier.

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	To describe the History of microbiology in detail and study the morphology and physiology of bacteria.
CO2	To discuss the principles of Sterilization, Disinfection, Cultivation methods and Antibiotic Susceptibility testing.
CO3	To illustrate the transmission of infection and prevention of HAI.
CO4	To Explain the concept of Antigen, Antibody and their reactions.
CO5	To evaluate the importance of immunity and Hypersensitivity with their types.
CO6	To design the parameters for identification of etiological features, pathogenesis and laboratory diagnosis of important parasites causing infections.

CO-PO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	3	-	-	-	-	-	-	-	-	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-
CO4	-	-	-	2	-	-	-	-	-	-	-	-
CO5	-	-	-	3	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	3	-	-	-

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

M.Sc MLT

Course code	: MMLT 103
Course Name	: Haematology and Clinical Pathology
Semester /Year	: 1 st year

	L	T	P	C
	02		01	03

L - Lecture T – Tutorial P – Practical C – Credit

Course Contents

Haematology and Clinical Pathology	2 hours/Week
<p>Basic Principles of laboratory organization and safety. Sample Collection – principles of analytical, pre and post analytical errors Reception, labelling and recording of laboratory investigations Cleaning of glassware, pipettes, E.S.R tubes and counting chambers Preparation of capillary pipette, distilled water, reagents, buffers. Collection of blood, preparation of blood smear, staining of blood and bone marrow smears. Genetics Continuity of life - heredity, variation; mendl's laws of inheritance, chromosomal basis of inheritance; other patterns of inheritance , mutation and chromosomal aberrations; Human genetics - methods of study, genetic disorders. DNA as a genetic material - its structure and replication; structure of RNA and its role in protein synthesis; Gene expression - transcription and translation Basic techniques in Molecular Biology and cytogenetics. Equipment relevant to lab haematology and transfusion medicine including Microscope: Light, phase contrast, interference, fluorescence, polarization and electron microscopy (principle, parts and its application). Photometry: Basic principal UV-Vis spectrometry and colorimetry instrumentation and its application Fluorimetry: Principal, Instrumentation and application. Electrophoresis: Principal, types and application (agarose gel electrophoreses, starch gel and polyacrylamide electrophoresis) Centrifuge: Basic principle, type analytical and preparative centrifuges, different density gradient centrifuge and analytical with its application Blood analyzer: Principal, instrument and its application. Incubator, hot air oven and autoclave: Principal, instrument and its application. Radioactivity: Radioisotopes, half-life units, Geiger Mueller counter, gamma counter and scintillation PH meter (principle types, types of electrodes and application). Freezers, coolers platelet agitators, cryo thawing baths Automated immunohematology analysers. Automated coagulation analysers, platelet aggregometers and thromboelastogram Haemopiesis. Red Blood Cells : Normal erythropoiesis, morphology Red cell disorders – inherited and acquired. Anemias – classification, pathophysiology and diagnosis Haemolytic disorders. Malignant disorders</p>	

White Cells – Normal myelopoiesis,
 White cell disorders - inherited and acquired
 Malignant disorders – classification, pathophysiology and diagnosis
 Platelet disorders – classification, diagnosis and pathophysiology.

Text Books:

1. Harshmohan. *Text book of Pathology*. 8th Edition. Jaypee Publishers.
2. Godkar. Third Edition. Volume 2. Bhalani Publishers.

Reference Books:

1. Robbins. *Basic Pathology*. 10th Edition. Elsevier

Course outcomes (COs):

Upon successful completion of the course, a student will be able to

CO1	To examine the role of laboratory techniques including sample collection and investigation procedures.
CO2	To discuss the basics of human genetics, DNA, techniques of Molecular biology and cytogenetics.
CO3	To demonstrate the principle and applications of various molecular techniques used in the laboratory.
CO4	To Explain the concept of important instruments with their principle and applications.
CO5	To assess the blood transfusion studies and procedures conducted in Blood Bank.
CO6	To prepare the classification and diagnosis of Haemolytic and malignant disorders in detail.

CO-PO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	-	-	-	-	3	-
CO2	-	-	-	-	-	2	-	-	-	-	-	-
CO3	-	-	-	-	-	2	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	-	1	-
CO5	-	-	-	-	-	-	-	-	-	3	-	-
CO6	-	-	-	-	-	1	-	-	-	-	-	-

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

M.Sc MLT

Course code	: MMLT 104
Course Name	: General Pathology
Semester /Year	: 1 st year

	L	T	P	C
	02		01	03

L - Lecture T – Tutorial P – Practical C – Credit

Course Contents

General Pathology	2 hours/Week
<p>Unit-1 General introduction to pathology causes of cell injury, cell injury and necrosis Apoptosis and sub-cellular responses to cell injury Cellular responses to growth and differentiation, pathologic calcification. Acute and chronic inflammation, morphologic patterns of acute and chronic inflammation, systemic effects of inflammation Complements and their functions Cytokines and their functions Intracellular accumulation, gangrene – pathology and classification, pathogenesis and classification of edema, reticulocyte structure. Pathogenesis of thrombosis, embolism, infarction and shock.</p> <p>Unit-2 Control of normal growth, cell cycle illustration and the regulation of cell division, labile cells, stable cells, permanent cells, molecular events in cell growth (autocrine signalling, paracrine signaling, endocrine signaling), cell surface receptors, signal transduction systems and transcription factors.</p> <p>Growth inhibition, growth factors, extra cellular matrix and cell matrix interactions, collagen, elastin, fibrillin and elastic fibres, adhesive glycoproteins and integrins, matricellular proteins, proteoglycans and hyaluronidase.</p> <p>Repair by connective tissue-angiogenesis, growth factors and receptors for angiogenesis, extra cellular matrix proteins as regulators of angiogenesis.</p> <p>Fibrosis, tissue modeling, wound healing, healing by first and second intention. Haemo dynamic disorders – hemostasis and thrombosis.</p> <p>Unit-3</p> <p>Genetics (molecular basis of human diseases, production of human biologically active agents, gene therapy, disease diagnosis, mutations, mendelian disorders, autosomal dominant disorders, autosomal recessive disorders and X linked disorders</p> <p>Biochemical and molecular basis of single gene disorders.</p> <p>Disorders with multifactorial inheritance, normal karyotype, fluorescence in situ hybridization, cyto genetic disorders involving sex chromosomes.</p>	

Diagnosis of genetic diseases. Direct gene diagnosis, indirect gene diagnosis, linkage analysis.

Unit – 4

Neoplasia, Nomenclature, characteristics of benign and malignant neoplasms. Molecular basis of cancer, oncogenes and cancer, protein products of oncogenes./Activation of oncogenes, point mutations, chromosomal rearrangements, gene amplification, cancer. Suppressor genes, protein products of tumor suppressor genes. Molecules that regulate nuclear transcription and cell cycle, Rb gene, P53 gene, BRCA-1 and BRCA-2 gene, molecules that regulate signal transduction, cell surface receptors, other tumor suppressor genes. Genes that regulate apoptosis and DNA repair, Telomeres and cancer, molecular growth, Kinetics of tumor cell growth, tumor, tumor angiogenesis. Lab diagnosis of cancer.

Practicals

Polymerase chain reaction

In situ hybridization

Cytogenetics

Unit - 5

Infectious diseases, new and emerging infectious diseases, categories of infectious diseases in brief, special techniques for diagnosing infections

Tuberculosis-etiology, pathogenesis and lab diagnosis Leprosy – etiology, pathogenesis and lab diagnosis HIV- epidemiology, pathogenesis and lab diagnosis

Practicals

Western blot

Northern blot

Southern blot

CD4 CD8 counts

Systemic pathology

PAS (Periodic Acid-Schiff) stain Romanowsky stain. Stain for micro-organisms Argentaffin and argyrophil stains Amyloid stains, Reticulin stains Trichrome stains, Phosphotungstic acid, hematoxylin stain (PTAH). Stains for hemodierin (Perls), melanin (Fontana) and calcium (von Kossa) Stains for neutral lipids, Mucin stains Glemsa stain Elastic fibers Myelin stains.

Enzyme histochemistry and immunoenzyme technique. Immunohistochemistry and the various immunohistochemical stains in the diagnosis of various disorders, Tissue of special interest– nervous system Hard tissue. Miscellaneous cells, Endocrine cells, Cytology technique, Quantitative methods, Autoradiography (specimen radiography), Microincineration, Museum technique, Specimen photography and microphotography, Microscopy.

- General microscopy
- Dark ground microscopy
- Immunofluorescence and fibers and formaldehyde induced fluorescence
- Fluorescence microscopy
- Polarizing microscopy
- Phase contrast microscopy
- Electron microscopy

Flow cytometry

Other methods for analysis of cell proliferation and Nucleolar Organiser region evaluation polymerase chain reaction and application of PCR technology in Pathology cytogenetics interphase cytogenetics.

Text Books:

1. Harshmohan. *Text book of Pathology*. 8th Edition. Jaypee Publishers.
2. Godkar. *Text Book of Medical Laboratory Technology*. Third Edition. Volume 1&2. Bhalani Publishers.
3. Ramnik Sood. *Text Book of Medical Laboratory Technology*. Second Edition. Jaypee Publishers.

Reference Books:

4. Robbins. *Basic Pathology*. 10th Edition. Elsevier.

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	To describe the basics of pathological processes including cell death and injury, inflammation and thrombosis.
CO2	To discuss the basics of the cell cycle, regulation of cell division and cell signalling mechanism.

CO3	To demonstrate the concept of molecular genetics of human diseases, disorders and diagnosis.
CO4	To Explain the nomenclature, characteristics of neoplasia and its molecular studies.
CO5	To assess the lab diagnosis, etiology and pathogenesis of emerging diseases.
CO6	To generalize the concept of various pathological and analytical techniques

CO-PO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	3	-	-	-	-	-	-	-
CO2	1	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	3	-	-	-	-	-	-
CO4	-	-	-	-	3	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	2	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	2	-

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

M.Sc MLT

Course code	: MMLT 105
Course Name	: Epidemiology & Biostatistics
Semester /Year	: 1 st year

	L	T	P	C
	02		01	03

L - Lecture T – Tutorial P – Practical C – Credit

Course Contents

Epidemiology & Biostatistics	2 hours/Week
<u>Epidemiology:</u>	
<ol style="list-style-type: none"> 1. Epidemiology - definition, concept and role in health and disease. 2. Definition of the terms used in describing disease transmission and control. 3. Modes of transmission and natural history of a disease 4. Measures for prevention and control of communicable and non-communicable disease. 5. Principal sources of epidemiological data. 6. Definition, calculation and interpretation of the measures of frequency of diseases and mortality. 7. Need and uses of screening tests. 8. Accuracy and clinical value of diagnostic and screening tests (sensitivity, specificity, & predictive values). 9. Causal Association & Various types of epidemiological study designs <p>Critical evaluation of published research.</p>	
<u>Biostatistics:</u>	
<p>Frequency distribution: diagrams, characteristics of a frequency distribution Basic distribution statistics: measures of central tendencies. Measures of variation/dispersions Confidence intervals. Measures of accuracy and precision Statistical sampling methods. Basic for statistical inference Sampling distribution Statistical inference. Statistical inference. Type I and Type II errors. Parametric comparison of populations. The null hypothesis and statistical significance Comparison of means test including paired test One way analysis of variance (Anova). Non Parametric distribution statistics Sign test Mann-whitney rank sum test X^2 (Chi Square) test. Linear regression and correlation Scatter diagram Correlation coefficient Regression coefficient Multiple regression. Sensitivity, specificity and predictive values Receiver – operating characteristics curve.</p>	

Text Books:

1. Gupta. *Research Methodology*. Second Edition. International Book House Ltd.

Reference Books:

1. Kothari. *Research Methodology*. Fourth Edition. New Age International Publishers.

Course outcomes (COs):**Upon successful completion of the course a student will be able t**

CO1	To describe the epidemiology of the disease, its transmission and control.
CO2	To discuss the importance of prevention and control of communicable and non-communicable diseases and interpretation of the epidemiological data.
CO3	To present the published research including the need of screening tests, its accuracy and types of study design.
CO4	To analyse the data using various statistical sampling methods.
CO5	To evaluate the data using statistical interference methods
CO6	To prepare a result out of the data using Anova.

CO-PO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	-	-	3	-	-	-
CO2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	2	-	-	-	-	-
CO4	-	-	-	-	-	-	3	-	-	-	-	-
CO5	-	-	-	-	-	-	3	-	-	-	-	-
CO6	-	-	-	-	-	-	3	-	-	-	-	-

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

M.Sc MLT

Course code	: MMLT 201
Course Name	: Clinical Biochemistry, Endocrinology and Nutritional Biochemistry
Semester /Year	: 1I nd year

	L	T	P	C
	02		01	

L - Lecture T – Tutorial P – Practical C – Credit

Course Contents

2 hours/Week
<p><u>Clinical Biochemistry</u></p> <p>Unit-1 Clinical Enzymology: Enzymes in plasma and their origin, general principles of the assay, the clinical significance of enzymes and isoenzymes, measurement of serum enzymes in diagnosis- cardiac and skeletal muscle enzymes, liver and biliary tract enzymes digestive, bone GI disorders.</p> <p>Unit- 2 Disorders of Carbohydrates metabolism: diabetes mellitus- diagnosis, gestation diabetes mellitus, role of laboratory in diagnosis and prognosis in diagnosis and prognosis, hypoglycemia. Determination of glucose in body fluids, ketone bodies, lactate and pyruvate. Glycated proteins, urinary albumin excretion- specimen collection, storage and quantitative assay. Qualitative tests for individual sugars in urine. Inborn errors of metabolism.</p> <p>Disorders of lipid Metabolism: Atherosclerosis and coronary artery disease. Disorders of lipoprotein metabolism, Measurement of lipids, lipoproteins and apolipoproteins. Sources of analytical and biological variations in measurements.</p> <p>Disorders of Protein metabolism: plasma proteins, proteins in body fluids. Analysis of proteins n blood and other body fluids. Electrophoresis of plasma proteins. Amino acidurias- selected disorders of amino acid metabolism- phenylalanine, tyrosine, alkaptonuria, melanuria, cystinula, homocystinuria, cystinosis, organic acidurias, analysis of amino acids- screening test, quantitative tests for specific amino acids.</p> <p>Unit – 3 Disease relates to organs: Liver- LFT, Jaundice, hepatitis, cholestasis, kidney- RFT, renal failure, uremia, nephritic syndrome, renal calculi, renal tubular acidosis, diabetes insipidus, dialysis. Early makers of renal pathology- microalbuminuria, albumin: Creatinine ratio. GIT- Gastric and pancreatic function tests, pancreatitis, malabsorption syndrome.</p>

Unit-4 Electrolytes and blood gas analysis- specimens for electrolyte determination- sodium, potassium, chloride, bicarbonate, determination of pCO₂, O₂ and pH.

Unit- 5 Miscellaneous topics: Composition of CSF, meningitis, encephalitis, cancer, oncogenes, tumour markers, AIDS- basic concepts, diagnosis, Cytokinetics.

Endocrinology and Nutritional Biochemistry

Unit-1 General concepts of endocrinology- the endocrine system, hormones- chemical nature, classification, hormonal action- receptors, hormone receptor interaction, regulation of gene expression by hormones, second messengers (camp, GMP, Ca⁺⁺) protein kinase cascade. Concepts of hormones assay.

Unit-2 Hypothalamus and pituitary- anatomy, chemistry, functions, regulation, diseases related to the hormones of these glands. Assessment of anterior and posterior pituitary.

Unit-3 Thyroid anatomy, chemistry, synthesis, functions, regulation, thyroid function test in various abnormal conditions, parathyroid- anatomy, chemistry, synthesis, functions, regulations, diseases of parathyroid glands. Hormones involved in calcium and phosphate metabolism. Diseases related to its metabolism calcium chemistry and functions.

Unit-4 Adrenal cortex and medulla- anatomy, chemistry, synthesis, metabolic effects, pathophysiology of the adrenal cortex. Assessment of adrenal functions, Gonadal hormones- anatomy, chemistry, functions, regulations and diseases related to these glands. Endocrinology of male and female infertility, pregnancy and lactation.

Unit-5 Gastrointestinal and pancreatic hormones- chemistry, synthesis, metabolic effects, regulation, diseases related to the hormones of these glands. Detection of anomalies.

Unit-6 Nutritional requirements of carbohydrates, proteins and lipids: Deficiency states of carbohydrates, proteins and lipid. RDA, Nutritional requirements of vitamins (fat and water soluble)- Structure, function, deficiency states, dietary source, Nutritional requirements of macro and microelements- functions, deficiency states, dietary source, RDA.

Practicals

Procedures using automated Analyzers

1. Estimation of blood glucose, GT, glycated haemoglobin, fructosamine, urine microalbumin.
2. RFT- Estimation of blood urea, serum creatinine, uric acid, GFR, Urinary proteins, protein, creatinine ratio.
3. LFT- Estimation of total bilirubin, total protein, albumin, SGOT, SGPT, ALP,GGT
4. Lipid Profile-total cholesterol, triglycerides, HDL, LDL
5. Cardiac enzymes- creatinine kinase, CK-MB, LDh

6. Pancreatic function tests-amylase.
7. Estimation of calcium, Phosphorous, Magnesium, Iron
8. Electrolytes
9. Quantitative analysis of Urine-Protein, Uric acid, Creatinine, Calcium chloride
10. Analysis of CSF
11. Hormones: Thyroid profile- FT2, FT4, TSH, Fertility profile – LH, FSH, prolactin, estradiol, testosterone; cortisol, insulin
12. Tumor markers: P:SA
13. CAD risk assessment: Apo A, Apo B 100, hs Homocysteine, LPA(a).

Text Books:

1. Satyanarayan and Chakrapani, 2021. *Text Book Of Biochemistry*. 6 edition. Elsevier.
2. Vasudevan and Sree kumari, 1995. *Text Book of Biochemistry for Medical Students*. Edition 1, Jaypee Brothers, New Delhi.
3. Chatterjee and Rana Shinde. *Text Book of Medical biochemistry* . Jaypee Publishers.

Reference Books:

1. Styrer. *Biochemistry*. 9th edition. MacMillan
2. Harper. *Illustrated Biochemistry*. 32nd Edition. McGraw Hill.

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	To highlights clinical significance of enzymology & role of Isoenzymes and plasma enzymes-separation and identification, in clinical diagnosis and interpretation with reference to cardiac and skeletal muscle enzymes, liver and biliary tract enzymes digestive, bone GI disorders.
CO2	To interpret the metabolic Disorders of Carbohydrates e.g. diagnosis, gestation diabetes mellitus, role of laboratory in diagnosis and prognosis and qualitative and quantitative analysis and protein and clinical significance: analysis of amino acids- screening test, quantitative tests for specific amino acids.

CO3	To integrate the metabolic Disorders of protein and clinical relevance to Atherosclerosis and coronary artery disease, its analytical and biological variations.
CO4	To correlate the concept of nutrition in health and disease, micro and macronutrition and essential nutrients, hormones, electrolytes and vitamins with interlinks of nutrients with metabolism and functions of a living system.
CO5	To detect Disease relates to organs functions and its tests specific for its clinical significance and early diagnostic markers with skills for practical with clinical diagnosis, testing, understanding of biochemical conditions with clinical approach.
CO6	To compose knowledge of basics of research methodology, develop a research protocol, an assigned research project as dissertations, analyze data using currently available statistical software, interpret results and disseminate these results, to pursue further specializations and eventually develop to be competent researcher.

CO-PO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	-	2	-	-	-	-
CO3	1	-	-	-	-	-	-	2	-	-	-	-
CO4	-	1	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	2	-	-	-	-
CO6	-	-	-	-	-	-	2	-	-	-	-	-

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

M.Sc MLT

Course code	: MMLT 202
Course Name	: Systematic Bacteriology, Virology and Mycology
Semester /Year	: 1I nd year

	L	T	P	C
	02		01	03

L - Lecture T – Tutorial P – Practical C – Credit

Course Contents

2 hours/Week
<p>Systemic Bacteriology</p> <p>Unit – 1 Gram-positive cocci- Staphylococci, Pneumococci, Streptococci. Gram-Negative cocci – N. gonorrhoeae, N. meningitides.</p> <p>Unit – 2 Gram-positive bacilli- Corynebacteria, Mycobacteria, Clostridia, Actinomycetes Bacillus Anaerobes.</p> <p>Unit- 3 Gram negative bacilli – Enterobacteriaceae, Pseudomonas, Vibria Brucella, Bordetella, Haemophilus, Yersinia.</p> <p>Unit – 4 Spirochetes – Treponema, Leptospira, Borrelia. Rickettsiae, Chlamydiae, Miscellaneous bacteria.</p> <p>Practicals i) Introduction of Clinical specimen, identification of bacteria, staining methods Biochemical tests, antibiotic sensitivity testing. ii) Darkground microscopy, special staining methods, use of experimental animals Food milk and water bacteriology. iii) Air Sampling and theatre sterility.</p> <p>Virology</p> <p>Unit – 1 Classification and general properties of viruses – interferon, inclusion bodies Cultivation of viruses and laboratory diagnostic methods of viral diseases.</p> <p>Unit – 2 Pox virus, herpes virus, myxoviruses, enteroviruses.</p> <p>Unit – 3 Rabies, Arbo viruses, hepatitis, HIV, viruses causing gastro enteritis, miscellaneous viruses.</p> <p>Practicals i) Tissue culture methods. ii) Fluorescent microscopy, ELISA, PCR</p> <p>Mycology</p> <p>Unit – 1 General properties of fungi, cultivation methods, laboratory methods of diagnosing fungal infection.</p> <p>Unit – 2 Superficial and deep fungal infections, opportunistic fungal infection. Mycotoxins</p> <p>Practicals i) Identification of fungi, microscopy, culture, special staining methods.</p>

Text Books:

1. Sastry and Bhat, 2021. *Essentials of Medical Microbiology*. Third Edition. Jaypee publishers.
2. Baweja, 2018. *Textbook of Microbiology*. Sixth Edition. Arya Publications.

Reference Books:

1. Ananthanarayan and Paniker's. *Textbook of Microbiology*. Twelvth Edition. Orient Blackswan.
2. Greenwood, *Medical Microbiology*. Eighteenth Edition. Churchill Livingstone Elseiver.

Course outcomes (Cos)

Upon successful completion of the course a student will be able to

CO1	To describe the etiologic characters, pathogenesis, lab diagnosis and treatment of Gram-positive bacteria.
CO2	To classify the pathogenic role of Gram-negative bacteria and spirochetes with special reference to their pathogenicity, Lab diagnosis and treatment.
CO3	To illustrate the classification, general properties and cultivation of Viruses.
CO4	To analyse the life cycle of pathogenic viruses with special emphasis on their multiplication and treatment.
CO5	To assess the importance of fungi, their cultivation methods and lab diagnostic procedures.
CO6	To generalize the identification methods for superficial, opportunistic fungal infections and mycotoxins.

CO-PO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	-	-	-	-	-	-	2	-	-	-
CO2	1	-	1	-	-	-	-	-	2	-	-	-
CO3	1	-	-	-	-	-	-	-	2	-	-	-
CO4	1	-	-	-	-	-	-	-	2	-	-	-
CO5	1	-	-	-	-	-	-	-	2	-	-	-

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

M.Sc MLT

Course code	: MMLT 203
Course Name	: Advances Haematology and Immuno Haematology
Semester /Year	: 1I nd year

	L	T	P	C
	02		01	03

L - Lecture T – Tutorial P – Practical C – Credit

Course Contents

Advanced Haematology and Immuno Haematology.	2 hours/Week
<p>Coagulation disorders and basics of their work up Thrombotic disorders and basics of testing Automated cell counters and coagulation analysers – principles Manual Haemoglobin and Counts. Peripheral smear –Preparation and Interpretation Manual tests of coagulation, factor assays. Urine and stool – analysis, micro and interpretation Immunohaematology: Basic Genetics and immunology ABO and Rh blood group systems. Other major blood group systems – clinical significance of Compatibility testing, Antibody screening and identification, clinical significance of Choice of reagents and QA of the same Donor Screening and bleeding. Blood bags, Anticoagulant and preservative solutions Blood Components – preparation, Quality control Apheresis. Infectious disease screening. Transfusion reactions, Haemolytic Disease of the Newborn Some basics of appropriate use of blood. Choice of blood in specific clinical scenarios – HDN, Multiply transfused etc Basics of HLA typing and anti-HLA antibody detection.</p>	

Text Books:

1. Tejinder Singh. *Text Book of haematology*. Arya Publications.
2. Rakesh Joshi. *Text Book of Clinical pathology, Haematology and Blood Banking*.

Reference Books:

1. Robbins. *Basic Pathology*. 10th Edition. Elsevier

Course outcomes (Cos)

Upon successful completion of the course a student will be able to

CO1	To describe the basics of blood disorders and analysis using analytical techniques.
CO2	To discuss the analysis and interpretation of urine and stool.
CO3	To illustrate the immunohematology techniques for studying the Blood group system.
CO4	To explain the Blood group compatibility and its clinical significance.
CO5	To evaluate quality control of blood bank system.
CO6	To develop an understanding of transfusion reactions and HDN disease.

CO-PO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	-	-	-	-	-	-	-	2	-	-
CO2	-	-	-	-	-	-	-	-	-	-	2	-
CO3	1	-	-	-	-	-	-	-	-	2	-	-
CO4	-	-	-	-	-	-	-	-	-	-	3	-
CO5	-	-	-	-	-	-	-	-	-	2	1	-
CO6	1	-	-	-	-	-	-	-	-	-	2	-

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

M.Sc MLT

Course code	: MMLT 204
Course Name	: Techniques in Histopathology
Semester /Year	: 1I nd year

	L	T	P	C
	02		01	03

L - Lecture T – Tutorial P – Practical C – Credit

Course Contents

Techniques in Histopathology and Cytology	2hrs/ Week
Unit -1	
PAS (Periodacid – Schiff) Stain Stain for micro-organisms Argentaffin and argyrophil stains Amyloid stains. Reticulin Stains Trichrome stains. Posphotugstic acid hematoxylin stain (PTAH) Stains for hemosiderin, Melanin and CA Stains for neural lipids. Mucin stains Giemsa Stain Elastic stain Myelin stain Romanowsky stain	
Unit - 2	
Enzyme histochemistry and immunoenzyme techniques. Immunohistochemistry and the various immunohistochemical stains in the diagnosis of various –disorders. Tissues of special interest – nervous system Hard tissue. Miscellaneous cells Endocrine cells	
Unit – 3	
Cytology techniques Quantitative methods Micro incineration.	
Unit – 4	
Autoradiography Museum tech. Specimen photography and microphotography.	
Unit -5	
Microscopy General Microscopy. Dark ground microscopy Immunofluoresence	

Text Books:

1. Sadhana Vishwakarma. *Techniques in Histopathology & Cytopathology*. Jaypee Publishers.
2. Ramdas Nayak. *Histopathology techniques*. Jaypee Publishers.

Reference Books:

1. Robbins. *Basic Pathology*. 10th Edition. Elsevier

Course outcomes (COs)

Upon successful completion of the course a student will be able to

CO1	To memorize the basic histopathological staining techniques.
CO2	To extend the knowledge on enzyme histochemistry and immunoenzyme techniques.
CO3	To apply the concept of immunohistochemistry in the diagnosis of various disorders.
CO4	To explain the Cytology techniques, quantitative methods and micro incineration.
CO5	To evaluate the applications of autoradiography techniques for disease diagnosis.
CO6	To develop an understanding of Microscopy, its types and immunofluorescence.

CO-PO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	-	-	-	-	-	-	-	-	-	2
CO2	1	-	-	-	-	-	-	-	-	-	2	-
CO3	1	-	-	-	-	-	-	-	-	-	2	-
CO4	-	-	-	-	-	-	-	-	-	-	-	3
CO5	-	-	-	-	-	-	-	-	-	-	-	2
CO6	-	-	-	-	-	-	-	-	-	-	2	-

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated