



**Bachelor of Science in
Medical Laboratory Technology
(B.Sc. MLT)**

CURRICULUM

POKHARA UNIVERSITY

2006

**Bachelor of Science in
Medical Laboratory Technology
(B.Sc. MLT)**

CURRICULUM

POKHARA UNIVERSITY

2006

Bachelor of Science in Medical Laboratory Technology (B.Sc. MLT) Program

GOALS

Clinical Laboratory Science is one of the important areas in Health Sciences, which supports the clinicians by providing laboratory test evidences in the treatment of patients. The goal of this curriculum is to produce clinical laboratory experts who are academically sound, technically skilled and fully capable of performing various clinical laboratory tests with quality control as well as interpretation of the results.

Pokhara University is aiming to produce highly qualified graduates and subsequently to promote research excellence in a free and scholastic environment.

Pokhara University has the goal to make students able to appreciate the sanctity of life that enables them to make a valuable contribution to medical treatment and people's health.

OBJECTIVES

The courses for BMLT program have been designed to achieve the following objectives:

- Provide adequate educational background for careers in Medical Laboratory Science profession
- Study and strengthen the existing Medical Laboratory Science practices in the private and public institutions through continuing education and training programs
- Assist Medical Laboratory Science and related organizations in solving their problems by providing consulting services
- Contribute to Medical Laboratory Science literature relevant to Nepal through research and publications.

ROLE of BMLT GRADUATES

After graduation, BMLT degree holders, start their profession as a Clinical Laboratory Experts. Their knowledge and technique are applied as a tool to diagnose the diseases. Therefore, the diagnosis of a medical doctor is further confirmed by the laboratory tests. Their services are essential in every hospital, clinic and research center. They practice according to regulation of Health Professional Council of HMG of Nepal. Major role of BMLT graduates will be as in the following area:

- Hospital and clinic
- Health care center
- Drug administration agency
- Industry
- University
- Environment protection

CAREER OPPORTUNITIES

After obtaining the BMLT degree, s/he will be eligible for rewarding employment in the following areas:

- Academic Field
- Hospital and Clinic
- Health Research Council
- Health Research Laboratory
- Pharmaceutical Industry
- Governmental Drug Administration
- Adverse Drug Reaction Monitoring Service
- Health Food Development, etc

AN INTRODUCTION TO BScMLT. PROGRAM

A. GENERAL

1. Title

The official title of the program is Bachelor of Science in Medical Laboratory Technology (B. Sc. MLT.). In short it may be referred as BMLT unofficially.

2. Objective

The objective of the B. Sc. MLT. program is to produce a qualified Clinical Laboratory Experts.

3. Course structure

- The B. Sc. MLT. course comprises of 17 credit hours in first semester, 19 credit hours each in second to seventh semester and 9 credit hours in eighth semester, with the total of 140 credit hours spreading over eight semesters.
- Three credit hours of theory or one credit hour of practical or one credit hour of seminar is equivalent to 45 hours work load per semester.
- All theory courses will be of three credit hours and all practical courses will be of one credit hour. The internship source will be of 3 credit hours. Project works will be of 6 credit hours.
- An average involvement of a student in University will be of 6 h/day, i. e. 36 h/week (Sunday to Friday). Approximate active weeks will be of 15 weeks/semester therefore, in total, the student will be engaged 540 h/semester. Students must carry on duties in the hospital as guided by the University.
- Each theory class will be of 55 minutes and after two continuous theory classes there will be a break of 15 minutes. Each practical class will be of minimum three hours. Seminar program will be compulsory and considered as noncredit course.
- Subject Code will be as follow based on the importance of the subjects:

0	MBL/MLS	=	Microbiology/ Medical Laboratory Science
1	PTL	=	Pathology
2	BCM/HML	=	Biochemistry/Hematology
3	APL	=	Anatomy and Physiology
4	CBL	=	Cell Biology
5	HTL/CTL	=	Histology/Cytology
6	IML	=	Immunology
7	CHM	=	Chemistry
8	HAD	=	Health and Disease
9	Others	=	English (ENG), Biostatics (MTH) Research (RES) and Project Work (PRW)

4. Course coding

Each course is identified by three capital letters followed by four digits. Three letters indicate the subject area (e.g., MBL for microbiology, MTH for mathematics etc). The first digit of each number indicates the academic year of the course (1 for first year, 2 for second year and so on). The second digit indicates the priority subject (*see* subject code as mentioned above), the third digit indicates the

sequence and the fourth digits after decimal, indicates the number of credit hours of the course (MBL 102.3 is a first year course of 3 credit hours).

5. Duration and academic schedule of the program

The program of study for B. Sc. MLT. will be over a period of eight semesters (four academic years). In exceptional case, however, the course can be completed within six years from the time of admission. The academic session consists of two semesters per year. The Fall semester (September - February) starts in September and the Spring semester (March-July) begins in March.

6. Medium of teaching and examination

The medium of instruction, text books in all subjects and examination for B. Sc. MLT. program will be English.

B. ADMISSION AND EXAMINATION

1. Entry requirement for new student

The applicants must have minimum of 50% aggregate marks/grades in 10+2 (Science Stream) or PCL (Science) or I. Sc. or equivalent in addition with the minimum of 50% aggregates marks in Physics-Chemistry-Biology (PCB) to apply for the entrance examination. Besides the basic academic requirement, an entrance examination will be held for all applicants.

2. Admission procedure

The application form and the information can be obtained on request from Pokhara University, Pokhara or concern college. Only the eligible candidates will be allowed to take part in the entrance test.

The subjects in the entrance test will be Chemistry, Biology, Mathematics, and English, according to the syllabus of higher secondary (10+2) level. The University may also hold interviews for the candidates before their final selection for admission, if necessary. The candidates will be admitted on merit basis. Eligible foreign national students may be admitted against limited seats on the basis of an interview.

The candidate, who is given provisional admission under special the condition, is required to submit all necessary documents before regular classes. Otherwise, the admission will be annulled.

3. Student evaluation

The student's academic performance during a semester will be evaluated internally (session work) and externally (the final examination). The session work examination will be evaluated by the teaching Faculty and it will be of 50% weight. The remaining 50% will be the final examination, conducted by University.

In the Practical courses, no final examination will be conducted and the session marks shall be awarded on the basis of continual assessment. Normally, final examinations are not conducted in courses which are offered as intensive courses conducted by reputed international scholars.

To pass a course, a student must obtain a minimum of D grade in session work (an average of three internal assessments) and the final examination, separately.

4. Attendance Requirement

The students must attend every lecture, tutorial, seminar and practical classes. However, to accommodate for sickness and other contingencies, the attendance requirement shall be a minimum of 80% of the classes in any particular subject, otherwise s/he shall not be allowed to take the final examination in that subject. If a student is continuously absent from the college for more than four weeks without notifying the head of the institution, his/her name will be removed from the school roll.

5. Course Registration

The academic record of a student is maintained in terms of the courses for which s/he registers in any semester, and the grades s/he obtains in those courses. Registration for courses is done at the beginning of each semester.

6. Final Examination

University conducts final examination at the end of each semester. The procedure of final examination conduction will be as per the examination rules of the University.

7. Scrutinizing of Final Examination Paper

Students may apply for retotaling or rechecking of their grades as per University rule, upon payment of prescribed fee.

C. GRADING SYSTEM

The grades (marks) awarded to student in a course is based on his/her consolidated performance in session and final examinations. The letter grade in any particular subject is an indication of a student's relative

performance in that course. The pattern of grading will be as follows:

Letter	Grade	Grade point description
A	4.0	Excellent
A-	3.7	
B+	3.3	
B	3.0	Good
B-	2.7	
C+	2.3	
C	2.0	Satisfactory
C-	1.7	
D+	1.3	
D	1.0	Minimum requirement
F	0	

In unusual circumstances, the student may be awarded an incomplete grade of "I". If all the requirements are not completed within the following semester, the grade of "I" will be automatically converted to an "F". A student receiving an "I" grade does not need to register for that subject in the following semester to complete the required works.

The performance of a student in a semester will be evaluated in terms of the semester grade point average (SGPA). The student's final grade will be calculated on cumulative grade point average (CGPA).

D. AWARD OF DEGREE

To award a degree of Bachelor of Sciences in Medical Laboratory Technology (B. Sc. MLT.):

- i) The student must complete total prescribed credits including theory, practical, seminar, compulsory training in hospital and project work within prescribed period.
- ii) CGPA must be 2.0 or more.

E. OTHER

All other rules and regulations will be followed as already established by Pokhara University.

CURRICULUM STRUCTURE
B. Sc. MLT

FIRST YEAR

FIRST SEMESTER

Code	Subject	Credit hours	Pre-requisite course	Core course
MLS 101.3	Medical Laboratory Science (Fundamentals of Medical Laboratory Science)	3	-----	☼
MBL 102.3	Microbiology I (Fundamentals)	3	-----	☼
CHM 171.3	General Chemistry I (Fundamentals and Analytical Technique)	3	-----	---
CHM 172.3	General Chemistry II (Structure and Reaction)	3	-----	---
MTH 191.3	Biostatistics	3	-----	---
LAB-1.1	Laboratory 1	1	-----	---
LAB-2.1	Laboratory 2	1	-----	---
TOTAL		17		

SECOND SEMESTER

Code	Subject	Credit hours	Pre-requisite course	Core course
BCM 121.3	Biochemistry I (General)	3	-----	---
APL 131.3	Anatomy and Physiology I	3	-----	---
CTL 151.3	General Cytology	3	-----	☼
HTL 152.3	Histology (General)	3	-----	☼
CHM 173.3	Analytical Chemistry (Instrumentation)	3	-----	---
LAB-3.1	Laboratory 3	1	-----	---
LAB-4.1	Laboratory 4	1	-----	---
LAB-5.1	Laboratory 5	1	-----	---
SEM-1.1	Seminar 1	1	-----	---
TOTAL		19		

**CURRICULUM STRUCTURE
B. Sc. MLT**

SECOND YEAR

THIRD SEMESTER

Code	Subject	Credit hours	Pre-requisite course	Core course
MBL 201.3	Microbiology-II (Bacteriology)	3	MBL 102.3	☼
BCM 221.3	Biochemistry II (General)	3	BCM 121.3	---
APL 231.3	Anatomy and Physiology II	3	APL 131.3	---
CBL 241.3	Molecular Cell Biology (Genetic Engineering)	3	-----	☼
IML 261.3	Immunology (Fundamentals)	3	-----	---
LAB-6.1	Laboratory 6	1	-----	---
LAB-7.1	Laboratory 7	1	-----	---
LAB-8.1	Laboratory 8	1	-----	---
SEM-2.1	Seminar 2	1	-----	---
TOTAL		19		

FOURTH SEMESTER

Code	Subject	Credit hours	Pre-requisite course	Core course
MBL 202.3	Microbiology III (Bacteriology)	3	MBL 201.3	☼
PTL 211.3	General Pathology	3	-----	☼
PTL 212.3	Cytopathology	3	-----	☼
BCM 222.3	Biochemistry III (Clinical)	3	BCM 221.3	☼
HAD 281.3	Health and Disease (General Clinical Problem)	3	-----	---
LAB-9.1	Laboratory 9	1	-----	---
LAB-10.1	Laboratory 10	1	-----	---
LAB-11.1	Laboratory 11	1	-----	---
SEM-3.1	Seminar 3	1	-----	---
TOTAL		19		

**CURRICULUM STRUCTURE
B. Sc. MLT**

THIRD YEAR

FIFTH SEMESTER

Code	Subject	Credit hours	Pre-requisite course	Core course
MBL 301.3	Microbiology IV (Parasitology)	3	MBL 202.3	☼
PTL 311.3	Histopathology I	3	-----	☼
BCM 321.3	Biochemistry IV (Clinical)	3	BCM 222.3	☼
BCM 323.3	Applied Biotech (Modern Tools in Biochemistry)	3	-----	☼
HML 322.3	Hematology I	3	-----	☼
LAB-12.1	Laboratory 12	1	-----	---
LAB-13.1	Laboratory 13	1	-----	---
LAB-14.1	Laboratory 14	1	-----	---
SEM-4.1	Seminar 4	1	-----	---
TOTAL		19		

SIXTH SEMESTER

Code	Subject	Credit hours	Pre-requisite course	Core course
MBL 302.3	Microbiology-V (Virology)	3	MBL 301.3	☼
MBL 303.3	Microbiology-VI (Mycology)	3	MBL 301.3	☼
PTL 312.3	Histopathology II	3	PTL 311.3	☼
BCM 324.3	Biochemistry-V (Clinical)	3	BCM 321.3	☼
HML 325.3	Hematology II	3	-----	☼
LAB-15.1	Laboratory 15	1	-----	---
LAB-16.1	Laboratory 16	1	-----	---
LAB-17.1	Laboratory 17	1	-----	---
SEM-5.1	Seminar 5	1	-----	---
TOTAL		19		

**CURRICULUM STRUCTURE
B. Sc. MLT**

FOURTH YEAR

SEVENTH SEMESTER

Code	Subject	Credit hours	Pre-requisite course	Core course
MBL 401.3	Microbiology-VII (Clinical)	3	MBL 302.3	☼
PTL 411.3	Autopsy and Medical Jurisprudence	3	-----	☼
BCM 421.3	Biochemistry-VI (Toxicology)	3	BCM 323.3	☼
HML 422.3	Immuno-Hematology and Blood Bank	3	HML 325.3	☼
RES 491.3	Clinical Laboratory Research	3	-----	---
LAB-18.1	Laboratory 18	1	-----	---
LAB-19.1	Laboratory 19	1	-----	---
LAB-20.1	Laboratory 20	1	-----	---
SEM-6.1	Seminar 6	1	-----	---
TOTAL		19		

EIGHTH SEMESTER

Code	Subject	Credit hours	Pre-requisite course	Core course
INT 491.3	Internship	3	-----	---
PRW 492.6	Project Work	6	-----	---
TOTAL		9		

☼ represents the core course.

Note:

A project work will be assigned in eighth semester and the topic for the Project will be decided by Head of the Department. This project work should be completed and submitted to Program Director before the final examination.

THE CONTENT OF SYLLABUS

**BMLT
First Year
First Semester**

MLS 101.3 (Credit hours 3)

Medical Laboratory Science (Fundamentals of Medical Laboratory Science)

BMLT, First Year, First Semester

Course Objectives:

The students will become familiar with the commonly used terminology in medical laboratory practice, which shall provide a broad view of Clinical Laboratory Sciences.

Course Contents:

- 1. Introduction to Laboratory Sciences** **5 hours**
Historical development, Role of clinical laboratory science in health care, Role of clinical laboratory scientists, Structure of clinical laboratory services in Nepal, International and national organization in laboratory practice.
- 2. Laboratory Safety Rules** **5 hours**
Laboratory hazard and accidents, Safe laboratory design and organization, Preventing laboratory infection, Pipetting and dispensing safety, Safe use and storage of chemical and reagent, WHO guide lines for clinical laboratory biosafety, Biological safety cabinet.
- 3. Clinical Laboratory Organization** **4 hours**
Operational standard and management, Staffing, Element of the services, The Laboratory Manual or protocol accommodation, equipment, training, safety precautions, quality assurance, use of computer in clinical laboratory.
- 4. The General Clinical Laboratories** **21 hours**
Introduction, purposes and practice in a) Microbiology, b) Pathology, c) Biochemistry, d) hematology and e) Blood bank laboratories.
- 5. Research and Literature in Clinical Laboratory** **10 hours**
Medical Dictionaries, Merck Index, Indian Pharmacopoea (IP), British Pharmacopoea (BP), United States Pharmacopoea (USP), European Pharmacopoea (EP), Japanese Pharmacopoea (JP), Nepalese Formularies, General Medical Books, Journals, Original research articles, Review, Pubmed Database, Role of seminar and conference, Role of literature on research.

Reference Books:

1. Clinical Diagnosis and Management by Laboratory Methods. 20th Ed. John Bernard Henry M. D. W. B. Saunders Co. Philadelphia.
2. Mackie and McCartney, *Practical Medical Microbiology*, 14th Ed.
3. Monica Chees Brough: *Medical Laboratory Manual for tropical countries*, volume I, II.
4. WHO: *Laboratory biosafety Manual*.
5. Mapping the literature of Clinical Laboratory Science JMLA, 2003; July91 (3)303-3110(1999a).
6. A brief history of medical diagnosis and the birth of the clinical laboratory: Part 1. Ancient times through the 19th century. *Medical Laboratory Observer* (July), 28-40.
7. Berger, D. (1999b). A brief history of medical diagnosis and the birth of the clinical laboratory: part 2. Laboratory science and professional certification in the 20th century. *Medical Laboratory Observer* (August), 32-38.
8. Berger, D. (1999c). A brief history of medical diagnosis and the birth of the clinical laboratory Part 3. Medicare, government regulation, and competency certification. *Medical Laboratory Observer* (October), 40-44.
9. Berger, D. (1999d). A brief history of medical diagnosis and the birth of the clinical laboratory: Part 4. Fraud and abuse, managed care, and lab consolidation. *Medical Laboratory Observer*(December), 38-42.
10. Bailey and Scott's *Diagnostic Microbiology*, 9th edition.

MBL 102.3 (Credit hours 3)

Microbiology I (Fundamentals)

BMLT, First Year, First Semester

Course Objectives:

This course will provide the basic knowledge on microbiology and its general application to Medical Laboratory Sciences.

Course Contents:

- 1. History of Microbiology** **3 hours**
Historical development of microbiology, Major contributor and their discoveries with the reference to Antony van Leuwenhook. Louis Pasteur, Robert Koch. Joseph Lister, Edward Jenner
- 2. Characteristics of Microorganisms** **2 hours**
Prokaryotes, Eukaryotes, Viruses, Prions
- 3. Types of Microscopes and their uses** **5 hours**
Light microscope, Phage contrast microscope, Fluorescence microscope, Dark field microscope, Electron microscope
- 4. Staining** **4 hours**
Various type of stains and their classification, Principle of staining and their preparation and uses, Gram stain, Ziehl Neelsen stain and other stains in laboratory
- 5. Safety in Microbiology Laboratory** **3 hours**
Laboratory contamination and laboratory associated infection, Classification of microorganism on the basic of hazard, Disposal of infectious materials, Laboratory safety measures, Types of biological safety cabinets, Laboratory discipline and practices
- 6. Sterilization and Disinfection** **6 hours**
Concept of sterilization, Antisepsis, Disinfection, Physical agents: Sun light, Heat, Radiation, Filtration, chemical agents: Alcohols, Phenolic agents, Aldehydes, Other chemical agents and gases
- 7. Morphology, Physiology and Classification of Bacteria** **8 hours**
Size and shape of bacteria, Bacterial anatomy, Cytoplasmic membrane, Cytoplasm, Ribosomes, Mesosomes, Intracytoplasmic inclusions, Nucleus, Slime layer and capsule, Flagella, Fimbriae, Bacterial spores, Pleomorphism and Involutional forms, Growth and multiplication of bacteria, Bacterial growth curve, Bacterial nutrition
- 8. Culture Media** **5 hours**
Basal media, enriched media, Enrichment media, Selective media, Indicator media, Differential media, Sugar media, Transport media, Anaerobic media
- 9. Culture Methods** **3 hours**
Aerobic culture: the streak culture, the Lawan culture, the stroke culture, sub culture, pour plate culture, sweep plate method, Liquid cultures. Anaerobic culture, Cultivation of fungus, Cultivation of parasites, Cultivation of viruses
- 13. Identification of Microorganisms** **6 hours**
Morphology, Staining reactions, Cultural characteristics, Resistance, Metabolism, Fermentation and other biochemical properties, Antigenic structure, Pathogenicity, Advanced technology

Reference Books:

1. Stainer, *General Microbiology*: Latest Edition
2. Hans g. Schlegel, *General microbiology*, Cambridge Low Price Edition
3. Mackie and Mc Cartney, *Practical Medical Microbiology*, 13th Edition
4. R.anantanarayan, *Text book of Microbiology*, 6th edition, Orient Longman
5. Monica Cheesbrough, *Medical Laboratory Manual for Tropical Countries*, Volume I, and II
6. Laboratory Biosafety Manual WHO.

CHM 171.3 (Credit hours 3)

General Chemistry I (Fundamentals and Analytical Technique)

BMLT, First Year, First Semester

Course Objectives:

This course is designed to understand fundamentals of chemistry and principles of qualitative and quantitative analysis.

Course Contents:

- 1. Atomic Structure** **8 hours**
Bohr's theory and refinements, Wave mechanical model of the atom, Matter wave, de Broglie's equation, Heisenberg's uncertainty principle, Shapes of s, p, d orbitals, Quantum numbers and their significance, Energy level diagram
- 2. Chemical Bonding** **6 hours**
General characteristics of covalent bond, electrovalent bond, coordinate covalent bond, hydrogen bond, and Van der Waals force and their biological significance, Hybridization, Inductive effective, Electrometric effect, Mesomerism, Resonance, Hyperconjugation.
- 3. Periodic Table** **6 hours**
Periodicity of element, s, p, d, f blocks, Long form of periodic table, Discussion of properties (atomic, ionic and covalent radii, ionization potential, screening or shielding effect, electronegativity, electron affinity)
- 4. Nuclear Chemistry** **6 hours**
Composition of nucleus (nuclear stability), Binding energy, Radioactivity, Half-life determination, Nuclear reaction
- 5. Coordination Chemistry** **5 hours**
Werner's theory, Nomenclature, Isomerism, Valence bond theory, Crystal field theory
- 6. Principles of Qualitative and Quantitative Analysis** **14 hours**
Solubility product, Common ion effect, Their application in group separation, Principles of gravimetric and volumetric analysis

Reference Books:

1. Samuel H. Maron and Carl F. Prutton: *Principles of Physical Chemistry*. (4th Ed.) Oxford and IBM Publishing Co. Pvt. Ltd., New Delhi.
2. B. S. Bahl, G. D. Tuli and Arun Bahl: *Essentials of Physical Chemistry*. (24th Ed.), 2000, S. Chand and Company Ltd.
3. F. Albert Cotton, Geoffrey Wilkinson and Paul L. Gaus: *Basic Inorganic Chemistry*. (3rd Ed.), 2001, John Wiley and Sons Inc.
4. Satya Prakash, G. D. Tuli, S. K. Basu, and R. D. Madan: *Advanced Inorganic Chemistry*. (18th Ed.), Vol I, 2000, S. Chand and Company Ltd.
5. G. Svehla: *Vogel's Qualitative Inorganic Analysis*. (7th Ed.), 1998, Longman Group Limited.
6. G. H. Jeffery, J. Bassett, J. Mendham, R. C. Denney *Vogel's Quantitative Chemical Analysis*. (5th Ed.), 1999, Addison Wesley Longman Inc.

CHM 172.3 (Credit hours 3)

General Chemistry II (Structure and Reaction)

BMLT, First Year, First Semester

Course Objectives:

This course will provide the fundamental knowledge on the three dimensional structure and chemical reaction of organic molecule.

Course Contents:

- 1. Structure and Nomenclature of some simple molecules** **8 hours**
Atomic Orbital, Molecular orbital, Hybrid Orbital, Structure of Water, Ammonia, Methane, Ethylene, Acetylene, Benzene, Classification of Organic compounds, and Nomenclature (Classical, IUPAC)
- 2. Stereochemistry** **10 hours**
Stereochemistry and stereoisomerism, Optical activity, Polarimeter, Specific rotation, Enantiomerism and Tetrahedral carbon, Enantiomerism and Optical activity, Prediction of enantiomerism (chirality), Chiral center, Racemic modification, Configuration, Specification of configurations (*R* and *S*), Sequence rule, Diastereomers, Epimers, Geometrical isomerism, *E* and *Z*-configurations
- 3. Conformational Analysis** **10 hours**
Conformation in open chain system, Conformation in six membered rings, Conformation in six membered rings containing heteroatoms, Conformation in other rings, conformation and physical properties, Conformational effects on stability and reactivity
- 4. Reaction Mechanism** **6 hours**
Types of mechanism, Types of reaction, Thermodynamic and Kinetic requirements for reaction, Kinetic and Thermodynamic control, the Hammond postulate, Microscopic reversibility
- 5. Methods for Determining Mechanism** **6 hours**
Identification of products, Determination of the presence of intermediate, Study of catalysis, Isotope labeling, Stereochemical evidence, Rate expression for the first and second order reaction, Isotope effect
- 6. Reactive Intermediates** **5 hours**
Stability, Structure, Generation, and Fate of Carbocation, Carbanion, Free radical, Carbene, Nitrene, and Benzyne, Aromaticity and Anti-aromaticity

Reference Books:

1. John McMurry: *Organic Chemistry* (5th Ed.) 2000, Brooks/Cole Publishing Company (Asian Books Pvt. Ltd.).
2. Robert Thornton Morrison and Robert Neilson Boyd: *Organic Chemistry* (6th Ed.) 1999, Prentice-Hall of India Pvt. Ltd., New Delhi.
3. Jerry March: *Advanced Organic Chemistry* (4th Ed.) 2000, John Wiley and Sons.
4. Ernest L. Eliel: *Stereochemistry of Carbon Compounds*, 23rd reprints (1998), Tata-McGraw-Hill Pub. Co. Ltd.

MTH 191.3 (Credit hours 3)

Biostatistics

BMLT, First Year, First Semester

Course Objectives:

The student would be able to understand the terminology of statistics and able to read and present medical data in the tabular and graphic form, calculate and understand the application of test of significance.

Course Contents:

- 1. Introduction** **4 hours**
Definition, Scope and limitations, Sources of data, Techniques of collecting primary data, General concepts of sampling
- 2. Classification and Presentation of Data** **6 hours**
Data classification (need, objectives, and types of data collection), Construction of frequency and relative frequency distribution and its principles, Tabular presentation, Diagrammatic presentation (Bar and Pie diagram), Graphic presentation (Histogram, Frequency polygon, Ogive), Stem and leaf display presentation
- 3. Fundamental Statistical Measures** **8 hours**
Measures of central tendency (Mean, Median, Mode, Weighted Average and Geometric mean), Measures of dispersion (Range, Quartile deviation, Standard deviation, Coefficient of variation)
- 4. Probability Theory** **6 hours**
Concept and Importance, Types of events, Objective and subjective probabilities, Marginal and joint probabilities, Theorems of probability, Conditional probability, Mathematical expectation
- 5. Probability Distribution** **7 hours**
Discrete probability distribution (Binomial and poisson distribution and mean of their distributions), Continuous probability distributions, Normal distribution, Normal approximation of Binomial distributions
- 6. Test of Significance** **8 hours**
Test of significance (t -test, Z -test, χ^2 -test), Computational procedure of hypothesis testing, Hypothesis testing when population S.D. is known, Hypothesis testing when population S.D. is unknown
- 7. Simple Correlation and Regression Analysis** **6 hours**
Scatter diagram, Correlation, Least square regression, Prediction and Confidence intervals for estimating regression parameters

Reference Books:

1. B. K. Mahajan: *Methods in Biostatistics*. (6th Ed.) 1999, Jaypee Brothers, Medical Publishers (P) Ltd., New Delhi.
2. Jit S. Chandan: *Statistics*. Vikash Publishing House, Pvt. Ltd.

LAB-1.1 (Credit hour 1)

Laboratory-1 Basic Microbiology BMLT, First Year, First Semester

Course Objectives:

The students will become familiar with the commonly used technique and basic practical knowledge in general microbiology.

Course Contents:

- | | |
|--|---------|
| 1. Observation of various part of compound microscope and their functions | 6 hours |
| 2. Observation and uses of Autoclave and Hot air oven | 4 hours |
| 3. Preparation of common Laboratory disinfectants and their uses | 4 hours |
| 4. Cleaning and decontamination of glasswares and laboratory waste materials | 4 hours |
| 5. Preparation of general laboratory reagents for staining of microorganisms in microbiology:
Gram stain,ZN stain,methyline blue stain,Albert stain | 6 hours |
| 6. Morphological study of Bacteria | 4 hours |
| 7. Preparation of different types of media in microbiology and their quality control. | 6 hours |
| 8. Perform different method of cultivation of bacteria and fungi in vitro | 5 hours |
| 9. Different methods of identification of organism from culture | 6 hours |

Reference Books:

LAB-2.1 (Credit hour 1)

Laboratory-2 General Chemistry BMLT, First Year, First Semester

Course Objectives:

Students will be able to understand simple laboratory techniques and titrations

Course Contents:

1. Laboratory safety, Chemical hazards, Prevention of accidents and Use of reagents
2. Use of Physical balance, Chemical balance, Micropipettes
3. Pharmacopoeial control and identification tests for important drugs and poisonous substances, environmental hazards, disposal of chemicals
4. Use of pipette, burette and balance (calibration), Standardization of solutions in volumetric analysis.
5. Limit tests for As, Hg, Pb, Fe, Cl⁻ and SO₄²⁻
6. Estimation of saline solution and calcium
7. Acid/base titration

Reference Books:

THE CONTENT OF SYLLABUS

**BMLT
First Year
Second Semester**

BCM 121.3 (Credit hours 3)

Biochemistry I (General)

BMLT, First Year, Second Semester

Course Objectives:

This course will provide the students about the knowledge on general principles of biochemistry applicable to medical sciences.

Course Contents:

- 1. Physicochemical Phenomena** **5 hours**
Importance of physicochemical phenomena in Biochemistry, Colloidal state, Surface tension, Viscosity Osmosis, Diffusion, Buffers, pH, Significance of pH, Henderson-Hasselbalch equation
- 2. Chemistry and Metabolism of Carbohydrates** **15 hours**
Introduction, Classification, Monosaccharides, Disaccharides, Polysacchrides, Carbohydrate derivatives, Glycogenesis, Gycogenolysis, Gluconeogenesis, Glycolysis, Tricarboxylic acid cycle, Hexose monophosphate shunt, Effect of hormones on carbohydrate metabolism
- 3. Chemistry and Metabolism of Lipids** **12 hours**
Introduction, Classification, Characterization tests, Fats, Waxes, Soaps, Phospholipids, Glycolipids, Steroids and Sterols, Theories of fat absorption, Oxidation of fatty acids, Synthesis of fatty acids, Abnormalities of lipid metabolism, Eicosanoids, Prostanoids, Leukotrienes, Lipoxygenase and cyclo-oxygenase pathway, Peroxidation of Lipid, Diphoters, HDL, LDL, VLDL
- 4. Chemistry and Metabolism of Proteins** **13 hours**
Introduction, Classification, Occurrence, General properties, Amino acids, Physicochemical properties, Structure of protein molecule, Metabolism of individual amino acids (e.g. phenyl alanine and tyrosine metabolism), Protein biosynthesis, Nucleic acids, Nucleotides, Nucleosides, RNA synthesis, Initiation, Translation Elongation, Genetic code and Protein synthesis

Reference Books:

1. Robert K. Murray, Daryl K. Granner, Peter A. Mayes and Victor W: Rodwell, *Harper,s Biochemistry* Latest Ed. Appleton and Lange, Stanford, CT.
2. Lubert Styrrer: *Biochemistry* (4th Ed.) W. H. Freeman and Company.
3. David L. Nelson and Michel M. Cox: *Lehninger's Principles of Biochemistry*, (3rd Ed.) 2000, Macmillan Worth Publisher.

APL 131.3 (Credit hours 3)

Anatomy and Physiology I

BMLT, First Year, Second Semester

Course Objectives:

This course will provide the basic knowledge on the structure and function of human body, which will enable the students to understand scientific basis of the drug action.

Course Contents:

- 1. The Cell (Structure and Function) 10 hours**
An organization of the cell, The membranous structure of the cell, The cytoplasm and its organelles, Functional systems of the cell, Diffusion, Kinetics of diffusion, Diffusion through the cell membrane, Active transport, Pinocytosis and Phagocytosis
- 2. Blood 8 hours**
An introduction of haematology, Functions of blood, Composition of blood, Blood coagulation, Formed elements of blood, Homeostatic imbalances of blood, Blood groups, Interstitial fluid and lymph, Body fluids, Lymphatic system, Reticuloendothelial system
- 3. Digestive System 8 hours**
An introduction of digestive system, Anatomy of gastrointestinal tract, Gastrointestinal movements, Deglutition, Secretions of digestive enzymes, Digestion, Absorption, Defecation, Homeostatic imbalances of the digestive system
- 4. Excretory System 7 hours**
An introduction to excretory system, Anatomy of kidney, Glomerular filtration, Reabsorption and secretion in the tubules, Acid-base balance, Counter current mechanism, Renal disease, Micturition, Abnormalities of micturition
- 5. The Functioning Nerve Cell 4 hours**
Nervous system, Electrical concepts for Neurophysiology action potential, impulse conduction, Synapses neurotransmitter substances
- 6. The Functioning Muscle Cell 4 hours**
Classification of Muscle cell, Muscle structure and function, Homeostatic imbalances of neuromuscular junctions or muscle tissue
- 7. The Autonomic Nervous System 4 hours**
Structure and physiology, Control of autonomic nervous system by the central nervous system

Reference Books:

1. Peter L. Williams et al. (Ed.): *Gray's Anatomy*. (38th Ed.) 1995, Churchill Livingstone.
2. Chummy S. Sinnatamby: *Last's Anatomy Regional and Applied*. 1999, Churchill Livingstone.
3. Arthur C. Guyton and John E. Hall: *Guyton Human Physiology and Mechanisms of Disease*. 1996, Harcourt Publishers Limited.

CTL 151.3 (Credit hours 3)

General Cytology

BMLT, First Year, Second Semester

Course Objectives:

The students will become familiar with the commonly used terminology and basic knowledge in normal human cytology.

Course Contents:

1. The cell

5 hours

Cell structure and organisation, Plasma membrane, Endoplasmic reticulum, Golgi apparatus, Mitochondria, Lysosomes, Secretory granules, Ribosomes, Cytoskeleton, Cytosol, Nucleus, Nucleolus, Chromatin nuclear matrix

2. Cytology Techniques and Staining

8 hours

Fixation, Cytological technique on female genital tract, respiratory tract, urinary tract, gastrointestinal tract, body fluid, Fine needle aspiration, Immunocytochemistry, Electron Microscopy, Flow Cytometry.

3. Cell and Tissue types (Gross Anatomy, Histology, Cytology, potentials pitfalls)

32 hours

Epithelium

Blood vessels

Respiratory System

Digestive Tract: Oral cavity, Esophagus, Stomach, Small intestine, Large intestine

Glands and Lymphoid system:

Thyroid gland, Salivary Glands, Lymph nodes, Tonsils thymus, Spleen

Female Reproductive System: Ovary, Fallopian Tube, Uterine Body, Uterine Cervix and Vagina

Breast

Body Cavity Fluids, Synovial Joint, Pleural fluid, Ascitis fluid, Cerebro spinal fluid

Skin

Reference Books:

1. Arlene J. Herzberg: *Color Atlas of Normal Cytology*. Churchill Livingstone.
2. Bibbo: *Comprehensive Cytopathology*. W. B. Saunders Company
3. Leopold G. Koss: *Diagnostic Cytopathology and its Histopathologic Basis*, (4th ed.), Lippincott
4. Demay: *Cytology*
5. Orell: *Manual of Fine Needle Aspiration Cytology*,
6. Difiore: *Atlas of Histology*
7. Janquira: *Text Book of Histology*,

HTL 152 (Credit hours 3)

Histology (General)

BMLT First Year, Second Semester

Course Objectives:

This course will provide the basic knowledge on the general histology of human body.

Course contents:

- | | |
|--|----------------|
| 1. Epithelium, and Glands | 3 hours |
| Introduction, Classification ground substance, Fibres and cells of connective tissue, | |
| 2. General Connective Tissue | 3 hours |
| Introduction, Intercellular ground substance, Fibers and cells of connective tissue, Adipose tissue | |
| 3. Cartilage | 3 hours |
| General microscopic structure of cartilage, Hyaline cartilage, Fibrocartilage, Elastic cartilage | |
| 4. Bone | 3 hours |
| Gross structure of bone, Structure of cancellous bone and compact bone, Periosteum, Synovium | |
| 5. Muscle | 3 hours |
| Microscopic arrangement of skeletal muscle, Cardiac muscle, Smooth muscle | |
| 6. Skin | 3 hours |
| Histological structure of skin including hair and hair follicles, Nails | |
| 7. Digestive System | 4 hours |
| Microscopic structural features of esophagus, stomach, small intestine, large intestine, appendix, Liver, pancreas | |
| 8. Respiratory System | 3 hours |
| Microscopic structural features of trachea and bronchi, Lungs | |
| 9. Urinary System | 3 hours |
| Histological structure of kidneys, Ureters, Urinary bladder, Urethra | |
| 10. Cardiovascular System | 5 hours |
| Microscopic structure characteristic of arteries, veins and capillaries, Histological features of heart, Microscopic structure of lymph nodes and spleen | |
| 11. Endocrine System | 3 hours |
| Thyroid gland, parathyroid gland | |
| 12. Reproductive System | 5 hours |
| Male: Microscopic structure of testis, Accessory urogenital organs
Female: General structure of ovaries, Uterine tubes, Mammary glands | |
| 13. Nervous Tissue | 4 hours |
| Tissue constituting the nervous system, Neuron structure, Myelinated and non-myelinated nerve fibres, Ganglia, Neuroglia | |

Reference Books:

1. Barbara Young and John W. Heath: *Where's functional Histology*. (4th Ed.) 2001, Churchill Livingstone, Edinburgh.
2. Inderbir Singh: *Textbook of Human Histology* (4th Ed.) 2004, Jaypee Brothers Medical publishers Ltd., New Delhi
3. Luiz Carlos Junqueira, Jose Cornerio and Robert O. Kelley: *Basic Histology*. (9th Ed.) 1998, McGraw- Hill, New York.
4. Victor P. Eroschenko: *di Fiore's Atlas of Histology*. (9th Ed.) 2001, Lippincott Williams and Wilkins, Philadelphia.

CHM 173.3 (Credit hours 3)

Analytical Chemistry (Instrumentation)

BMLT, First Year, Second Semester

Course Objectives:

This course is designed to understand general principles of instrumental analysis techniques and their application in clinical laboratory tests.

Course Contents:

- 1. An Introduction to Analytical Methods** **5 hours**
Classification of analytical methods, Types of instrumental methods, Instruments for analysis, Selecting for analytical methods, Calibration of instrumental methods
- 2. An Introduction to Spectrometric Methods** **5 hours**
Wave properties of electromagnetic radiation, Quantum-mechanical properties of radiation, Component of optical instrument
- 3. Atomic Absorption and Fluorescence Spectrometry** **5 hours**
Sample atomization technique, Atomic absorption instrumentation, Atomic absorption analytical technique, Atomic fluorescence spectroscopy
- 4. Atomic Emission Spectrometry** **5 hours**
Emission spectroscopy based on plasma source, Emission spectroscopy based on arc and spark sources, Miscellaneous sources for optical emission spectroscopy
- 5. Flame Photometry** **5 hours**
Principles of flame photometry, Inferences in flame photometry, Evaluation method in flame photometry,
- 6. Polarimetry** **5 hours**
Polarised light, Application of polarimetry, Optical rotatory dispersion (ORD) and circular dichroism (CD), Principles and instrumentation for ORD and CD
- 7. Potentiometry** **5 hours**
Electrochemical cells, Electrode potential, Standard electrode potential, Various electrodes in potentiometry, Instrumentation, Potentiometric titration, Potentiometry in quantitative analysis
- 8. Polarography and Volatametry** **5 hours**
Principles, Instrumentation, Application of polarography and voltametry
- 9. Conductometry** **5 hours**
Principles, Instrumentation, Application of conductometry

Reference Books:

- Douglas A. Skoog, F. James Holler and Timothy A. Nieman: *Principles of Instrumental Analysis*. (5th Ed.) 1998, Harcourt College Publisher (Harcourt Asia PTE Limited), Singapore.
- S. M. Khopkar: *Basic Concept of Analytical Chemistry*. 1998, New Age International (P) Ltd., Publisher, New Delhi.

LAB-3.1 (Credit hour 1)

Laboratory-3

BMLT, First Year, Second Semester

Course Objectives:

Course Contents:

Reference Books:

LAB-4.1 (Credit hour 1)

Laboratory-4

BMLT, First Year, Second Semester

Course Objectives:

Course Contents:

Reference Books:

LAB-5.1 (Credit hour 1)

Laboratory-5

BMLT, First Year, Second Semester

Course Objectives:

Course Contents:

1. One step preparation of compounds of medicinal properties
2. Assay of Pharmaceutical compounds based on acid-base, oxidation-reduction, precipitation and diazotization titration
3. Preparation of complexes and complexometric titration
4. Gravimetric determination of official compounds and detection of metal ions

Reference Books:

SEM-1.1 (Credit hour 1)

SEMINAR-1

BMLT, First Year, Second Semester

Course Objectives:

Course Contents:

THE CONTENT OF SYLLABUS

**BMLT
Second Year
Third Semester**

MBL 201.3 (Credit hours 3)

Microbiology II (Bacteriology)

BMLT, Second Year, Third Semester

Course Objectives:

This course will provide the basic knowledge on systemic microbiology and its general application to medical laboratory sciences.

Course Contents:

Describe Morphology, Staining property, Cultural characteristics, Biochemical reactions, Antigenic characters, Pathogenicity, Laboratory diagnosis and the diseases caused by the following:

- | | |
|---|-----------------|
| 1. Gram Positive Cocci | 10 hours |
| <i>Staphylococci, Streptococci, Pneumococci, Micrococci</i> | |
| 2. Gram Negative Bacilli | 20 hours |
| <i>Esherichia coli, Klebsiella, Enterobacter, Citrobacter, Proteus, providencia, Salmonella, Shigella, Yersenia</i> | |
| 3. Curve Gram Negative Bacilli | 7 hours |
| <i>Vibrio, Campylobacter, Helicobacter</i> | |
| 4. Gram Negative Cocci | 5 hours |
| <i>Branhamella, Neisseria</i> | |
| 5. Hemophilus | 3 hours |
| <i>Haemophilus influenzae and other species</i> | |

Reference Books:

1. Mackie and McCartney: *Practical Medical Microbiology* (14th Ed.) 1999, Churchill Livingstone, London.
2. David Greenwood, Richard C.B. Slack and John F. Peutherer: *Microbiology* (15th Ed.) 2000, Churchill Livingstone, London.
3. R. Ananthanarayan and C.K.J. Paniker: *Textbook of Microbiology* (6th Ed.) 2002, Orient Longman Ltd. Hydrabad.

BCM 221.3 (Credit hours 3)

Biochemistry II (General)

BMLT, Second Year, Third Semester

Course Objectives:

This course will provide a basic knowledge on vitamins, hormones and enzymes and their application in pharmaceutical sciences.

Course Contents:

- 1. Vitamins** **18 hours**
Chemistry, Physiological functions, Deficiency symptoms, Sources, Requirements and therapeutic uses of the following vitamins: vitamin A, vitamin D, vitamin K, vitamin E and D, and vitamins of B group, (i.e. thiamine, riboflavin, niacin, pantothenic acid, pyridoxine, lipoic acid, biotin, inositol, paraaminobenzoic acid, folic acid, vitamin B₁₂).
- 2. Hormones** **17 hours**
Chemistry, Mechanism of action, Biosynthesis, Release, Metabolic function and therapeutic uses of the following hormones: insulin, glucagon, thyroxine, parathormone, adrenaline, noradrenaline, corticosteroids, sex hormones, hormones of hypophysis, hypothalamic regulating factors and hormone antagonists.
- 3. Enzymes** **10 hours**
Chemical nature of enzymes, Classification, Active site, Different shapes of active sites, Factors influencing enzyme actions, Inhibitors and activators, Clinical enzymology.

Reference Books:

1. Robert K. Murray, Daryl K. Granner, Peter A. Mayes and Victor W: Rodwell, *Harper's Biochemistry* (25th Ed.) 2000 Appleton and Lange, Stamford.
2. Lubert Styrer: *Biochemistry* (4th Ed.) 2000, W. H. Freeman and Company, New York.
3. David L. Nelson and Michel M. Cox: *Lehninger's Principles of Biochemistry*, (3rd Ed.) 2000, Macmillan Worth Publisher, New York.

APL 231.3 (Credit hours 3)

Anatomy and Physiology II

BMLT, Second Year, Third Semester

Course Objectives:

This course will provide the basic knowledge on the structure and function of human body, which will enable the students to understand scientific basis of drug action.

Course Contents:

- 1. Respiratory System** **10 hours**
A general introduction and physiological anatomy of respiratory system, Pulmonary ventilation, Mechanism of respiration, Volume and capacities, Gaseous exchange, Transport of gases, Regulation of respiration
- 2. Nervous System** **12 hours**
Protection and coverings, Cerebrospinal fluid, Blood supply, Brain stem, Diencephalon, Cerebrum, Brain waves, Cerebellum, Cranial nerves, Homeostatic imbalances of the central nervous system
- 3. Circulatory System** **10 hours**
Introduction, Anatomy of heart, Conduction system of heart, Nervous regulation of heart, Coronary circulation, Cardiac cycle, Blood pressure, Heart rate cardiac output and homeostatic imbalances of the cardiovascular
- 4. Endocrinology and Reproduction** **13 hours**
An introduction to endocrinology. Male and female reproductive organs. Male and female sex hormones. Mechanism of hormonal action, Endocrine regulation, The pituitary hormones and their control by the hypothalamus. The thyroid metabolic hormones, The adrenal hormones. Homeostatic imbalances of the above mentioned hormones. Reproductive functions of the male and female sex hormones, Menstrual cycle

Reference Books:

1. Peter L. Williams et al. (Ed.): *Gray's Anatomy*, (38th Ed.) 1995, Churchill Livingstone, New York.
2. Chummy S. Sinnatamby: *Last's Anatomy Regional and Applied*, 1999, Churchill Livingstone, New York.
3. Arthur C. Guyton and John E. Hall: *Guyton Human Physiology and Mechanisms of Disease*, 1996, Harcourt Publishers Limited, Singapore.

CBL 241.3 (Credit hours 3)

Molecular Cell Biology (Genetic Engineering)

BMLT, Second Year, Third Semester

Course Objectives:

This course is designed to explain the general principles of genetic engineering and its application to laboratory sciences.

Course Contents:

- 1. Fundamental Terminology** **3 hours**
DNA, RNA, Nucleotides, Nucleosides, tRNA, mRNA, Translation, Transcription, Genes
- 2. RNA and Protein Synthesis** **8 hours**
Process of DNA transcription, The promoter sequence, Translation of nucleotide sequence into protein sequence, Specific enzyme copulation, Addition of amino acids to the carboxyl terminal end, Degeneration of genetic code, Protein synthesis in ribosome, Release of a protein chain from ribosome, The reading frame for protein synthesis, Protein synthesis in eucaryotes and procaryotes
- 3. DNA Repair Mechanism** **4 hours**
DNA sequence maintenance, Mutation rate and its importance, Stability of genes and DNA repair, Recognition of DNA damage
- 4. DNA Replication Mechanism** **6 hours**
DNA replication, Proof reading mechanism, DNA replication in the 5' to 3', DNA primers, DNA helicases, DNA primase, Mismatch proof reading, Replication origins, DNA topoisomerase, DNA replication in eucaryotes and procaryotes
- 5. Genetic Recombination Mechanism** **6 hours**
Genetic recombination, General recombination, DNA renaturation (hybridization), recA protein, Branch migration, Cross-Strand exchange, Gene conversion, Site-specific genetic recombination
- 6. Virus, Plasmids and Transposable Genetic Elements** **6 hours**
Viral genomes, RNA virus, DNA virus, Provirus, Retrovirus, Reverse transcriptase, Plasmids
- 7. DNA Cloning and Genetic Engineering** **10 hours**
Restriction Nucleases, DNA library, Plasmid vectors, Genomic DNA cline, cDNA, Subtractive hybridization, Chromosome walking, Hybrid selection, Expression vectors, Design of genes, Insertion of engineered genes, Transgenic animal, PCR, Mapping and analysis of large genomes
- 8. Use of Genetic Engineering in Pharmaceutical Sciences** **2 hours**
Production of commercial insulin from *E. Coli*

Reference Books:

1. Bruce Albert, Dennis, Bray, Julians Lewis, Martin Raff, Keith Roberts and James D. Watson: *Molecular Biology of the Cell* (2nd Ed.) 1989, Garland Publishing, Inc, New York.
2. James Darnell, Harvey Lodish and David Baltimore: *Molecular Cell Biology*, (2nd Ed.) 1990, Scientific American Books, New York.

IML 261.3 (Credit hours 3)

Immunology (Fundamentals)

BMLT, Second Year, Third Semester

Course Objectives:

This course will provide the fundamental knowledge on the immune system.

Course Contents:

- 1. Introduction to the Immune System** **6 hours**
Adaptive and innate immunity, Cells of the immune system, Soluble mediators of immunity, Antigens, Immune responses, Defences against extracellular and intracellular pathogens, Vaccination, Immunopathology
- 2. Cells Involved in Immune Responses** **4 hours**
Lymphoid cells, Mononuclear phagocyte system, Polymorphonuclear granulocytes and platelets
- 3. The Lymphoid System** **4 hours**
Primary and secondary lymphoid tissue, Primary lymphoid organs, Secondary lymphoid organs and tissues, Lymphocyte traffic
- 4. Antigen Receptor Molecules** **4 hours**
Immunoglobulins, T-cell antigen receptors, Major histocompatibility complex antigens
- 5. Antigen Recognition** **6 hours**
Antigen-Antibody binding, The structure of antigens, T-cell-antigen recognition, Antigen processing and presentation, Role of accessory molecules, basic immunological application (Immunofluorescence, RIA, ELISA)
- 6. Cell Cooperation in the Antibody Response** **4 hours**
Cooperation between different cell types, Cell activation, Antibody responses *in vivo*
- 7. Cell-Mediated Immune Reactions** **6 hours**
T-cell-independent cell-mediated defense mechanism, T-cell-dependent cell-mediated responses, Cell-mediated cytotoxicity, Lymphokine-mediated activation of macrophages, Granuloma formation, Immunopathology, The cytokine network
- 8. Regulation of the Immune Response** **3 hours**
Regulation by antigen, Regulation by antibody, Regulation by immune complexes, Regulation by lymphocyte
- 9. Immunological Tolerance** **4 hours**
T-cell tolerance to self antigens, B-cell tolerance to self antigens, Artificially induced tolerance *in vivo*, Artificially induced tolerance *in vitro*, Potential therapeutic applications of tolerance
- 10. Complement** **4 hours**
Introduction, Activation of complement, Complement receptors, Biological effects of complement

Reference Books:

1. Ivan Roitt, Jonathan Brostoff and David Male (Ed.): *Immunology*, (3rd Ed.) 1993, Mosby-Year Book Europe Limited, London.
2. Ivan Roitt: *Essential Immunology*, (8th Ed.) 1994, Blackwell Scientific Publication, London

LAB-6.1 (Credit hour 1)

Laboratory-6

BMLT, Second Year, Third Semester

Course Objectives:

Course Contents:

Reference Books:

LAB-7.1 (Credit hour 1)

Laboratory-7

BMLT, Second Year, Third Semester

Course Objectives:

Course Contents:

Reference Books:

LAB-8.1 (Credit hour 1)

Laboratory-8

BMLT, Second Year, Third Semester

Course Objectives:

Course Contents:

Reference Books:

SEM-2.1 (Credit hour 1)

SEMINAR-2

BMLT, First Year, Second Semester

Course Objectives:

Course Contents:

THE CONTENT OF SYLLABUS

**BMLT
Second Year
Fourth Semester**

MBL 202.3 (Credit hours 3)

Microbiology III (Bacteriology)

BMLT, Second Year, Fourth Semester

Course Objectives:

This course will provide the basic knowledge on systemic microbiology and its general application to Medical Laboratory Sciences.

Course Contents:

Describe morphology, Staining properties, Cultural characteristics, Biochemical reaction, Antigenic characters, Pathogenicity, Laboratory diagnosis and the diseases caused by the followings:

- | | |
|--|----------------|
| 1. Mycobacteria
<i>Mycobacterium tuberculosis</i> , Atypical mycobacteria, <i>Mycobacterium leprey</i> | 5 hours |
| 2. Non fermentative Gram negative bacilli
<i>Pseudomonas</i> , <i>Acinetobacter</i> , <i>Moraxella</i> | 4 hours |
| 3. Spirochaete
<i>Treponema</i> , <i>Borrelia</i> , <i>Leptospira</i> | 6 hours |
| 4. Miscellaneous organisms
<i>Mycoplasma</i> , <i>Chlamydia</i> , <i>Rickettsia</i> | 3 hours |
| 5. Gram Positive bacilli
<i>Corynebacteria</i> , <i>Bacillus</i> , <i>Clostridia</i> , <i>Listeria</i> and <i>Erysipelothrix</i> | 6 hours |
| 6. Bloodstream infection | 3 hours |
| 7. Infections of the Respiratory Tract | 3 hours |
| 8. Meningitis and other infections of the central nervous system | 3 hours |
| 9. Infections of the eyes, ears, sinuses, skin, soft tissue, and wound | 3 hours |
| 10. Infections of the urinary tract | 3 hours |
| 11. Genital tract infection | 3 hours |
| 12. Gastrointestinal tract infection | 3 hours |

Reference Books:

1. Mackie & McCartney: *Practical Medical Microbiology* (14th Ed.) 1999, Churchill Livingstone, London.
2. David Greenwood, Richard C. B. Slack and John F. Peutherer: *Medical Microbiology* (15th Ed.) 2000, Churchill Livingstone, London.
3. R. Ananthanarayan and C. K. J. Paniker: *Textbook of Microbiology* (6th Ed.) 2002, Orient Longman Private Ltd., Hyderabad.
4. Bailey & Scott's: *Diagnostic Microbiology* (11th Ed.) 2004, Mosby, London.

PTL 211.3 (Credit hours 3)

General Pathology

BMLT, Second Year, Fourth Semester

Course Objectives:

This course will provide the basic knowledge of the aetiological factors of disease, mechanism of disease production and laboratory techniques used in disease diagnostics.

Course Contents:

- 1. Introduction** **2 hours**
Terminology, Evolution of pathology, Modern pathology and subdivisions of pathology
- 2. Cell injury, Death and Cellular Adaptation** **2 hours**
Causes of cell injury, Mechanism of cellular injury, Morphology of reversible cell injury, Cellular adaptation
- 3. Inflammation** **4 hours**
Definition, Acute inflammation, Chronic inflammation, Types of exudation, Cerebrospinal fluid analysis, Laboratory tests in diagnosis of chronic granulomatous inflammation
- 4. Infectious and Parasitic Diseases** **10 hours**
Infecting agents, Host defense mechanism, Mechanism of cell injury, Common infectious diseases and laboratory techniques used for their diagnosis
- 5. Immunopathology** **10 hours**
Immunity, Cells of immune system, Cytokines, Major histocompatibility complex (HLA) and organ transplant, complement system, diseases of immunity, Laboratory tests for identification of immuno-induced diseases
- 6. Haemodynamic Disorders** **4 hours**
Internal environment of body, Disturbances of acid-base balance, Body fluids and electrolytes, Septic shock, Coagulation cascade, Laboratory tests related to haemodynamic disorders
- 7. Genetic Diseases** **5 hours**
Terminology, DNA, Gene, Chromosomes, Mutations, Karyotyping, Basis of inheritance, Autosomal and sex linked inheritance, Techniques used in detection of genetic diseases
- 8. Neoplasia** **5 hours**
Definitions and nomenclature, Aetiology and carcinogenesis, Characteristics of benign and malignant neoplasm, Tumor antigens, Laboratory diagnosis of cancer
- 9. Environmental and Nutritional Diseases** **3 hours**
Environmental pollution, Chemical and drug injury, injury caused by ionizing radiation, Essential nutrients, Protein energy, Malnutrition, Disorders of vitamins and minerals

Reference Books:

1. Ramzi S. Cotran, Vinay Kumar and Tucker Collins: *Robbins Pathologic Basis of Disease* (6th Ed.) 2001, Harcourt India Private Ltd., New Delhi.
2. Harsh Mohan: *Textbook of Pathology* (4th Ed.) 2000, Jaypee Brothers Medical Publishers, New Delhi.
3. Walter and Israel: *General Pathology*
4. J. R. Anderson: *Muir's Textbook of Pathology*
5. John. D. Bancroft and Alan Stevens: *Theory and Practice of Histological Techniques*

PTL 212.3 (Credit hours 3)

Cytopathology

BMLT, Second Year, Fourth Semester

Course Objectives:

The students will be able to fix and stain appropriately the smears sent for cytopathological diagnosis. This course will also provide the knowledge of fixation and smear preparation from the cytological samples.

Course Contents:

- 1. Introduction** **2 hours**
Early historical era, Development, Expansions and consolidation, Diagnostic utility and importance
- 2. Collection of Samples** **8 hours**
 - a) female genital tract, Respiratory system, Urinary system, Stomach, Skin and oral cavity, Breast nipple discharge
 - b) Body fluids
 - c) Fine Needle Aspiration (FNA) and USG guided FNA
- 3. Cytopreparatory Techniques** **23 hours**
 - a) Fixation of samples of female genital tract, Body fluids from different sites and FNA materials
 - b) Staining methods, PAP stain, MGG stain, PAS stain, Supravital stain, Destaining techniques
 - c) Interpretation, evaluation of quality of stained smears, prevention of cross contamination, Normal cells, Inflammatory and malignant changes
- 4. Clinical cytogenetics** **6 hours**
Introduction, Utility, Cell cycle and cell division, Sample collection, Storage of cells, Chromosomal analysis, Banding techniques, Microscopy and interpretation
- 5. Immunocytochemistry** **3 hours**
Introduction, Useful markers and antibodies, Diagnostic significance of immunocytochemistry in cytological specimens, Techniques
- 6. Molecular Techniques** **3 hours**
Terminology, Southern blot analysis, Northern blot analysis, Polymerase chain reaction, Fluorescence In Situ Hybridization (FISH)

Reference Books:

1. Winfrid Gray: *Diagnostic Cytopathology*
2. Bibbo: *Comprehensive Cytopathology*, W. B. Saunders Company
3. L. G. Koss: *Diagnostic Cytopathology and its Histopathological Basis*
4. Stanley S. Rapheal: *Lynch's Medical Laboratory Technology*
5. Kanai L Mukharjee: *Medical Laboratory Technology*
6. John D. Bancroft and Alan Stevens: *Theory and Practice of Histological Techniques*

BCM 222.3 (Credit hours 3)

Biochemistry III (Clinical)

BMLT, Second Year, Fourth Semester

Course Objectives:

This course will provide the basic knowledge on Clinical Biochemistry.

Course Contents:

- 1. Basics of Techniques involved in Clinical Biochemistry** **10 hours**
Basic concepts of Biochemistry Laboratory, Laboratory Requirements: Glass wares, Plastic wares, Chemical, Reagents, Distilled water, Deionized water, Centrifugation: - Principle, Types, Applications, Photometry: - Colorimetry and Spectrophotometry. Applications, End point reaction method, Rate of reaction method (visible kinetic method and UV- kinetic methods) Calibration of photometer, Basics of semi automation and fully automation in Biochemistry, Calibration and Programming the test parameters
- 3. Handling the Specimens** **5 hours**
Specimen collection, Special precautions in specimen collection, Labeling, Entry of records, Specimen processing, Preservation. Specimen Stability. Use of anticoagulants, Separation of serum or plasma. Disposal of biological materials. Significance of biochemical tests in clinical medicine
- 4. Blood Glucose and Diabetes** **10 hours**
Mechanism of glucose absorption and digestion, Regulation of metabolism (Hormones responsible for regulation) Glycosylation of Hemoglobin. Hypoglycemia, Glucosuria. Diabetes - Types, Diagnosis, management and complications of diabetes. Estimation of blood glucose, OGTT, Spot test for GDM, Glyco-Hb estimation, Insulin, Proinsulin, C-peptide assay. Microalbuminuria, Galactosemia, Glycogen storage diseases.
- 5. Plasma proteins** **10 hours**
Introduction, Separation of plasma proteins: Electrophoresis and interpretation, Estimation of plasma proteins (albumin globulin A/G ratio), and clinical significances. Proteins belonging to different globulins α_1 - Globulin (α -1-antitrypsin, α -1acid glycoprotein,, α -1-lipoproteins, TBG), α_2 -globulins, wilson's disease, ceruloplasmin. β -globulins. γ -globulins, types, Functions, Hyper/Hypogamaglobulinaemia, Estimation of IgG, IgA , IgM. Determination of Fibrinogen. Protein in urine- Albumin, Blood and Hb (Test of Haemoglobinuria) Myoglobin, Urinary protein analysis. Protein in CSF- (estimation and clinical significance). Color reaction of protein.
- 6. Lipids, Lipoproteins and Dyslipoproteinaemia** **10 hours**
Cholesterol and phospholipids, Triglycerides, Classification and metabolism of lipoproteins (Chylomicrons, VLDL, IDL, LDL and HDL) Reference ranges and laboratory investigations (Lipid profile tests), Disorders of Lipid metabolisms, atherosclerosis, Miocardial infarction, Ketone body formation, ketosis, Obesity.

Reference Books:

1. Tietz: *Textbook of Clinical Chemistry* (3rd Ed.) 1999, W. B. Saunders
2. Todd, Sanford, Davidson: *Clinical Diagnosis and Management by Laboratory Method* (17th Ed.) 1998, W. B. Saunders
3. W. J. Marshall and S. K. Bangert: *Clinical Chemistry* (5th Ed.) 2004, Mosby Inc.
4. T. M. Devlin: *A Textbook of Biochemistry with Clinical Correlation* (5th Ed.) 2002, Dyse-Wiley
5. L. Kaplan et al.: *Clinical Chemistry Theory, Analysis and Correlations* (4th Ed.) 2003, Mosby Inc.
6. H. Varley: *Practical Clinical Biochemistry* (4th Ed.), CBS
7. Robert K. Murray, Daryl K. Granner, Peter A. Mayes and Victor W. Rodwell: *Harper's Biochemistry* (25th Ed.) 2000 Appleton and Lange, Stamford.
8. R. A. Harvey and P. C. Champe: *Lippincott's Illustrated Review: Biochemistry* (3rd Ed.) 2004, Lippincott Williams and Wilkins

HAD 281.3 (Credit hours 3)

Health and Disease (General Clinical Problem)

BMLT, Second Year, Fourth Semester

Course Objectives:

This course will provide the knowledge on basic concepts of health and disease, types of diseases, prevention of disease, with particular focus on most common diseases in South Asian region.

Course Contents:

- 1. Man and Medicine** **2 hours**
History of medicine, Modern medicine, Curative medicine, Preventive medicine, Social medicine
- 2. Concepts of Health and Disease** **4 hours**
Biomedical concept, Ecological concept, Definition of health, Dimensions of health, Concept of wellbeing, HPI, Determination of health, Responsibility for health, Indicators of health, Mortality, Morbidity, Concepts of disease, Concepts of causation, Concepts of control, Modes of intervention, Population medicine
- 3. Principles of Epidemiology and Epidemiological Methods** **4 hours**
Aims, Approaches, Measurements of morbidity and mortality, Methods, Infectious disease epidemiology, Disease transmission, Immunity, Prevention and control, Dealing with an epidemic
- 4. Screening for disease** **2 hours**
Concepts, Criteria, Sensitivity and Specificity, Problems
- 5. Epidemiology of Communicable Diseases** **12 hours**
Respiratory infections, Intestinal infections, Arthropod-borne infections, Zoonoses, Surface infections, Emerging and re-emerging infectious diseases, Hospital acquired infections, Emporiatics
- 6. Epidemiology of Chronic Non-Communicable Diseases** **5 hours**
Coronary hearth disease, Hypertension, Stroke, Rheumatic hearth disease, Cancer, Diabetes
- 7. Demography and Family Planning** **3 hours**
Demographic trends, Family planning, Contraceptive methods, Post-conceptual methods, Terminal methods, Delivery system
- 8. Preventive Medicine in Obstretics, Paediatrics and Geriatrics** **3 hours**
Mother and child, Antenatal care, Intranatal care, Postnatal care, Care of children, Infancy, Neonatal care, Growth chart, School Health Service, Geriatric prevention of disease
- 9. Nutrition and Health** **3 hours**
Classification of food, Dietary goals, Deficiencies, Food hygiene, Foodborne diseases, Food toxicants
- 10. Environment and Health** **4 hours**
Water, Acceptability, Microbiological aspects, Chemical aspects, Air pollution, Meterological environment, Excreta disposal, Medical Entomology
- 11. Occupational Health** **3 hours**
Occupational hazards, Radiation hazards, Prevention, Legislation

Reference Books:

1. K. Park: *Park's Textbook of Preventive and Social Medicine* (16th Ed.) 2000, M/s Banarsidas Bhanot Publishers, Jabalpur.
2. Carolyn Jarvis: *Physical Examination and Health Assessment* (2nd Ed.) 1996, W. B. Saunders Company, Philadelphia.
3. Robert H. Gates: *Infectious Disease Secrets*, 1999, Jaypee Brothers Medical Publishers Ltd., New Delhi.

LAB-9.1 (Credit hour 1)

Laboratory-9

BMLT, Second Year, Fourth Semester

Course Objectives:

Course Contents:

Reference Books:

LAB-10.1 (Credit hour 1)

Laboratory-10

BMLT, Second Year, Fourth Semester

Course Objectives:

Course Contents:

Reference Books:

LAB-11 (Credit hour 1)

Laboratory-11

BMLT, Second Year, Fourth Semester

Course Objectives:

Course Contents:

Reference Books:

will be organized according to the Hospital schedule.

SEM-3.1 (Credit hour 1)

SEMINAR-3

BMLT, First Year, Second Semester

Course Objectives:

Course Contents:

THE CONTENT OF SYLLABUS

**BMLT
Third Year
Fifth Semester**

MBL 301.3 (Credit hours 3)

Microbiology IV (Parasitology)

BMLT, Third Year, Fifth Semester

Course Objectives:

This course will provide the basic knowledge on human parasitology and enable the students to diagnose the infections caused by parasites.

Course Contents:

1. Features and classification of parasites of medical importance, parasites associated with HIV 3 hours
2. Procedures for collection and preservation of clinical specimens for laboratory diagnosis and parasitic infections 2 hours
3. Life cycle, pathogenesis, clinical findings, laboratory diagnosis, culture, prevention and control, epidemiology and diseases caused by the following parasites: 35 hours
 1. *Plasmodium* spp.
 2. *Giardia lamblia*
 3. *Entamoeba histolytica*
 4. *Balantidium* spp.
 5. *Ascaris* spp.
 6. *Taenia* spp.
 7. *Brugia* spp.
 8. *Hymenolepis* spp.
 9. *Leishmania* spp.
 10. *Trichomonas* spp.
 11. *Wucheria bancrofti*
 12. *Toxoplasma* spp.
 13. *Anacylostoma* spp.
 14. *Echinococcus* spp.
 15. *Trichinella* spp.
 16. *Schistosomes* spp.
 17. *Diphyllobothrium* spp.
 18. Flukes: blood flukes, intestinal flukes, lung flukes
4. Diagnostic methods 5 hours

Principles and methodology used in diagnostics of helminthes, worms, egg counting techniques, concentrations techniques, Casoni test, aldehyde test

Reference Books:

1. Chatterjee K. D. *Parasitology (Protozoology and helminthology in relation to clinical medicine)* (12th Ed.) 1980, Calcutta.
2. Mackie and McCartney: *Practical Medical Microbiology* (14th Ed.) 1999, Churchill Livingstone, London.
3. David Greenwood, Richard C.B. Slack and John F. Peutherer: *Microbiology* (15th Ed.) 2000, Churchill Livingstone, London.

PTL 311.3 (Credit hours 3)

Histopathology I

BMLT, Third Year, Fifth Semester

Course Objectives:

Students will be able to prepare staining reagents and perform tissue processing, sections cutting and staining sections of tissues. In addition they will gain knowledge about frozen sections and special histopathological techniques.

Course Contents:

- 1. Introduction** **6 hours**
Managing the laboratory, hazards and safety in laboratory, quality control, light microscopy
- 2. General outline procedures in the examination of tissues** **1 hour**
General considerations, Electrolyte balance and homeostasis, Estimation of sodium, potassium, chloride, calcium and phosphate ions, Clinical correlations
- 3. Fixation, fixatives and decalcification** **4 hours**
Definition of fixation, aims of fixation, classification of fixatives, theoretical aspects of fixation, secondary fixation, practical aspects of fixation, decalcification.
- 4. Tissue processing** **4 hours**
Introduction, labeling of tissues, dehydration, clearing, infiltration and embedding, automated tissue processing, manual tissue processing
- 5. Microtomy and section cutting** **8 hours**
Microtomes, types of microtomes, microtome knives, terms used in microtomy, sharpening of microtome knives, routine paraffin section cutting, adhesive mixture for coating slides, floating out bath, difficulties encountered in paraffin section cutting, frozen sections
- 6. Theory of staining** **10 hours**
Introduction, chemistry of colours in dyestuffs, classification of dyes, storage and maintainance of dyes, staining properties of dyes, staining equipments and materials, methodology of staining, staining in general, mounting stained sections, hematoxylin staining solutions, hematoxylin and eosin methods, staining reactions of carbohydrates, staining of connective tissues, lipids and CNS tissues, microorganisms, demonstration of pigments and minerals
- 7. Special techniques in histopathology** **12 hours**
Enzyme histochemistry, immunohistochemistry, immunofluorescence, electron microscopy in histopathology, microwave technology in histology, molecular pathology, in-situ hybridization, plastic embedding media and techniques

Reference Books:

1. John D. Bancroft and Alan Sleves: *Theory and Practice of Histological Techniques.*
1. J. Ochei and A. Kolhatkar: *Medical Laboratory Science, Theory and Practice.*
2. Praphul B. Godkar and Darshan B. Godkar: *Textbook of Medical Laboratory Technology.*
3. Kanai L. Mukharjee: *Medical Laboratory Technology.*

BCM 321.3 (Credit hours 3)

Biochemistry IV (Clinical)

BMLT, Third Year, Fifth Semester

Course Objectives:

This course will provide the knowledge on Clinical Biochemistry with emphasis on metabolism.

Course Contents:

1. Metabolic intermediates and inorganic ions 15 hours

Introduction, Non-protein nitrogenous compounds –urea/BUN (Synthesis, clinico-pathological correlations and estimations), Creatin and creatinine (Synthesis, clinico-pathological correlations and estimations), Renal function tests, Clearance tests, Hypertension, CRF, Hemodialysis and osmometry, Uric acid (Synthesis, clinico-pathological correlations and estimations), Arthritis, Ammonia, Amino acids, Prophyryns, Calcium and phosphorous homeostasis, Role of parathyroid hormone, Vitamin D compounds, Calcitonin, Clinico-pathological correlations, Bone disease, Parathyroid diseases, Renal diseases, Estimation of calcium (total and ionized) Phosphorus, cAMP, Other inorganic ions: Magnesium, Iron, Copper, Zinc, Chromium (estimation and clinical significance)

2. Water and electrolyte metabolism 5 hours

General considerations, Electrolyte balance and homeostasis, Estimation of sodium, potassium, chloride, calcium and phosphate ions, Clinical correlations

3. Acid – base balance 7 hours

Diffusion of gases in lungs, Action of buffer systems in body, Disturbances in acid-base balance, Arterial blood gas determination and clinical significances, Acidosis, Alkalosis, Spirometry, ABG abnormalities in COPD, Bronchial asthma, Diffuse interstitial pulmonary diseases, Shock, MI, Pulmonary edema and embolism, Exercise, Respiratory distress, Aspirin intoxication, Respiratory failure

4. Diagnostic enzymology 10 hours

Principles of enzyme activity determinations, Phosphatases- ACP, ALP (Determination and clinical significance), Leucine aminopeptidase (LAP), 5'-nucleotidase, γ -GT, Aminotransferases, Glycolytic enzymes (LD), Citric acid cycle enzymes, Cholinestrace, Ornithine carbamyl transferases (OCT) Iditol dehydrogenases (ID), CK, G-6-PD, Angiotension converting enzyme (ACE), ADA, Enzymes of formed elements of blood: - glutathione peroxidase (GSH-PX); Glutathione synthetase, Other enzymes: amylase, lipases, Enzymes and their clinical significance in body fluids assays

5. Liver function tests 8 hours

Hepatic tests based on excretory function (hemoglobin degradation, bilirubin metabolism and estimation), Jaundice, Detoxification and drug metabolism, Tests for hepatic synthetic ability (protein, albumin, globulin, A/G ratio, prothrombin time and vitamin K responses), Metabolic tests, tests related to disordered nitrogen metabolism, Serum enzymes (AST, ALP, ALT, γ -GT), Serum metals and related proteins, Clinical applications of LFT and LFT in non-hepatic diseases

Reference Books:

1. Tietz: *Textbook of Clinical Chemistry* (3rd Ed.) 1999, W. B. Saunders.
2. Todd, Sanford, Davidson: *Clinical Diagnosis and Management by Laboratory Method* (17th Ed.) 1998, W. B. Saunders.
3. W. J. Marshall and S. K. Bangert: *Clinical Chemistry* (5th Ed.) 2004, Mosby Inc.
4. T. M. Devlin: *A Textbook of Biochemistry with Clinical Correlation* (5th Ed.) 2002, Dyse-Wiley.
5. L. Kaplan et al.: *Clinical Chemistry Theory, Analysis and Correlations* (4th Ed.) 2003, Mosby Inc.
6. H. Varley: *Practical Clinical Biochemistry* (4th Ed.), CBS.
7. Robert K. Murray, Daryl K. Granner, Peter A. Mayes and Victor W. Rodwell: *Harper's Biochemistry* (25th Ed.) 2000 Appleton and Lange, Stamford.
8. R. A. Harvey and P. C. Champe: *Lippincott's Illustrated Review: Biochemistry* (3rd Ed.) 2004, Lippincott Williams and Wilkins.

HML 322.3 (Credit hours 3)

Hematology I

BMLT, Third Year, Fifth Semester

Course Objectives:

This course will provide the basic knowledge on Hematology and its general application to Medical Laboratory Sciences.

Course Contents:

- 1. Formation of blood cell** **10 hours**
General aspects of blood cell formation. Sites of blood formation. Development of blood cells. Morphology. Erythropoiesis, granulopoiesis, lymphopoiesis. Monocyte-macrophage series. Thrombopoiesis. Regulation of haemopoiesis.
- 2. Bone marrow** **5 hours**
Normal bone marrow structure. Bone marrow biopsy. Bone marrow aspiration. Processing of aspirated bone marrow. Examination of aspirated bone marrow, Reporting bone marrow aspirated films.
- 3. Red cells** **5 hours**
Structure and metabolism of the red cell. Nutritional requirements for red cell production. Function of the red cells. Red cell count. Red cell indices.
- 4. White cells** **7 hours**
Physiology of white cells, metabolic and enzymatic characteristics of white cells, functions of white cells, normal white cells, white cells values, Neutrophilia, eosiniphilia, monocytes, lymphocytes, neutropenia, agranulocytosis and lymphopenia. Infectious mononucleosis.
- 5. Platelets** **3 hours**
Structure of platelets, development of platelets, functions of platelets, platelet count. Platelet values.
- 6. Basic aspects of anaemi** **5 hours**
Definition of anaemia, physiological adaptation of anaemia, clinical features of anaemia, morphological classification of anaemia, causes of anaemia.
- 7. Hypochromic anaemia: iron deficiency** **5 hours**
Iron metabolism. Iron deficiency anaemia. Sideroblastic anaemia
- 8. Megaloblastic anaemia** **5 hours**
Vitamin B12 and folate metabolism, general considerations in vitamin B12 and folate deficiencies. Megaloblastic Erythropoiesis. Pernicious anaemia. Megaloblastic anaemia following gastrectomy. Megalosblastic anaemia in alcoholics, pregnancy, infancy and childhood.

Reference books:

1. de Gruchy's: *Clinical Haematology* (5th Ed.) 2003, Blackwell Science. Oxford.
2. Dacie and Lewis: *Practical Haematology* (9th Ed.) 2001, Churchill Livingstone, London.

BCM 323.3 (Credit hours 3)

Applied Biotech (Modern Tools in Biochemistry)

BMLT, Third Year, Fifth Semester

Course Objectives:

This course will provide the knowledge on basic concepts of.

Course Contents:

1. Chromatographic Techniques

7 hours

Chromatography theory and practice. Low pressure column chromatography, High performance liquid chromatography, Adsorption chromatography, Partition Chromatography, Ion-exchange chromatography, Molecular exclusion chromatography, Affinity chromatography, Gas-liquid chromatography, Paper and Thin layer chromatography. Selection of chromogenic system.

2. Electrophoretic Techniques

10 hours

General principles, supporting media. Agrose gels, Polyacrylamide gels. Electrophoresis of proteins- SDS-PAGE Electrophoresis, Native (buffer) gels, Gradient gels, isoelectric focusing gels, Two dimensional PAGE Electrophoresis, Cellulose acetate electrophoresis, continuous flow electrophoresis, Detection, estimation and recovery of proteins in gels, Western blotting.

Electrophoresis of nucleic acids, Agrose gel electrophoresis of DNA, DNA Sequencing gels, Pulsed-field gel electrophoresis, Electrophoresis of RNA, Capillary Electrophoresis, Densitometry.

3. Immunochemical Techniques

8 hours

Introduction, Radio immunoassay (RIA), Enzyme linked immunosorbent Assay (ELISA), Chemiluminescence Technique (CIL), Electrochemiluminescence technique (ECL), Fluorescence polarization immunoassay (FPIA).

4. DNA Probing and PCR Techniques:-

10 hours

Introduction, Gene cloning, Probe labeling, Hybridization, Expression of foreign gene, Analyzing genes and expression, Analyzing whole genome. Molecular biotechnology and applications RT-PCR, Bioinformatics and the internet.

5. Electrochemical Techniques.

10 hours

Introduction, Principles of electrochemical techniques Redox-reactions, The pH electrode, Ion-Selective and Gas-sensing electrodes, Clark oxygen electrode, electrochemical detectors for HPLC, Spirometry, Biosensors.

References Books:

1. Tietz, "Text Book of Clinical Chemistry", Third edition (1999). W.B. Saunders.
2. Todd. Sanford. Davidson, "Clinical Diagnosis & Management By Laboratory Method" Seventeenth edition (1998), W.B. Saunders.
3. Marshall W.J. and Bangert S.K., "Clinical Chemistry, Fifth edition, (2004), Mosby Inc. USA.
4. Devlin T. M. "A Text Book Of Biochemistry With Clinical Correlation", Fifth edition (2002), Dyse-wiley, USA.
5. Kaplan L. et.al, "Clinical Chemistry Theory, Analysis and Correlations", Fourth edition, (2003), Mosby Inc. USA.
6. Plummer D., "An Introduction To Practical Biochemistry", Third edition, Tata McGraw Hill, India.
7. Wilson and Walker, "Practical Biochemistry", Fifth edition, Cambridge.
8. Varley H., "Practical Clinical Biochemistry", Fourth edition, CBS. India
9. Murray et. al, "Harper's Biochemistry", Twenty sixth edition (2003), Appleton-Lange, USA.
10. Harvey R.A. and Champe P.C., Lippincott's Illustrated Review, "Biochemistry" third edition, (2004) Lippincott Williams and Wilkins.

LAB-12.1 (Credit hour 1)

Laboratory-12

BMLT, Third Year, Fifth Semester

Chosen topics in Medicinal Microbiology

Course Objectives:

Course Contents:

Reference Books:

LAB-13.1 (Credit hour 1)

Laboratory-13

BMLT, Third Year, Fifth Semester

Chosen topics in Clinical Biochemistry

Course Objectives:

Course Contents:

Reference Books:

LAB-14.1 (Credit hour 1)

Laboratory-14

BMLT, Third Year, Fifth Semester

Advanced clinical tests encountered in Hospital Practice of Medicinal Technologies

This practical will be performed and organized according to the Hospital schedule.

Course Objectives:

Course Contents:

Reference Books:

SEM-4.1 (Credit hour 1)

SEMINAR-4

BMLT, Third Year, Fifth Semester

Course Objectives:

Course Contents:

THE CONTENT OF SYLLABUS

**BMLT
Third Year
Sixth Semester**

MBL 302.3 (Credit hours 3)

Microbiology V (Virology)

BMLT, Third Year, Sixth Semester

Course Objectives:

This course will enable students to become familiar with most common viruses causing infections in man and animals, with emphasis on viruses common in South Asian region

Course Contents:

- 1. Introduction to Virology** **5 hours**
History of viral evolution, General properties of viruses, Morphology, Size, Shape, Structure, Chemical properties, Viral haemagglutination, Classification and Replication
- 2. Virus Cultivation** **5 hours**
Animal inoculation, Embryonated egg inoculation and tissue culture, Detection of viral growth in cell culture, Viral assay, Assay of infectivity, Viral genetics
- 3. Virus-host Interaction** **5 hours**
Pathogenesis, Spread of virus in the body, Significance of the incubation period, Host response to virus infection, Immunity in virus infections, Non-immunological response
- 4. Laboratory Diagnosis of Viral Diseases** **10 hours**
Microscopy, Demonstration of viral antigen, Virus isolation, Serology e.g. ELISA, CFT, Haemagglutination inhibition, Neutralization, Western blotting, Agglutination, Precipitation, RIA, IFA
- 5. Viral Vaccines** **2 hours**
- 6. Systemic virology** **18 hours**
Bacteriophage, Small pox, Herpes viruses, Hepatitis viruses A, B, C, D and E, Polio virus, Rhino virus, Influenzae virus, Mumps virus, Measles virus, Rabies virus, Rubella virus, Rota virus, Oncogenic viruses, HIV

Reference Books:

1. D. Greenwood, R. C.B. Slack and J. F. Peutherer: *Microbiology* (15th Ed.) 2000, Churchill Livingstone, London.
2. B. A. Forbes, D. F. Sahm and A. S. Weissfeld: *Bailey & Scott's Diagnostic Microbiology* (11th Ed.) 200, Mosby, St. Louis.
3. P.R. Murray, K.S. Rosenthal, G.S. Kobayashi and M.A. Pfaller: *Medical Microbiology* (3rd Ed.) 1998, Mosby, St. Louis.
4. R. Y. Stanier, J. L. Ingraham, M/ L. Wheelis and P. R. Painter: *General Microbiology* (5th Ed.) 1995, Macmillan, Hong Kong.
5. M. C. Timbury: *Notes on Medical Virology*, 1997, Churchill Livingstone, New Delhi.
6. G. J. Tortora, B. R. Funke and C. L. Case: *Microbiology-an Introduction* (8th Ed.) 2004, Pearson Education, Patparganj.

MBL 303.3 (Credit hours 3)

Microbiology VI (Mycology)

BMLT, Third Year, Sixth Semester

Course Objectives:

This course will enable students to become familiar with medically important fungi and to diagnose the infections caused by fungi.

Course Contents:

- 1. Introduction to Mycology** **4 hours**
Introduction, Classification of medically important fungi, Fungal species associated with AIDS.
- 2. Medically Important Fungi** **5 hours**
General characteristics of medically important fungi and their significance to human beings, Opportunistic fungi.
- 3. Specimen Preparation** **2 hours**
Procedures for collection and preservation of clinical specimens for diagnostic purposes.
- 4. General Characteristics, Pathogenesis, Clinical Findings, Laboratory Diagnosis, Epidemiology and Diseases, Prevention and Control of the following Fungi** **30 hours**
Aspergillus spp., Candida albicans, Fusarium spp., Cryptococcus neoformans, Histoplasma capsulatum, Sporothrix spp., Philophora spp., Trichophyton microsprum, Epidermphyton spp., Blastomyces dermatitidis, Coccidioides immitens, Paracoccidioides brasiliensis.
- 5. Antifungal sensitivity test, Antifungal drugs** **4 hours**

Reference Books:

1. J. Chander: *Textbook of Medical Mycology* (2nd Ed.) 2002, Mehta Publishers, Delhi.
2. D. Greenwood, R. C.B. Slack and J. F. Peutherer: *Microbiology* (15th Ed.) 2000, Churchill Livingstone, London.
2. B. A. Forbes, D. F. Sahm and A. S. Weissfeld: *Bailey & Scott's Diagnostic Microbiology* (11th Ed.) 200, Mosby, St. Louis.
3. P.R. Murray, K.S. Rosenthal, G.S. Kobayashi and M.A. Pfaller: *Medical Microbiology* (3rd Ed.) 1998, Mosby, St. Louis.
4. Mackie and McCartney: *Practical Medical Microbiology* (14th Ed.) 1999, Churchill Livingstone, London.

PTL 312.2 (Credit hours 3)

Histopathology II

BMLT, Third Year, Sixth Semester

Course Objectives:

Students will be able to prepare staining reagent and perform tissue processing, section cutting, stain tissue section, handle frozen section and museum sample.

Course Contents:

- 1. Laboratory handling: 2 hours**
Practical aspect of laboratory management, hazards and safety in histopathological laboratory techniques .
- 2. Fixatives 7 hours**
Definition of fixatives, its aims & objectives, classification, Preparation of fixatives
A) Simple fixative: Aldehyde & Gluteraldehyde, Oxidizing agents, Protein denaturing agents and other reagents with unknown mechanism B) Compound fixatives: Classification and preparation of compound fixatives: *i) Micro anatomical fixatives:* a) 10% Formalin b) 10% Formal Saline c) 10% Buffered formalin d) 10% formal calcium, e) Heidenhain's susa f) Zenker Fluid g) Beuin's fluid h) Gender's fluid *ii) Cytological fixatives:* a) Nuclear Fixative: Carnoy's fixative, Clarke's Fluid, Alcohol Formalin. b) Cytoplasmic Fixative: Champy's Fluid c) Histochemical Fixatives: -Buffered Formalin, Cold acetone & Absolute alcohols *iii) Other Methods of Fixation:* a) Vapour Fixation b) Secondary fixation c) Past chromatization d) Freeze drying e) Heat fixation
- 3. Tissue Processing 5 hours**
Collection, Labeling and Fixation of Specimen
A) *Dehydration* - Definition, Mode of action, manual and automation technique, Advantages and disadvantages of dehydrating agents B) *Clearing agent* - Definition, Purpose, Criteria of ideal clearing agent, Advantages and disadvantages of clearing agents, Manual and automatic technique C) *Impregnation and Infiltration* - Definition, Purpose, Manual and automatic technique, Factors affecting impregnation. D) *Embedding* - Definition, Types of embedding media, advantages and disadvantages of embedding media, Technique of embedding and Types of Moulds
- 4. Section Cutting 8 hours**
A) *Microtome Knives:* a) Parts of knives, classification of microtome knives based on size & manner in which they are ground, b) Knives sharpening both (honing & stropping), Types of hones used, procedure of honing types of stropps used, procedure for stropping, c) Care of Microtome knives, d) Lubricants used, Abrasives. B) *Microtomes:* Definition, Principle, Parts and Types a) Rocking, b) Rotary, c) Sliding Base-sledge, d) Freezing, e) Cryostat (their parts, principle, advantages and disadvantages), Care of microtome C) *Technique of section cutting:* -Requirements, procedure, deparaffinization, adhesives, causes & remedies of improper sections.
- 5. Histology Routine and Special Staining 23 hours**
Definition, Classification, Stain preparation and staining Procedure, Principle of Interpretation,
a) Haematoxyline and Eosin Stain b) Papanicolou Technique (PAP) for Diagnostic Exfoliative Cytology c) Periodic Acid Schiffs (PAS) for Carbohydrates d) Gomorri's Silver Impregnation for Reticoulin Fibres e) Peril's-Prussian Blue Reaction For Hemosiderine f) Grimelius Silver Method For Argyrophel Cell g) Gomorri's Method for Demonstrating Haemosiderin (Ferric Salts) h) Veroff's Method for Elastic Fibres i) Ziehl-Neelsen Technique for Mycobacterium Tuberculosis j) Fite Stain for Mycobacterium Leprae in Tissue k) Phosphotungstic Acid Haematoxylin (PTAM) for Neurological Fibres l) Sudan W or Sudan IV Staining For Fat m) Masson Fontana for Melanin n) Methanamine Silver-Grocott's Method For Fungi o) Masson's Trichrome for Collagen Fibres p) Alkaline Congo-Red Technique for Amyloid q) Warthin-Starry Method for Spirochetes r) Southgate's-Mayer's Mucicarmin Method s) Museum Techniques

Reference Books:

- 1) John.D. Bancroft and Stevens: *Theory and Practice of Histological Techniques*
- 2) Harsh Mohan: *Textbook of pathology* (4th Ed.)
- 3) Winfrid Gray: *Diagnostic Histo-Cytopathology*
- 4) Bibbo: *Comprehensive Cytopathology*
- 5) L. G. Koss *Diagnostic Hystopathological and Cytopathology*

BCM 324.3 (Credit hours 3)

Biochemistry V (Clinical)

BMLT, Third Year, Sixth Semester

Course Objectives:

This course will enable students to broaden their knowledge in Clinical Biochemistry with emphasis on hormonal, gastrointestinal, heart and cancer disorders.

Course Contents:

1. Gastrointestinal and Pancreatic Function

5 hours

Disorders and investigation of gastric function, Pancreatic disorders and their investigation, Acute and chronic pancreatitis, α -amylase, Lipase, Other pancreatic enzymes (Trypsin, Chymotrypsin and carboxypeptidases), Sweat Test.

2. Cardiac Profile Tests

6 hours

The heart, Electric charges in heart, ECG, Ischemic heart disease, Myocardial infarction, Tests for atherosclerosis and risk factor - (FBS, PPBS, BUN, Creatinine, electrolytes), Cardiac risk evaluation tests- (Lipid profile test).

Cardiac injury panel test – CPK and isoenzymes, SGOT, LDH, SHBD, Myoglobin, α -1-acid glycoprotein, Markers of myocardial infarction- CPK-MB, Myoglobin, Troponin- T and I. CRP.

Apolipoproteins.

3. Endocrinology and Hormone Assays

18 hours

Pituitary Gland

Anterior pituitary- Growth hormone and Prolactin.

Posterior pituitary- ADH and Oxytocin.

Thyroid Gland- Thyroid disease, Thyroxin, Triiodothyronine, Thyrotropin (TSH), Thyroxin binding globulin, Thyroglobulin.

Adrenal Gland-Pheochromocytoma and catecholamine producing tumors, Epinephrines, VMA, Catecholamines. Cortisol, ACTH, Glucocorticoids, Cushing's syndrome, Addison's disease. Renin, Aldosterone.

Gonadotropins and sex hormones – LH, FSH, Estrogens, Progesterone, Androgens. Eicosanoids.

4. Cancer and Tumour Markers

16 hours

Introduction, Oncogenes, Mechanism of action of oncogens, Benign and malignant tumors, Characteristics of growing tumor cells.

Enzymes as tumor marker- ALP, CPK, Neuron specific enolase, Alcohol dehydrogenase, Amylase, Esterase, 5'-nucleotidase, Ribonuclease.

Hormones- PSA, Oncofetal antigen, AFP, CEA, Squamous cell carcinoma antigen (SCC), Other Hormones ACTH, ADH, Calcitonin, gastrin, HCG, PTH, Prolactin, GH, human placental lactogen.

Carbohydrate markers- CA-15-3, CA-125,

Blood group antigens- CA-19-9, CA-50, CA-72-4, CA-242.

Reference Books:

1. Tietz: *Textbook of Clinical Chemistry* (3rd Ed.) 1999, W. B. Saunders
2. Todd, Sanford, Davidson: *Clinical Diagnosis and Management by Laboratory Method* (17th Ed.) 1998, W. B. Saunders
3. W. J. Marshall and S. K. Bangert: *Clinical Chemistry* (5th Ed.) 2004, Mosby Inc.
4. T. M. Devlin: *A Textbook of Biochemistry with Clinical Correlation* (5th Ed.) 2002, Dyse-Wiley
5. L. Kaplan et al.: *Clinical Chemistry Theory, Analysis and Correlations* (4th Ed.) 2003, Mosby Inc.
6. H. Varley: *Practical Clinical Biochemistry* (4th Ed.), CBS
7. Robert K. Murray, Daryl K. Granner, Peter A. Mayes and Victor W. Rodwell: *Harper's Biochemistry* (25th Ed.) 2000 Appleton and Lange, Stamford.
8. R. A. Harvey and P. C. Champe: *Lippincott's Illustrated Review: Biochemistry* (3rd Ed.) 2004, Lippincott Williams and Wilkins

HML 325.3 (Credit hours 3)

Hematology II

BMLT, Third Year, Sixth Semester

Course Objectives:

This course will provide the basic knowledge on hematology and its application in Laboratory Medical Sciences

Course Contents:

- 1. Different types of red blood cells anomalies** **2 hours**
- 2. Anemia:** **9 hours**
Blood loss anemia, Hemolytic anemia, Aplastic anemia, Laboratory investigation of various types of anemia
- 3. Principles, interpretation and clinical correlation of the common laboratory tests** **3 hours**
G6PD, Fetal hemoglobin, Osmotic fragility, Hemoglobin electrophoresis, Sickling phenomena, Methemoglobin, Ferritin and TIBC.
- 5. Hemoglobinopathies and their diagnosis.** **2 hours**
- 6. LE cell phenomenon and its demonstration.** **1 hour**
- 7. Coulter counter and its principle and uses.** **1 hour**
- 8. Leukocyte disorder: Neoplastic and non-neoplastic** **2 hours**
- 9. Leukemia: Definition, Etiology, Clinical features, Classification and laboratory diagnosis.** **6 hours**
- 10. Principle of cytochemical stains** **2 hours**
MPO, Sudan black B, PAS and Non-specific esteras
- 11. Leukemoid reaction: Definition, Causes, Blood picture and differences from leukemia.** **1 hour**
- 12. Coagulation** **9 hours**
Theories of normal hemostasis and blood coagulation, Physico chemical properties of different coagulation factors, Screening of coagulation, Principle of coagulation factor assay
- 13. Fibrinolysis:** **2 hours**
Components, Mechanism and diagnosis
- 14. Disseminated Intravascular Coagulation (DIC):** **2 hours**
Definition, Etiology, Pathogenesis, Clinical symptoms and Diagnosis
- 15. Cytogenetics:** **2 hours**
Numerical and structural chromosomal abnormalities, Cytogenetic disorders, Karyotyping, Application of cytogenetics in hematology
- 16. Platelet disorders, Platelet function tests and their interpretation** **1 hour**

References:

4. F. Firkin, C. Chesterman, D. Penington and B. Rush: *de Gruchy's Clinical Hematology in Medical Practice* (5th Ed.) 1989, Oxford University Press, Delhi.
2. S.M. Lewis, B.J. Bain and I. Bates: *Dacie and Lewis Practical Hematology* (9th Ed.) 2002, Churchill Livingstone, New Delhi.
3. J.M. Thompson: *Blood Coagulation and Hemostasis* (3rd Ed.) 1985, Churchill Livingstone, New Delhi.
4. S.S. Raphael: *Lynch's Medical Laboratory Technology* (4th Ed.) 1983, W. B. Saunders Co., New Delhi.

LAB-15.1 (1 credit hour)

Laboratory 15.1

BMLT, Third Year, Sixth Semester

Chosen topics in Medicinal Microbiology

Isolation and identification of *Staphylococcus aureus* from nostrils

Isolation and identification of microorganisms GI tract from stool samples

Isolation and identification of *Vibrio cholerae* from the patients suffering from cholera

Isolation and identification of etiological agents causing cystitis in pregnant patients (urine samples) Bacteriological examination of drinking water by Most Probable Number method (MPN method) Study of synergism

Study of antagonism

LAB-16.1 (1 credit hour)

Laboratory 16.1

BMLT, Third Year, Sixth Semester

Chosen topics in Clinical Biochemistry

Gel electrophoresis, Protein determination, Hormone determination, Specialized biochemical techniques used in Clinical Biochemistry

LAB-17.1 (1 credit hour)

Laboratory 17.1

BMLT, Third Year, Sixth Semester

Advanced clinical tests encountered in Hospital Practice of Medicinal Technologies

This practical will be performed and organized according to the Hospital schedule.

SEM-5.1 (Credit hour 1)

SEMINAR-5

BMLT, Third Year, Sixth Semester

Course Objectives:

Course Contents:

THE CONTENT OF SYLLABUS

**BMLT
Fourth Year
Seventh Semester**

MBL 401.3 (Credit hours 3)

Microbiology VII (Clinical)

BMLT, Fourth year, Semester

Course Objectives:

Students will gain knowledge and skills to tackle the laboratory aspects of medico-legal cases as well as learn Professional ethics related to clinical microbiology

Course Contents:

- 1. General Issues in Clinical Microbiology** **10 hours**
 - a. General Issues and role of B. Sc. MLT: responsibilities to the Patient and clinician
 - b. Laboratory Safety
 - c. Laboratory design, management and organization
 - d. Quality control and quality analysis
 - e. Infection control : nosocomial infections, antibiotic-resistant microorganisms, Epidemiology and control of community infections, Hospital infections, Outbreaks, Prevention
 - f. Examination of water, milk, food and air
- 2. Scientific and Laboratory Bases for Clinical Microbiology** **6 hours**

Host-microorganism interactions, Diagnosis of infectious diseases, Molecular methods for microbial identification and characterization, Immunochemical methods, Serologic diagnosis, Antimicrobial action and resistance, Antimicrobial susceptibility testing
- 3. Diagnosis by organ Systems** **20 hours**
 - a. Bacteremia and other relevant organisms isolated from blood
 - b. Laboratory diagnosis of lower respiratory tract infections
 - c. Laboratory diagnosis of upper respiratory tract infections
 - d. Laboratory diagnosis of infections in oral cavity and neck
 - e. Laboratory diagnosis of meningitis and other infections of CNS
 - f. Laboratory diagnosis of infections in eyes, ears and sinuses
 - g. Laboratory diagnosis of infections in urinary tract]
 - h. Laboratory diagnosis of infections in genital tract
 - i. Laboratory diagnosis of skin, soft tissues and wound infections
 - j. Normally sterile body fluids, bone and bone marrow and solid tissues
- 4. Special Infection Problems** **4 hours**

Health-care associated infection, Pyrexia of unknown origin, Infection in immuno-compromised patients, Infection and pregnancy
- 5. Management of experimental animals** **4 hours**

In vivo microbiological techniques, Organization of experiment, Guinea pig, Mouse, Rat
- 6. Case studies** **4 hours**

Reference books:

1. Betty A. Forbes, Daniel F. Sahn and Alice S. Wessfeld: Bailey and Scott's Diagnostic Microbiology (11th Ed.) Mosby, St. Louis 2002
2. Morag C. Timbury, Christine McCartney, Bishan Thakker and Katherine N. Ward: Notes on Medical Microbiology 200, Churchill Livingstone, Edinburgh.
3. David Greenwood, Richard C.B. Slack and John F. Peutherer : Medical Microbiology (16th Ed) 2002 , Churchill Livingstone, New Delhi
4. Patrick R. Murray, Ken S. Rosenthal, George S. Kobaysahi and Michael A.Pfaller: Medical Microbiology (3rd Ed) 1998, Mosby, St. Louis.
5. Gerald J. Collee, Andrew G. Fraser, Barrir P. Marminn and Anthony Simmous: Mackie and McCartney Practical Medical Microbiology (14th Ed) 1999, Churchill Livingstone, Edinburgh.

PTL 411.3 (Credit hours 3)

Autopsy and Medical Jurisprudence

BMLT, Fourth Year, Seventh Semester

Course Objectives:

Students will gain knowledge and skills to tackle the laboratory aspects of medico-legal cases as well as learn laboratory professional ethics.

Course Contents:

- 1. Introduction** **2 hours**
Definition, history of forensic medicine
- 2. Legal procedures in medico-legal cases** **4 hours**
Inquest, witness, medical evidence, attendance by a medical man in court as a witness
- 3. Legal and ethical aspects of laboratory practices** **6 hours**
Codes of ethics, acts in connection with medical laboratory profession, Nepal Health Professional Council, professional misconduct and negligence, duties of a registered laboratory practitioner, consent, maintenance of laboratory records
- 4. Laboratory methods of identification of an individual** **10 hours**
Determination of sex, estimation of age (in infants), use of DNA (PCR), identification from blood and other medico-legal aspects of blood, forensic aspects of Hbs, medico-legal aspects of examination of seminal fluid and hairs.
- 5. Forensic science laboratory** **9 hours**
Introduction, set up of a forensic science laboratory, chromatography, electrophoresis, spectrophotometry, microscopies in forensic medicine, biological tests for hCG
- 6. Forensic toxicology** **12 hours**
Definition, medico-legal autopsies and preservation of viseras and blood, laboratory tests for qualitative and quantitative analysis of poison, organo-phosphorous compounds and other common poisoning.
- 7. Drug dependence and drug abuse** **2 hours**

Reference Books:

1. Apurba Nandy: *Principles of Forensic Medicine*.
2. B. V. Suvramanyan: *Modi's Medical Jurisprudence and Toxicology* (22nd Ed.) 1999, Butterworths, New Delhi.

BCM 421.3 (Credit hours 3)

Biochemistry VI (Toxicology)

BMLT, Fourth Year, Seventh Semester

Course Objectives:

Students will gain knowledge and skills to tackle the laboratory aspects of medico-legal cases as well as learn laboratory professional ethics.

Course Contents:

- 1. Genetic Disorders and Inborn Error of Metabolism** **5 hours**
Introduction, Autosomal disorders, sex linked disorders, Laboratory diagnosis of Albinism, Alkaptonuria, Maple Syrup Urine disease, histidinemia, cystinuria, Wilson's disease.
- 2. Study and Analysis of Calculi** **5 hours**
Urinary calculi- Mechanism of formation of calculi, Clinical findings. Biochemical analysis.
Gall stones- Factors responsible for formation of stones, clinical findings and chemical analysis.
Pancreatic calculi, salivary calculi, Faecal concretions.
- 3. Therapeutic Drug Monitoring and Clinical Aspects of Toxicology.** **15 hours**
Introduction, Mechanism of absorption, Metabolism and excretion of drugs, Drug assay techniques, Antiepileptic Drugs and methods of determination- (Phenytoin, Phenobarbital, Pyrimidine, Carbamazepin, and ethosuximide) Valporic acid, Digoxin. Bronchodilators and method of determination- Theophylline, Caffeine and dyphylline. Others- Lithium, Cyclosporine, Ethanol, Methanol, Paracetamol, Salicylates, Gentamycin. Drugs of abuse- Barbiturates, Cocaine, Marijuana (Cannabinoid) Amphetamine, Metamphetamine, Phencyclidine, Methadone, Benzodiazepines, Opiates (Morphine).
- 4. Automation in Clinical Chemistry** **10 hours**
- 5. Quality Control in Clinical Biochemistry** **10 hours**

Reference Books:

1. Tietz: *Textbook of Clinical Chemistry* (3rd Ed.) 1999, W. B. Saunders
2. Todd, Sanford, Davidson: *Clinical Diagnosis and Management by Laboratory Method* (17th Ed.) 1998, W. B. Saunders
3. W. J. Marshall and S. K. Bangert: *Clinical Chemistry* (5th Ed.) 2004, Mosby Inc.
4. T. M. Devlin: *A Textbook of Biochemistry with Clinical Correlation* (5th Ed.) 2002, Dyse-Wiley
5. L. Kaplan et al.: *Clinical Chemistry Theory, Analysis and Correlations* (4th Ed.) 2003, Mosby Inc.
6. H. Varley: *Practical Clinical Biochemistry* (4th Ed.), CBS
7. Robert K. Murray, Daryl K. Granner, Peter A. Mayes and Victor W. Rodwell: *Harper's Biochemistry* (25th Ed.) 2000 Appleton and Lange, Stamford.
8. R. A. Harvey and P. C. Champe: *Lippincott's Illustrated Review: Biochemistry* (3rd Ed.) 2004, Lippincott Williams and Wilkins
9. Plummer D., "An Introduction To Practical Biochemistry", Third edition, Tata McGraw Hill, India.
10. Wilson and Walker, "Practical Biochemistry", Fifth edition, Cambridge.

HML 422.3 (Credit hours 3)

Immuno-Hematology and Blood Banking

BMLT, Fourth Year, Seventh Semester

Course Objectives:

The course provide knowledge of principle and techniques involved in blood banking.

Course Contents:

- 1. Basic Concepts of Immunoematology** **10 hours**
Introduction and history of blood transfusion, Fundamentals of immunology and immunoematology, Erythrocyte antigen and antibodies, Antigen-antibody reactions (agglunitation, sensitization, hemolysis, neutralization, precipitation). Blood group systems, ABO, Rh and other blood groups. Leu ocyte antigens and HLA typing. Platelet antigens.
- 2. Collection, Preservation and Storage of Blood** **10 hours**
Donor selection and preparation, Procedure for blood collection, Blood containers, Use of anticoagulant and preservatives, Storage of blood and blood components, changes during storage. Clinical use of whole blood.
- 3. Blood Components and Separation Techniques** **10 hours**
Blood components, their production and Clinical use. RBCs or Packed RBCs (PRBCs). Platelets. Fresh frozen plasma (FFP), Cryoprecipitated antihemophilic factor. Apheresis: Plasma pheresis, Leukopheresis, Platelet pheresis, Thetapeutic pheresis
- 4. Blood Bank Procedures** **10 hours**
Test procedures: Blood grouping (ABO), Rh typing, Antiglobulin tests (DCT and ICT), Antiboby screening tests, Compatibility testing, Pre-transfusion tests and Post-transfusion tests
- 5. Complications of Blood Transfusion and Quality Control** **5 hours**
Infectious complications, Non-infectious complications, Quality control in Blood banking

Reference Books:

1. Quinly E. D. (ed): *Immunoematology ,Principle and Practice*, 2nd Ed., Lippincott, Philadelphia, 1998.
2. Beutler E, Lichtman M. A., Coller B. S., Kipps T. J. and Seligosohn U: *Willims Hematology* (6th. Ed), Mc Graw-Hill, 2001.
3. Lewish S. M., Bain B. J. and Bates T: *Practical Haematology* (9th Ed) Churchill Livingstone.

RES 491.3 (Credit hours 3)

Clinical Laboratory Research

BMLT, Fourth Year, Seventh Semester

Course Objectives:

The course will enable students to independently search the relevant clinical laboratory science literature, and write a research project based on scientific background. The research project will be submitted to relevant authorities.

Course Contents:

- | | |
|---|-----------------|
| 1. Medline and Related Data Bases | 7 hours |
| Introduction to literature search, Key words, Medline, PubMed, SCI, Current Contents, Chemical Abstracts, Biological Abstracts, | |
| 2. Pharmaceutical and Pharmacy-related Publications | 7 hours |
| The most quoted journals, Original research article, Review article, Short communication, Notes, Rapid communication, Conferences, congresses and symposiums, Workshops | |
| 3. Research Article | 5 hours |
| Summary, Key words, Introduction, Materials and methods, Results, Discussion, Conclusions, References | |
| 4. Patents | 3 hours |
| Patent, Access to patents, Citation of a patent, Expired patents | |
| 5. Writing a Research Proposal* | 23 hours |
| Literature search, Originality, Applicability to the available resources, Time-frame, Report, Publications | |

* Four students are jointly writing a proposal under the supervision of a teacher. The proposal will be submitted to the relevant authorities.

LAB-18.1 (1 credit hour)

Laboratory 18
BMLT, Fourth Year, Seventh Semester
Chosen topics in Medicinal Microbiology

LAB-19.1 (1 credit hour)

Laboratory 19
BMLT, Fourth Year, Seventh Semester
Chosen topics in Clinical Biochemistry

LAB-20.1 (1 credit hour)

Laboratory 20
BMLT, Fourth Year, Seventh Semester
Advanced clinical tests encountered in Hospital Practice of Medicinal Technologies
This practical will be performed and organized according to the Hospital schedule.

SEM-6.1 (Credit hour 1)

SEMINAR-6
BMLT, Fourth Year, Seventh Semester

Course Objectives:

Course Contents:

THE CONTENT OF SYLLABUS

**BMLT
Fourth Year
Eighth Semester**

INT 491.3 (Credit hours 3)

Internship

BMLT, Fourth Year, Eighth Semester

PRW 492.6 (Credit hours 6)

Project work

BMLT, Fourth Year, Eighth Semester

**THE CONTENT OF
PRACTICAL SYLLABUS**

Bachelor of Science in Medical Laboratory Technology (B.Sc.MLT)

Haematology

HAEMATOTOLOGY SECTION		In-Hrs
1.	Introduction to Clinical Laboratory Sciences and Laboratory Safety Rules	5
2.	Instrumentation and Laboratory Glassware	5
3.	Introduction to:	-
(a)	Microscopy and Hematology	1
(b)	Normal constituents of Blood and their Structure and Functions	2
(c)	Haematoposis	1
4.	Anticoagulants and their uses in hematology	2
5.	Blood collection and preservation Technique	3
6.	Structure, Function and Fate of RBC	2
7.	Structure, Function and Maturation of WBC	2
8.	Packed Cell Volume (PCV)	1
9.	Erythrocyte Sedimentation Rate (ESR)	1
10.	Cell Counting, RBC, WBC, Platelet Count, Absolute Eosinophil Count	5
11.	Reticulocyte Count	2
12.	RBC Indices and their Significances.	1
13.	Preparation and Staining of Blood Smear and WBC Morphology(D.C.)	5
14.	WBC, Abnormalities including Leukemia	3
15.	Anemia	3
16.	Osmotic Fragility Test	2
17.	Sickling Test	1
18.	Sucrose Lysis Test	1
19.	Acid Elution Test	1
20.	Bone Marrow Staining	5
21.	Coagulation Study or Normal Hemostasis	5
(a)	Bleeding Time	2
(b)	Clotting Time	2
(c)	Clot Retraction test	2
(d)	PT, APTT and INR	3
(e)	Coagulation Disorder and Mixing Study	5
(f)	L.E. Cell Phenomenon	2
(g)	Parasites (MP/MF)	2

BODY FLUID SECTION

URINE EXAMINATION		
1.	Physiology of Kidney Function Normal Constituents of Urine	3
3.	Physical Examination of Urine Sample	3
4.	Chemical Examination of Urine Sample	1
(a)	pH	1
(b)	Protein	1
(c)	Sugar	1
(d)	Ketones	1
(e)	Urobilinogens	1
(f)	Bile Salts	1
(g)	Bile Pigments	1
(h)	Blood	1
(i)	B. J. Protein	1
5.	Microscopy Examination	-
(a)	WBC	2
(b)	RBC	2
(c)	E. P. Cells	2
(d)	Casts	3
(e)	Crystals	3
(f)	Others	-

6.	Urine Examination by Strip Method	3
7.	Urine for Pregnancy Test (UPT)	1
8.	Cerebro Spinal Fluid (C.S.F.) and Other Body Fluids Examination	5
9.	Semen Analysis	1
(a)	Physical Examination	2
(b)	Chemical Examination	2
(c)	Microscopy Examination	2
10.	Sputum Examination For T.B.	3
11.	Fine Needle Aspiration Cytology (F.N.A.C.) and PAP-Smear	5

STOOL SECTION

1.	Occult Blood	2
2.	Ova and Parasite	5

IMMUNO-HEMATOLOGY OR BLOOD BANK SECTION

1.	Selection of Donor's , Collection of Blood and Processing	
(a)	Donor Registration	1
(b)	Collection of Blood	2
(c)	Adverse Donor Reaction	3
2.	Storage & Preservation of Blood	1
(a)	ACD-Solution	1
(b)	Uses of CPDA, CPDA ₂ & Heparin.	2
3.	ABO Blood Grouping	2
(a)	Slide Technique	2
(b)	Tube Technique	2
(c)	Rh-Blood Group & D ^u Typing	3
4.	Compatibility Test	3
(a)	Major cross Matching	3
(b)	Minor Cross Matching	3
5.	Anti-Human Globulins test(AHG) or Coomb's Test	5
(a)	Direct Coomb's Test	2
(b)	Indirect Coomb's Test	2
6.	Procedures of Blood Component Preparation & Transfusion	5
7.	For Transfusion	2
(a)	Selection of Blood	2
(b)	Testing Procedures	5
(c)	Choice of blood in ABO System	2
(d)	Choice of blood in Rh- System	2
(e)	Pre- Transfusion-Testing Procedures	5
(f)	Identification of Recipient's Blood Sample	2
(g)	ABO & Rh- Grouping of Recipients Antibodies	2
(h)	Screening in Recipient's Blood	2
(i)	Issue of Blood	2
8.	Screening of Diseases Transmitted through Blood	5
9.	Laboratory Diagnosis of Blood Transfusion Reaction	5
10.	Screening & Identification of Anti-bodies	2
11.	Anti-D Titration or Screening	2
12.	Quality Assurance	2
(a)	Documentation & Specification	2
(b)	Quality control of reagents.	5

HISTOPATHOLOGY-SECTION

1.	Sample Collection, Lab-No. or Code-No. & Fixation Technique	2
2.	Fixative & Preparation	-
(a)	10% Formalin	1
(b)	10% Formal Saline	1
(c)	10% Neutral Buffered Formalin	1
(d)	10% Formal Calcium/Calcium Acetate Formalin	1

(e)	Heidenhain's Susa	1
(f)	Zenker's Formal (Helly Formal Zenker)	1
(g)	Bouin's Fluid	1
3.	Preparation of Decalcifier Reagent	3
(a)	Formic Acid-Formalin & Others	1
4.	Tissue Processing	2
(a)	Dehydration	1
(b)	Clearing	1
(c)	Impregnation	1
(d)	Embedding & Blocking	2
5.	Microtome or their Type & Sharpening of their Knives	5
6.	Technique of Section Cutting	5
7.	Preparation of Stain and Different Staining Procedure	-
(a)	Haematoxyline & Eosin Stain	2
(b)	Papanicolou Technique (PAP) For Diagnostic Exfoliative Cytology.	2
(c)	Periodic Acid Schiff's(PAS) For Carbohydrates	2
(d)	Gomori's Silver Impregnation For Reticoulin Fibres	2
(e)	Peril's-Prussian Blue Reaction For Hemosiderine	2
(f)	Grimelius Silver Method For Argyrophel Cell	2
(g)	Gomorri's Method For Demonstrating Haemosiderin(Ferric Salts)	2
(h)	Veroff's Method For Elastic Fibres	2
(i)	Ziehl-Neelsen Technique For Mycobacterium Tuberculosis	3
(j)	Fite Stain For Mycobacterium Leprae in Tissue	3
(k)	Phosphotungstic Acid Haematoxylin (PTAM) For Neurological Fibres	2
(l)	Sudan III or Sudan IV Staining For Fat	2
(m)	Masson Fontana For Melanin	2
(n)	Methanamine Silver-Grocott's Method For Fungi	2
(o)	Masson's Trichrome For Collagen Fibres	2
(p)	Alkaline Congo-Red Technique For Amyloid	2
(q)	War thin-Starry Method For Spirochetes	2
(r)	Southgate's—Mayer's Mucicarmine Method	2
8.	Museum Technique	5

Biochemistry

1.	Introduction to Practical Laboratory Sciences & Laboratory Safety Rules	5
2.	Instrumentation & Techniques or Lab. Glass Ware	10
3.	Titration	1
a.	Determination of Free Acidity and Total Acidity in Gastric Juice	3
4.	Preparation of	1
a.	Normal Solution	2
b.	Molar Solution	2
c.	Percent Solution	2
d.	Volumetric Analysis	2
e.	Standard Solution of Oxalic Acid	2
f.	Sulfuric Acid	2
g.	Hydrochloric Acid	2
h.	Sodium Hydroxide	2
i.	Potassium Permanganate	2
5.	Dilution of the Solution	1
a.	Preparation of Saturated Solution	2
b.	Preparation of Half Saturated Solution	2
c.	Preparation of Different Buffers.	2
6.	Color Reaction With The Given Protein Sample	3
7.	Precipitation Reactions of Proteins	3
8.	Scheme for Identification of Unknown Proteins	3
9.	Reactions of Monosaccharide	2
10.	Reactions of Disaccharide	2
11.	Reactions of Polysaccharide	2

12.	Scheme for Identification of Unknown CHO Solution	3
13.	General Scheme for Identification of (CHO) ,Proteins & Non- Protein Nitrogenous (NPN) Substances	3
	CLINICAL- BIOCHEMISTRY	2
14.	Glucose-Estimation	1
A.	BLOOD GLUCOSE	1
a.	O-Toluidine With Standard Graph Method	3
b.	Folin Wu Method	2
c.	Glucose Oxidase-Peroxidase (GOD-_POD) Method or Kit Method	2
d.	Spot Test	1
e.	Glucose Tolerance Test	3
B.	URINE-GLUCOSE	1
a.	Benedict's Test	1
b.	Glucose Oxidase-Peroxidase (GOD-POD) Method or Kit Method	1
C.	C.S.F. GLUCOSE OR Other BODY FLUIDS GLUCOSE ESTIMATION	2
a.	O-Toluidine With Standard Graph Method	1
b.	Glucose Oxidase-Peroxidase (GOD-POD) Method or Kit Method	1
c.	Turbidimetry Method	1
15.	UREA-ESTIMATION IN BLOOD & URINE	1
a.	Diacetyl Monoxime Method With Standard Graph Method	2
b.	Kit Method.	1
16.	Creatinine-Estimation	1
a.	Jaffe's Method With Standard Graph	2
b.	Urine Creatinine Kit Method	1
17.	BLOOD CALCIUM-ESTIMATION	1
a .	Diethanolamine Method	1
b.	Kit Method	1
18.	Phosphorus By Fiske Subb Rao Method	2
19.	Uric Acid By Henry et.al & Kit Method	2
20.	CHOLESTEROL-ESTIMATION	1
a.	Zak's With Standard Graph Method	2
b.	Kit Method	1
21.	Triglycerides By Kit Method	1
22.	Bilirubin By Malloues & Evelyn Method	3
23.	Serum Protein-Estimation	1
a.	Biuret Method & Kit Method	1
b.	Turbidimetric Method	1
c.	Photometric Method	1
d.	Electrophoresis Method	3
24.	C.S.F. & Other Body Fluid Protein-Estimation	1
a.	Biuret Method	1
b.	Turbidimetry Method	1
c.	Kit Method	1
25.	URINE PROTEIN-ESTIMATION	1
a.	Biuret Method & Kit Method	1
b.	Turbidimetric Method	1
c.	B.J.Protein-Estimation By Heat & Cool Method	2
26.	Albumin –Estimation By Dye Binding Standard Graph or Kit Method	3
27.	AST , ALT By Manual & Kit Method	5
28.	ALP By Manual & Kit Method	3
29.	HDL-Cholesterol By Using Kit Method	2
30.	Amylase-estimation By Kit Method	2
31.	LDH-Estimation By Enzymatic Method	2
32.	CK or CKMB – Estimation By Kit Method	3
33.	Urine Screening Test By Strip Method	5
34.	Immunodiffusion	2
35.	Hormones and tumor markers by FIA and ELISA	5
36.	Drug analysis	2
37.	Blood gas analysis	3
38.	Electrolyte analysis	5

Bachelor of Science in Medical Laboratory Technology (B.Sc.MLT)

Microbiology

1.	Introduction to Practical laboratory Sciences & Laboratory Safety rules	5
2.	Instrumentation & Techniques or Lab. Glass ware	5
(a)	Microscopy (1)Light &(2)Compound	2
(b)	Observation & Uses of Autoclave & Hot Air Oven	3
(c)	Preparation of Common Laboratory Disinfectants & their uses	3
(d)	Cleaning & Decontamination of Glass Wares & Lab Waste Materials	3
3.	Preparation of General Laboratory Reagents for Staining of Microorganisms in Microbiology	5
(a)	Gram's Stain	2
(b)	ZN Stain	2
(c)	Methyline Blue Stain	2
(d)	Albert Stain	2
(e)	Negative Staining by Wet Indian Ink For Capsules	2
(f)	Silver Impregnation Method For Fimbrial	2
(g)	Pellicle formation Method For Fimbrial	2
(h)	Staining of Flagella by Leifson Method	3
(i)	Wet- Mount	2
(j)	Leishman's Stain	2
(k)	Giemsa's Stain For Protozoa, Spirochaetes & Designed to Differentiate Leucocytes Staining.	3
(l)	Lacto phenol cotton Blue-Mounting Medium-Used For Study of fungus cultures.	5
4.	Morphological Study of Bacteria	5
5.	Motility, Hanging Drop Method	5
6.	Sample Collection, Preservation & Processing Method	5
7.	Methods & Cultivation of Bacteria	10
8.	Culture Methods	5
(a)	Aerobic Method:-Streak, Lawn, Stroke, Stab, Pour Plate & Liquid Culture.	10
(b)	Anaerobic Method:-Displacement of O ₂ with other gases, Cultivation in Vacuum, Addition of Reducing Agents, Biological Method, Chemical Method, Growing Aerobes, Anaerobes together Using Anaerobic Jars –McIntosh & Fildesjar & Modifications-Gaspak System.	10
9.	Antibiotic Sensitivity Test	5
(a)	Diffusion-(1)Ditch plate(2)Cup plate & (3) Disc Diffusion Method	1
(b)	Dilution-(1)Tube Dilution & (2)Agar Dilution Method	1
10.	Isolation & Identification of pure Culture/Clinical Specimen	10
11.	Isolation & Identification of Mixed Culture/Clinical Specimen	10
12.	Preparation, Sterilization & Uses of Common Media in Lab.	15
13.	Serological Test in Microbiology	10
(a)	Coagulation test	2
(b)	Agglutination test:-Widal & Haemagglutination test (Coomb's Test)For TPHA, Brucella Agglutination Test & Paul Bunnel Test	5
(c)	Precipitation Test:-VDRL/RPR	2
(d)	C-Reactive Protein (CRP)	2
(e)	Anti-Streptolysin "O" Test (ASO)	2
(f)	Rheumatic Factor Detection (RF or RA)	2
(g)	Anti-Nuclear Antibody Test(ANA)	2
(h)	Neutralization Test	2
(i)	Complement Fixation Test	2
(j)	Enzyme Linked Immunosorbent Assay(ELISA)For HIV,HCV,ANA, HBsAg & Spot Test For HIV, HBsAg & HCV	7
(k)	Radio-Immunoassay(RIA)	2
(l)	Immunoflorescence Test (1)Direct & (2)Indirect	2
14.	STOOL RE/ME For Parasitological Examination	5
15.	KOH Mount Test For Fungal Detection	2
16.	Mantoux Test For Tuberculin Detection	2
17.	Slit Smear For M. Lepray	2