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:

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

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 retotalling 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:

<table>
<thead>
<tr>
<th>Letter</th>
<th>Grade</th>
<th>Grade point description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>4.0</td>
<td>Excellent</td>
</tr>
<tr>
<td>A-</td>
<td>3.7</td>
<td></td>
</tr>
<tr>
<td>B+</td>
<td>3.3</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>3.0</td>
<td>Good</td>
</tr>
<tr>
<td>B-</td>
<td>2.7</td>
<td></td>
</tr>
<tr>
<td>C+</td>
<td>2.3</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>C</td>
<td>2.0</td>
<td></td>
</tr>
<tr>
<td>C-</td>
<td>1.7</td>
<td></td>
</tr>
<tr>
<td>D+</td>
<td>1.3</td>
<td>Minimum requirement</td>
</tr>
<tr>
<td>D</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>0</td>
<td>Failing</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Code</th>
<th>Subject</th>
<th>Credit hours</th>
<th>Pre-requisite course</th>
<th>Core course</th>
</tr>
</thead>
<tbody>
<tr>
<td>MLS 101.3</td>
<td>Medical Laboratory Science (Fundamentals of Medical Laboratory Science)</td>
<td>3</td>
<td>--------</td>
<td>☉</td>
</tr>
<tr>
<td>MBL 102.3</td>
<td>Microbiology I (Fundamentals)</td>
<td>3</td>
<td>--------</td>
<td>☉</td>
</tr>
<tr>
<td>CHM 171.3</td>
<td>General Chemistry I (Fundamentals and Analytical Technique)</td>
<td>3</td>
<td>--------</td>
<td>---</td>
</tr>
<tr>
<td>CHM 172.3</td>
<td>General Chemistry II (Structure and Reaction)</td>
<td>3</td>
<td>--------</td>
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</tr>
<tr>
<td>MTH 191.3</td>
<td>Biostatistics</td>
<td>3</td>
<td>--------</td>
<td>---</td>
</tr>
<tr>
<td>LAB-1.1</td>
<td>Laboratory 1</td>
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<td>---</td>
</tr>
<tr>
<td>LAB-2.1</td>
<td>Laboratory 2</td>
<td>1</td>
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**TOTAL** 17

#### SECOND SEMESTER

<table>
<thead>
<tr>
<th>Code</th>
<th>Subject</th>
<th>Credit hours</th>
<th>Pre-requisite course</th>
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<tbody>
<tr>
<td>BCM 121.3</td>
<td>Biochemistry I (General)</td>
<td>3</td>
<td>--------</td>
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</tr>
<tr>
<td>APL 131.3</td>
<td>Anatomy and Physiology I</td>
<td>3</td>
<td>--------</td>
<td>---</td>
</tr>
<tr>
<td>CTL 151.3</td>
<td>General Cytology</td>
<td>3</td>
<td>--------</td>
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</tr>
<tr>
<td>HTL 152.3</td>
<td>Histology (General)</td>
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<td>--------</td>
<td>☉</td>
</tr>
<tr>
<td>CHM 173.3</td>
<td>Analytical Chemistry (Instrumentation)</td>
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<td>--------</td>
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<tr>
<td>LAB-3.1</td>
<td>Laboratory 3</td>
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</tr>
<tr>
<td>LAB-4.1</td>
<td>Laboratory 4</td>
<td>1</td>
<td>--------</td>
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</tr>
<tr>
<td>LAB-5.1</td>
<td>Laboratory 5</td>
<td>1</td>
<td>--------</td>
<td>---</td>
</tr>
<tr>
<td>SEM-1.1</td>
<td>Seminar 1</td>
<td>1</td>
<td>--------</td>
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**TOTAL** 19
## CURRICULUM STRUCTURE

### B. Sc. MLT

#### SECOND YEAR

##### THIRD SEMESTER

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

##### FOURTH SEMESTER

<table>
<thead>
<tr>
<th>Code</th>
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<th>Credit hours</th>
<th>Pre-requisite course</th>
<th>Core course</th>
</tr>
</thead>
<tbody>
<tr>
<td>MBL 202.3</td>
<td>Microbiology III (Bacteriology)</td>
<td>3</td>
<td>MBL 201.3</td>
<td>☀</td>
</tr>
<tr>
<td>PTL 211.3</td>
<td>General Pathology</td>
<td>3</td>
<td>-------</td>
<td>☀</td>
</tr>
<tr>
<td>PTL 212.3</td>
<td>Cytopathology</td>
<td>3</td>
<td>-------</td>
<td>☀</td>
</tr>
<tr>
<td>BCM 222.3</td>
<td>Biochemistry III (Clinical)</td>
<td>3</td>
<td>BCM 221.3</td>
<td>☀</td>
</tr>
<tr>
<td>HAD 281.3</td>
<td>Health and Disease (General Clinical Problem)</td>
<td>3</td>
<td>-------</td>
<td>---</td>
</tr>
<tr>
<td>LAB-9.1</td>
<td>Laboratory 9</td>
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<td>-------</td>
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<tr>
<td>LAB-10.1</td>
<td>Laboratory 10</td>
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</tr>
<tr>
<td>LAB-11.1</td>
<td>Laboratory 11</td>
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<tr>
<td>SEM-3.1</td>
<td>Seminar 3</td>
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**TOTAL** 19
## CURRICULUM STRUCTURE
### B. Sc. MLT

#### THIRD YEAR

##### FIFTH SEMESTER

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

##### SIXTH SEMESTER

<table>
<thead>
<tr>
<th>Code</th>
<th>Subject</th>
<th>Credit hours</th>
<th>Pre-requisite course</th>
<th>Core course</th>
</tr>
</thead>
<tbody>
<tr>
<td>MBL 302.3</td>
<td>Microbiology-V (Virology)</td>
<td>3</td>
<td>MBL 301.3</td>
<td>☀</td>
</tr>
<tr>
<td>MBL 303.3</td>
<td>Microbiology-VI (Mycology)</td>
<td>3</td>
<td>MBL 301.3</td>
<td>☀</td>
</tr>
<tr>
<td>PTL 312.3</td>
<td>Histopathology II</td>
<td>3</td>
<td>PTL 311.3</td>
<td>☀</td>
</tr>
<tr>
<td>BCM 324.3</td>
<td>Biochemistry-V (Clinical)</td>
<td>3</td>
<td>BCM 321.3</td>
<td>☀</td>
</tr>
<tr>
<td>HML 325.3</td>
<td>Hematology II</td>
<td>3</td>
<td>--</td>
<td>☀</td>
</tr>
<tr>
<td>LAB-15.1</td>
<td>Laboratory 15</td>
<td>1</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>LAB-16.1</td>
<td>Laboratory 16</td>
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<td>--</td>
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<tr>
<td>LAB-17.1</td>
<td>Laboratory 17</td>
<td>1</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>SEM-5.1</td>
<td>Seminar 5</td>
<td>1</td>
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<td>--</td>
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</tbody>
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**TOTAL** 19
## CURRICULUM STRUCTURE
### B. Sc. MLT

#### FOURTH YEAR

**SEVENTH SEMESTER**

<table>
<thead>
<tr>
<th>Code</th>
<th>Subject</th>
<th>Credit hours</th>
<th>Pre-requisite course</th>
<th>Core course</th>
</tr>
</thead>
<tbody>
<tr>
<td>MBL 401.3</td>
<td>Microbiology-VII (Clinical)</td>
<td>3</td>
<td>MBL 302.3</td>
<td>☉</td>
</tr>
<tr>
<td>PTL 411.3</td>
<td>Autopsy and Medical Jurisprudence</td>
<td>3</td>
<td>--------</td>
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</tr>
<tr>
<td>BCM 421.3</td>
<td>Biochemistry-VI (Toxicology)</td>
<td>3</td>
<td>BCM 323.3</td>
<td>☉</td>
</tr>
<tr>
<td>HML 422.3</td>
<td>Immuno-Hematology and Blood Bank</td>
<td>3</td>
<td>HML 325.3</td>
<td>☉</td>
</tr>
<tr>
<td>RES 491.3</td>
<td>Clinical Laboratory Research</td>
<td>3</td>
<td>--------</td>
<td>---</td>
</tr>
<tr>
<td></td>
<td>Laboratory 18</td>
<td>1</td>
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<tr>
<td></td>
<td>Laboratory 19</td>
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<td>--------</td>
<td>---</td>
</tr>
<tr>
<td></td>
<td>Laboratory 20</td>
<td>1</td>
<td>--------</td>
<td>---</td>
</tr>
<tr>
<td>SEM-6.1</td>
<td>Seminar 6</td>
<td>1</td>
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<tr>
<td></td>
<td><strong>TOTAL</strong></td>
<td><strong>19</strong></td>
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</table>

☉ represents the core course.

**EIGHTH SEMESTER**

<table>
<thead>
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<th>Code</th>
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<th>Credit hours</th>
<th>Pre-requisite course</th>
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</thead>
<tbody>
<tr>
<td>INT 491.3</td>
<td>Internship</td>
<td>3</td>
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<td>---</td>
</tr>
<tr>
<td>PRW 492.6</td>
<td>Project Work</td>
<td>6</td>
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<td><strong>TOTAL</strong></td>
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</table>

☉ 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
   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
   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
   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
   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
   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:
2. Mackie and McCartney, Practical Medical Microbiology, 14th Ed.
3. Monica Chees Brough: Medical Laboratory Manual for tropical countries, volume I, II.
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

References:
5. Monica Cheesbrough, *Medical Laboratory Manual for Tropical Countries, Volume I, and II*
6. Laboratory Biosafety Manual WHO.
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:
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 (chairality), 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 Benzyn, Aromaticity and Anti-aromaticity

Reference Books:
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, $x^2$-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 internals for estimating regression parameters

Reference Books:
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, methylene 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  
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  
Introduction, Classification, Monosaccharides, Disaccharides, Polysaccharides, Carbohydrate derivativs, Glycogenesis, Glycogenolysis, Gluconeogenesis, Glycolysis, Tricaboxylic acid cycle, Hexose monophosphate shunt, Effect of hormones on carbohydrate metabolism

3. Chemistry and Metabolism of Lipids  
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, Prostanoïds, Leukotrienes, Lipoxigenase and cyclo-oxygenase pathway, Peroxidation of Lipid, Diphosphers, HDL, LDL, VLDL

4. Chemistry and Metabolism of Proteins  
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:  
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, Deglution, 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, Homeostatis 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:
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 grnules, Ribosomes, Cytoskeleton, Cytosol, Nucleus, Nucleolus, Chromatin nuclear matrix

2. Cytology Techniques and Staining 8 hours

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

Reference Books:
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 Voltametry 5 hours
   Principles, Instrumentation, Application of polarography and voltametry

9. Conductometry 5 hours
   Principles, Instrumentation, Application of conductometry

Reference Books:
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
   Staphylococci, Streptococci, Pneumococci, Micrococci
   10 hours

2. Gram Negative Bacilli
   Esherichia coli, Klebsiella, Enterobacter, Citrobacter, Proteus, providencia, Salmonella, Shigella, Yersenia
   20 hours

3. Curve Gram Negative Bacilli
   Vibrio, Campylobacter, Helicobacter
   7 hours

4. Gram Negative Cocci
   Branhamella, Neisseria
   5 hours

5. Hemophilus
   Haemophilus influenzae and other species
   3 hours

Reference Books:
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
   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 B_{12}).

2. Hormones
   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
   Chemical nature of enzymes, Classification, Active site, Different shapes of active sites, Factors influencing enzyme actions, Inhibitors and activators, Clinical enzymology.

Reference Books:
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**  
   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**  
   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**  
   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**  

Reference Books:
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
   DNA, RNA, Nucleotides, Nucleosides, tRNA, mRNA, Translation, Transcription, Genes
   3 hours

2. RNA and Protein Synthesis
   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
   8 hours

3. DNA Repair Mechanism
   DNA sequence maintenance, Mutation rate and its importance, Stability of genes and DNA repair, Recognition of DNA damage
   4 hours

4. DNA Replication Mechanism
   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
   6 hours

5. Genetic Recombination Mechanism
   Genetic recombination, General recombination, DNA renaturation (hybridization), recA protein, Branch migration, Cross-Strand exchange, Gene conversion, Site-specific genetic recombination
   6 hours

6. Virus, Plasmids and Transposable Genetic Elements
   Viral genomes, RNA virus, DNA virus, Provirus, Retrovirus, Reverse transcriptase, Plasmids
   6 hours

7. DNA Cloning and Genetic Engineering
   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
   10 hours

8. Use of Genetic Engineering in Pharmaceutical Sciences
   Production of commercial insulin from E. Coli
   2 hours

Reference Books:
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**
   - Adaptive and innate immunity, Cells of the immune system, Soluble mediators of immunity, Antigens, Immune responses, Defences against extracellular and intracellular pathogens, Vaccination, Immunopathology
   - 6 hours

2. **Cells Involved in Immune Responses**
   - Lymphoid cells, Mononuclear phagocyte system, Polymorphonuclear granulocytes and platelets
   - 4 hours

3. **The Lymphoid System**
   - Primary and secondary lymphoid tissue, Primary lymphoid organs, Secondary lymphoid organs and tissues, Lymphocyte traffic
   - 4 hours

4. **Antigen Receptor Molecules**
   - Immunoglobulins, T-cell antigen receptors, Major histocompatibility complex antigens
   - 4 hours

5. **Antigen Recognition**
   - 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 hours

6. **Cell Cooperation in the Antibody Response**
   - Cooperation between different cell types, Cell activation, Antibody responses *in vivo*
   - 4 hours

7. **Cell-Mediated Immune Reactions**
   - 6 hours

8. **Regulation of the Immune Response**
   - Regulation by antigen, Regulation by antibody, Regulation by immune complexes, Regulation by lymphocyte
   - 3 hours

9. **Immunological Tolerance**
   - 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
   - 4 hours

10. **Complement**
    - Introduction, Activation of complement, Complement receptors, Biological effects of complement
    - 4 hours

**Reference Books:**
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
   *Mycobacterium tuberculosis*, Atypical mycobacteria, *Mycobacterium leprae* 5 hours

2. Non fermentative Gram negative bacilli
   *Pseudomonas, Acinetobacter, Moraxella* 4 hours

3. Spirochaete
   *Treponema, Borrelia, Leptospira* 6 hours

4. Miscellaneous organisms
   *Mycoplasma, Chlamydia, Rickettsia* 3 hours

5. Gram Positive bacilli
   *Corynebacteria, Bacillus, Clostridia, Listeria and Erysipelothrix* 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:
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
   Terminology, Evolution of pathology, Modern pathology and subdivisions of pathology
   2 hours

2. Cell injury, Death and Cellular Adaptation
   Causes of cell injury, Mechanism of cellular injury, Morphology of reversible cell injury, Cellular adaptation
   2 hours

3. Inflammation
   Definition, Acute inflammation, Chronic inflammation, Types of exudation, Cerebrospinal fluid analysis, Laboratory tests in diagnosis of chronic granulomatous inflammation
   4 hours

4. Infectious and Parasitic Diseases
   Infecting agents, Host defense mechanism, Mechanism of cell injury, Common infectious diseases and laboratory techniques used for their diagnosis
   10 hours

5. Immunopathology
   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
   10 hours

6. Haemodynamic Disorders
   Internal environment of body, Disturbances of acid-base balance, Body fluids and electrolytes, Septic shock, Coagulation cascade, Laboratory tests related to haemodynamic disorders
   4 hours

7. Genetic Diseases
   Terminology, DNA, Gene, Chromosomes, Mutations, Karyotyping, Basis of inheritance, Autosomal and sex linked inheritance, Techniques used in detection of genetic diseases
   5 hours

8. Neoplasia
   Definitions and nomenclature, Aetiology and carcinogenesis, Characteristics of benign and malignant neoplasm, Tumor antigens, Laboratory diagnosis of cancer
   5 hours

9. Environmental and Nutritional Diseases
   Environmental pollution, Chemical and drug injury, injury caused by ionizing radiation, Essential nutrients, Protein energy, Malnutrition, Disorders of vitamins and minerals
   3 hours

Reference Books:
3. Walter and Israel: General Pathology
4. J. R. Anderson: Muir's Textbook of Pathology
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
   Early historical era, Development, Expansions and consolidation, Diagnostic utility and importance
   2 hours

2. Collection of Samples
   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
   8 hours

3. Cytopreparatory Techniques
   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) Interpretetion, evaluation of quality of stained smears, prevention of cross contamination, Normal cells, Inflammatory and malignant changes
   23 hours

4. Clinical cytogenetics
   Introduction, Utility, Cell cycle and cell division, Sample collection, Storage of cells, Chromosomal analysis, Banding techniques, Microscopy and interpretation
   6 hours

5. Immunocytochemistry
   Introduction, Useful markers and antibodies, Diagnostic significance of immunocytochemistry in cytological specimens, Techniques
   3 hours

6. Molecular Techniques
   Terminology, Southern blot analysis, Northern blot analysis, Polymerase chain reaction, Flourescence In Situ Hybridization (FISH)
   3 hours

Reference Books:
1. Winfrid Gray: *Diagnostic Cytopathology*
2. Bibbo: *Comprehensive Cytopathology*, W. B. Saunders Company
3. L. G. Koss: *Diagnostic Cytopathology and its Hystopathological Basis*
4. Stanley S. Raphael: *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

5. Plasma proteins 10 hours

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
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, Emporiatrics

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-conceptional methods, Terminal methods, Delivery system

8. Preventive Medicine in Obstetrics, 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:
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
   5. Ascaris spp.
   6. Taenia spp.
   7. Brugia spp.
   8. Hymenolepsis spp.
   9. Leishmania spp.
   10. Trihomonas spp.
   11. Wucheria bancrofti
   12. Toxoplasma spp.
   15. Trichinella 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:
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**
   Managing the laboratory, hazards and safety in laboratory, quality control, light microscopy

2. **General outline procedures in the examination of tissues**
   General considerations, Electrolyte balance and homeostasis, Estimation of sodium, potassium, chloride, calcium and phosphate ions, Clinical correlations

3. **Fixation, fixatives and decalcification**
   Definition of fixation, aims of fixation, classification of fixatives, theoretical aspects of fixation, secondary fixation, practical aspects of fixation, decalcification.

4. **Tissue processing**
   Introduction, labeling of tissues, dehydration, clearing, infiltration and embedding, automated tissue processing, manual tissue processing

5. **Microtomy and section cutting**
   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**
   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**
   Enzyme histochemistry, immunohistochemistry, immunofluorescence, electron microscopy in histopathology, microwave technology in histology, molecular pathology, in-situ hybridization, plastic embedding media and techniques

**Reference Books:**
4. Kanai L. Mukharjee: *Medical Laboratory Technology*.
Course Objectives:

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

Course Contents:

1. **Metabolic intermediates and inorganic ions**  
   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, Prophyrins, 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**  
   General considerations, Electrolyte balance and homeostasis, Estimation of sodium, potassium, chloride, calcium and phosphate ions, Clinical correlations

3. **Acid – base balance**  
   Diffusion of gases in lungs, Action of buffer systems in body, Disturbances in acid-base balance, Arterial blood gas determination and clinical significance, 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**  
   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, Cholinestrase, 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 synthatase, Other enzymes: amylase, lipases, Enzymes and their clinical significance in body fluids assays

5. **Liver function tests**  
   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:

2. Todd, Sanford, Davidson: *Clinical Diagnosis and Management by Laboratory Method* (17th Ed.) 1998, W. B. Saunders.
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

2. Bone marrow 5 hours

3. Red cells 5 hours

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, eosinophilia, 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 anaemia 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

Reference books:
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

2. Electrophoretic Techniques 10 hours
General principles, supporting media. Agrose gels, Polyacrylamide gels. Electrophoresis of proteins- SDS-PAG Electrophoresis, Native (buffer) gels, Gradient gels, isoelectric focusing gels. Two dimensional PAG 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

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:
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
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
   - History of viral evolution, General properties of viruses, Morphology, Size, Shape, Structure, Chemical properties, Viral haemagglutination, Classification and Replication
   - 5 hours

2. Virus Cultivation
   - Animal inoculation, Embryonated egg inoculation and tissue culture, Detection of viral growth in cell culture, Viral assay, Assay of infectivity, Viral genetics
   - 5 hours

3. Virus-host Interaction
   - Pathogenesis, Spread of virus in the body, Significance of the incubation period, Host response to virus infection, Immunity in virus infections, Non-immunological response
   - 5 hours

4. Laboratory Diagnosis of Viral Diseases
   - Microscopy, Demonstration of viral antigen, Virus isolation, Serology e.g. ELISA, CFT, Haemagglutination inhibition, Neutralization, Western blotting, Agglutination, Precipitation, RIA, IFA
   - 10 hours

5. Viral Vaccines
   - 2 hours

6. Systemic virology
   - 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
   - 18 hours

Reference Books:
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
   Introduction, Classification of medically important fungi, Fungal species associated with AIDS.

2. Medically Important Fungi
   General characteristics of medically important fungi and their significance to human beings, Opportunistic fungi.

3. Specimen Preparation
   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

5. Antifungal sensitivity test, Antifungal drugs

Reference Books:
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 hone used, procedure of honing types of strops 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,

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 Histocytopathology
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  
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  
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.
Apolyproteins.

3. Endocrinology and Hormone Assays  

Pituitary Gland  
Anterior pituitary- Growth hormone and Prolactin.
Pesterior pituitary- ADH and Oxytocin.
Thyroid Gland- Thyroid disease, Throxin, Triiodothyronine, Thyrotropin (TSH), Thyroxin binding globulin, Thyroglubulin.

4. Cancer and Tumour Markers  
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,  

Reference Books:
2. Todd, Sanford, Davidson: *Clinical Diagnosis and Management by Laboratory Method* (17th Ed.) 1998, W. B. Saunders
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:
LAB-15.1 (1 credit hour)

**Laboratory 15.1**
BMLT, Third Year, Sixth Semester

**Choosen 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 *I. holara* 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

**Choosen 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 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:

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*.
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
   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
   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.
   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.

4. Automation in Clinical Chemistry

5. Quality Control in Clinical Biochemistry

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
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 Immunohematology 10 hours

2. Collection, Preservation and Storage of Blood 10 hours

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:
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**

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**BODY FLUID SECTION**

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**STOOL SECTION**

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**IMMUNO-HEMATOLOGY OR BLOOD BANK SECTION**

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**HISTOPATHOLOGY-SECTION**

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Impregnation
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Technique of Section Cutting
Preparation of Stain and Different Staining Procedure
Haematoxyline & Eosin Stain
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Gomori's Silver Impregnation For Reticulin Fibres
Peril's-Prussian Blue Reaction For Hemosiderine
Grimalius Silver Method For Argyrophil Cell
Gomorri's Method For Demonstrating Haemosiderin(Ferric Salts)
Veroff's Method For Elastic Fibres
Ziehl-Neelsen Technique For Mycobacterium Tuberculosis
Fite Stain For Mycobacterium Leprae in Tissue
Phosphotungstic Acid Haematoxylin (PTAM) For Neurological Fibres
Sudan III or Sudan IV Staining For Fat
Masson Fontana For Melanin
Methanamine Silver-Grocott's Method For Fungi
Masson's Trichrome For Collagen Fibres
Alkaline Congo-Red Technique For Amyloid
War thin-Starry Method For Spirochetes
Southgate's—Mayer's Mucicarmine Method
Museum Technique

Biochemistry

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   2. Instrumentation & Techniques or Lab. Glass Were
   3. Titration
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      b. Molar Solution
      c. Percent Solution
      d. Volumetric Analysis
      e. Standard Solution of Oxalic Acid
      f. Sulfuric Acid
      g. Hydrochloric Acid
      h. Sodium Hydroxide
      i. Potassium Permanganate
      4. Preparation of
         a. Normal Solution
         b. Molar Solution
         c. Percent Solution
         d. Volumetric Analysis
         e. Standard Solution of Oxalic Acid
         f. Sulfuric Acid
         g. Hydrochloric Acid
         h. Sodium Hydroxide
         5. Dilution of the Solution
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            6. Color Reaction With The Given Protein Sample
            7. Precipitation Reactions of Proteins
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| 18. | b. Folin Wu Method | 2 |
| 19. | c. Glucose Oxidase-Peroxidase (GOD-POD) Method or Kit Method | 2 |
| 20. | d. Spot Test | 1 |
| 21. | e. Glucose Tolerance Test | 3 |
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| 23. | a. Benedict’s Test | 1 |
| 24. | b. Glucose Oxidase-Peroxidase (GOD-POD) Method or Kit Method | 1 |
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| 33. | a. Jaffé’s Method With Standard Graph | 2 |
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| 36. | a. Diethanolamine Method | 1 |
| 37. | b. Kit Method | 1 |
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| 40. | b. Kit Method | 1 |
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| 50. | **BLOOD PROTEIN-ESTIMATION** | 1 |
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| 52. | b. Turbidimetric Method | 1 |
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| 56. | 31. ALP By Manual & Kit Method | 3 |
| 57. | 32. HDL-Cholesterol By Using Kit Method | 2 |
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| 59. | **ENZYMATIC ESTIMATION** | 2 |
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# Bachelor of Science in Medical Laboratory Technology (B.Sc.MLT)

## Microbiology

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<td>(c) Preparation of Common Laboratory Disinfectants &amp; their uses</td>
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<td></td>
<td>(d) Cleaning &amp; Decontamination of Glass Wares &amp; Lab Waste Materials</td>
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<tr>
<td>3. Preparation of General Laboratory Reagents for Staining of</td>
<td>Microorganisms in Microbiology</td>
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<tr>
<td></td>
<td>(a) Gram's Stain</td>
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<td></td>
<td>(b) ZN Stain</td>
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<td></td>
<td>(c) Methylene Blue Stain</td>
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<td>(d) Albert Stain</td>
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<td></td>
<td>(e) Negative Staining by Wet Indian Ink For Capsules</td>
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<td></td>
<td>(f) Silver Impregnation Method For Fimbrial</td>
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<td>(g) Pellicle formation Method For Fimbrial</td>
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<td>(h) Staining of Flagella by Leifson Method</td>
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<tr>
<td></td>
<td>(i) Wet-Mount</td>
<td>2</td>
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<td>(j) Leishman's Stain</td>
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<td></td>
<td>(k) Giemsa's Stain For Protozoa, Spirochaetes &amp; Designed to Differentiate Leucocytes Staining.</td>
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<td>(l) Lacto phenol cotton Blue-Mounting Medium-Used For Study of fungus cultures.</td>
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<td>4. Morphological Study of Bacteria</td>
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<td>5. Motility, Hanging Drop Method</td>
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<td>6. Sample Collection, Preservation &amp; Processing Method</td>
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<td>7. Methods &amp; Cultivation of Bacteria</td>
<td></td>
<td>10</td>
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<td>8. Culture Methods</td>
<td>(a) Aerobic Method: Streak, Lawn, Stroke, Stab, Pour Plate &amp; Liquid Culture.</td>
<td>10</td>
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<td>(b) Anaerobic Method: Displacement of O2 with other gases, Cultivation in Vacuum, Addition of Reducing Agents, Biological Method, Chemical Method, Growing Aerobes, Anaerobes together Using Anaerobic Jars – McIntosh &amp; Filde's Jar &amp; Modifications - Gaspak System.</td>
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<td>9. Antibiotic Sensitivity Test</td>
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<td></td>
<td>(a) Diffusion -(1) Ditch plate (2) Cup plate &amp; (3) Disc Diffusion Method</td>
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<td>(b) Dilution -(1) Tube Dilution &amp; (2) Agar Dilution Method</td>
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<td>10. Isolation &amp; Identification of pure Culture/Clinical Specimen</td>
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<td>11. Isolation &amp; Identification of Mixed Culture/Clinical Specimen</td>
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<td>12. Preparation, Sterilization &amp; Uses of Common Media in Lab.</td>
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<td>13. Serological Test in Microbiology</td>
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<td></td>
<td>(a) Coagulation test</td>
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<td>(b) Agglutination test: Widal &amp; Haemagglutination test (Coomb's Test) For TPHA, Brucella Agglutination Test &amp; Paul Bunnel Test</td>
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<td>(c) Precipitation Test: VDRL/RPR</td>
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<td>(d) C-Reactive Protein (CRP)</td>
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<td>(e) Anti-Streptolysin &quot;O&quot; Test (ASO)</td>
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<td>(f) Rheumatic Factor Detection (RF or RA)</td>
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<td>(g) Anti-Nuclear Antibody Test (ANA)</td>
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<td>(h) Neutralization Test</td>
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<td>(i) Complement Fixation Test</td>
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<td>(j) Enzyme Linked Immunosorbent Assay (ELISA) For HIV, HCV, ANA, HBsAg &amp; Spot Test For HIV, HBsAg &amp; HCV</td>
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<td></td>
<td>(k) Radio-Immunooassay (RIA)</td>
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<td>(l) Immunofluorescence Test (1) Direct &amp; (2) Indirect</td>
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<td>14. STOOL RE/ME For Parasitological Examination</td>
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<td>15. KOH Mount Test For Fungal Detection</td>
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<td>16. Mantoux Test For Tuberculin Detection</td>
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<td>17. Slit Smear For M. Lepran</td>
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