

# **SHRI GURU RAM RAI UNIVERSITY**

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



## **SYLLABUS FOR**

### **Bachelor in Medical Lab Technology**

### **With CO And PO Mapping**

### **School of Paramedical Sciences**

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**(W.E.F 2023-2024)**

**BACHELOR IN MEDICAL LAB TECHNOLOGY****OUTCOME BASED EDUCATION****Programme outcome (POs)****Students will be able to**

1.	PO 1	Provide the healthcare community with graduate's expertise in the knowledge and skills to display ethical, professional conduct in education and clinical settings.
2.	PO 2	Perform analytical tests including quality control on biological specimens; including collecting and processing of biological specimens for analysis and interpret.
3.	PO 3	Demonstrate conceptual knowledge in haematology, blood chemistry, clinical Biochemistry, Immunology, immune haematology and pathogenic Microbiology.
4.	PO 4	Recognize factors that affect laboratory procedures and results and take appropriate action, within predetermined limits
5.	PO5	Acquire basic knowledge of human Anatomy and Physiology to integrate both the functional and structural aspects of a Human body.
6.	PO6	Acquire knowledge and application of the principle of biostatistics for the purpose of establishment and maintenance of Quality Controls (instruments and diagnostic tests).
7.	PO7	Recognize factors that affect laboratory procedures, results and take appropriate action, within predetermined limits and safety.
8.	PO8	Describe the principles of learning technology in application. Take interactive classroom lectures, small group discussions (debate), Seminars etc.
9.	PO9	Apply basic scientific principles in learning new techniques and procedures of advanced Lab technology and inculcate the knowledge of handling of automatic analysers, organization and management of clinical laboratory.
10.	PO10	Provide a high quality, educational program that prepares the student to achieve competent skills essential for employment as medical laboratory technicians or researchers in diverse clinical areas.
11.	PO11	Provide guidance to Medical Laboratory Technology program which assist them in pursuing educational and occupational opportunities that maximize their professional potential.
12.	PO12	Assessing analytically and critically while solving problems and making decisions during daily practice with a major focus on public health care, quality diagnostic protocols and safety.

**SHRI GURU RAM RAI UNIVERSITY DEHRADUN, (UTTARAKHAND)**

**REGULATION OF THE UNIVERSITY FOR THE AWARD OF THE  
DEGREE OF BACHELOR OF SCIENCE – MEDICAL LAB.  
TECHNOLOGY**

An exercise of the powers conferred by section of S.G.R.R University Act, the academic Council of the Shri Guru Ram Rai University, Dehradun Uttarakhand hereby makes the following regulations: -

**SHORT TITLE AND COMMENCEMENT**

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

- I. These Regulations and the syllabus shall come into force from the 2001-2002 academic session onwards.
  - II. The regulations framed are subject to modification from time to time by the standing Academic Board of the University.
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- A) Graduate Allied Health Science curriculum is oriented towards training students to help the responsibilities of physician of first contact who is capable of looking after the Preventive, promotive, curative and rehabilitative aspects of medicine.
  - B) With wide range of career opportunities available today, an Allied Health Science graduate has a wide choice of career opportunities. The training though broad based and flexible should aim to provide an educational experience of the essentials required for health in our country.
  - C) To undertake the responsibilities of service situations which is a changing condition and of various types. It is essential to provide adequate placement training tailored to the needs of such services as to enable the Allied Health Science graduates to become effective instruments of implementation of those requirements. To avail of opportunities and be able to conduct professional requirements the graduate shall endeavour to have required basic training in different aspects of medical care.

- D)** The importance of the community aspects of health care and of rural health care service is to be recognized including rehabilitation. The aspect of education and training of Allied Health Science graduates should be adequately recognized in the prescribed curriculum. Its importance has been systematically upgraded over the past years and adequate exposure to such experiences should be available throughout all phases of education and training. This has to be further emphasized and intensified by providing exposure to field practice areas and training during the internship period. The aim of the period of training during internship is to enable the fresh graduates to function efficiently under such settings.
- E)** As such all the basic concepts of modern scientific medical education allied with allied health sciences are to be adequately dealt with particularly the Physiotherapy and Physiotherapy areas.
- F)** There must be enough experience o be provided for self-learning. The methods and techniques that would ensure this must become a part of teaching-learning process.
- G)** The Allied Health Science graduate of modern scientific medicine shall endeavour to become capable of functioning independently under the supervision of a physician in both urban and rural environment. He / She shall endeavour to give emphasis on fundamental aspects of the subject taught and on common problems on health and disease.
- H)** The importance of social factors in relation to the problem of health and disease should receive proper emphasis throughout the course and to achieve this purpose, the educational process should also be community based particularly for occupational therapy and physiotherapy.
- I)** Adequate emphasis is to be place on cultivating logical and scientific habits of thought, clarity of expression and independence of judgment, ability to collect and analyse information and to correlate them.
- J)** The educational process should be placed in a Laboratory/practical background as an evolving process and not merely as an acquisition of a large number of disjointed facts without a proper perspective.
- K)** Lectures alone are generally not adequate as a method of training and are a poor means of transferring/acquiring information and even less effective at skill development and in generating the appropriate attitudes. Every effort should be made to encourage the use of active methods related to demonstration and on first-hand experience, Students will be encouraged to learn in small groups through peer interactions so as to gain maximal experience. While the curriculum objectives often refer to areas of knowledge or science,

they are best taught in a setting of clinical relevance and hands on experience for students who assimilate and make this knowledge apart of their own working skills.

- L)** The Allied Health Science graduate medical education in clinical subjects should be based primarily on outpatient teaching, other medical and surgical departments and within the community including peripheral health care institutions. The outpatient departments should be suitably planned to provide training to graduates in small groups and demonstration subjects of all the appropriate technique.
- M)** Clinics should be organized in small groups of preferably not more than 10 students so that a teacher can give personal attention to each student with a view to improve his skill and competence in handling of the patients.
- N)** Proper records of the work should be maintained which will form the basis for the students' internal assessment and should be available to the inspectors/examiners at the time of inspection/examination of the college.
- O)** Maximal efforts have to be made to encourage integrated teaching between traditional subjects areas using a problem based learning approach starting with clinical and exploring the relevance of various pre-clinical disciplines in both understanding and resolution of the problem. Every attempt be made to de-emphasize compartmentalization of disciplines so as to achieve both horizontal and vertical integration in different phases.
- P)** Every attempt is to be made to encourage students to participate in group discussions and seminars to enable them to develop personality, character, expression and other faculties which are necessary for Allied Health Science graduate to function either in solo practice or as a team leader when he begins his independent career. A discussion group should not have more than 20 students.
- Q)** Faculty members should avail of modern educational technology while teaching the students and to attain this objective.
- R)** To derive maximum advantage out of this, the vacation period to students in one calendar year should not exceed one month, during the 4 years of Bachelor of Allied Health Science Courses, which includes BPT, BOT, B.Sc (MLT), B.Sc (Medi. Micro), B.Sc (RD&IT), B.Sc (Nursing), B pharm. Etc

## **OBJECTIVES OF ALLIED HEALTH SCIENCE GRADUATE TRAINING PROGRAMME:**

**NATIONAL GOALS:** At the end of undergraduate program, the Allied Health Science student shall endeavour to be able to:

- a) Recognize 'health for all' as national goal and health right of all citizens and by undergoing training for Allied Health Science profession fulfil his/her social obligations towards realization of this goal; learn every aspect of National policies of health and devote himself/herself to its practical implementation.
- b) To help to achieve competence in practice of holistic medicine encompassing promotive, preventive, curative and rehabilitative aspects of diseases particularly with Physiotherapy and Occupational Therapy;
- c) Develop scientific temper, acquire educational experience for proficiency in profession and promote healthy living; particularly in the field of rehabilitation.
- d) Become exemplary citizen by observation of medical ethics and fulfilling social and professional obligations, so as to respond to national aspirations.

### **INSTITUTIONAL GOALS:**

In consonance with the national goals each Allied Health Science Institution should evolve institutional goals define the kind of trained manpower (or professional) they intend to produce. The undergraduate students coming out of an Allied Health Science institute should:

Be competent in therapeutic techniques of common health problems of the individual and the community, associated with or concerned with Physiotherapy commensurate with his/her position as a member of the health team at the primary, secondary or tertiary levels using his/her clinical /technical skills based on history, physical examination and relevant investigation techniques and as per the advice of the attending physician.

Be competent to practice preventive, promotive, curative and rehabilitative medicine in respect to all the applicable and encountered health problems with Occupational Therapy and Physiotherapy;

To help to appreciate rationale for different therapeutic modalities pertaining to the subjects of Physiotherapy.

To be able to appreciate the socio-psychological, cultural, economic and environmental factors affecting health and develop human attitude towards the patients in discharging one's professional responsibilities (Occupational Therapy and Physiotherapy;)

Possess the attitude for continued self-learning and to seek further expertise or to pursue research in any chosen area of Occupational Therapy and Physiotherapy;

Acquire basic management skills in the area of human resources, materials and resource management related to health care delivery;

Be able to identify community health problems and learn to work to resolve these by designing, instituting corrective steps and evaluating outcome of such measures (Occupational Therapy and Physiotherapy); in community rehabilitation.

Be able to work as a leading partner in health care teams and acquire proficiency in communication skills;

Be competent to work in a variety of health care settings.

Have personal characteristics and attitude required for professional life such as personal integrity, sense of responsibility and dependability and ability to relate to or show concern for other individuals.

## **ADMISSION, SELECTION, MIGRATION AND TRAINING**

### **ADMISSION TO THE B.Sc. (Medical Lab, Technology) COURSE**

#### **ELIGIBILITY CRITERIA**

No Candidate shall be allowed to be admitted to the B.Sc. (Medical Lab Technology) until:-

- a) He/she has completed the age of 17 years on or before first day of July of the year commencing the prescribed academic session of the said course:
- b) He/she has passed qualifying examination as under:

The Indian School Certificate Examination which is equivalent to 10+2 higher Secondary examination after a period of 12 years study, the last two years of Study comprising of Physics, Chemistry, Biology and Mathematics or any other elective subjects with English at a level not less than the core course for English as prescribed by the National Council for Educational Research and Training after the introduction of the 10+2+3 years educational structure as recommended by the National Committee on education.

**OR**

The Intermediate examination in Science of an Indian University/Board or other recognized examining body with Physics, Chemistry and Biology which shall include a Practical test in these subjects and also English as a compulsory subject.

**OR**

The Pre-Professional or medical examination with Physics, Chemistry and Biology, after passing their higher secondary school examination, or the pre-university or an equivalent examination. The pre-Professional /pre-medical examination shall include a practical test in Physics, Chemistry and biology and also English as a compulsory subject.

**OR**

The first year of the three years degree course of a recognized University, with Physics, Chemistry and Biology, including a Practical test in these subjects provided the examination is a "University Examination" and candidate has passed 10+2 with English at a level not less than a core course.

**OR**

B.Sc. examination of an Indian University, provide that he/she has passed the B.Sc. examination with not less than two of the following subjects-Physics, Chemistry, Biology (Botany, Zoology) and further that he/she has passed the earlier qualifying examination with the following subjects-Physics, Chemistry, Biology and English (10+2 level).



**OR**

Any other examination which in scope and standard is found to be equivalent to the intermediate science examination of an Indian University/Board, taking Physics, Chemistry, Biology including a Practical test in each of these subjects and English.

**Note:** 10+2 with vocational training in Nursing/Medical Lab technology/Medical Microbiology are also eligible and 10+2 with Diploma in Medical Microbiology are also eligible for the respective course. Marks obtained in Mathematics are not to be considered for admission to the B.Sc. MLT Course. After the 10+2 course is introduced, the integrated courses should be abolished.

**MIGRATION /TRANSFER OF CANDIDATES**

Migration / Transfer of candidates from one recognized Institution to another Institution of this University or from another University will not generally be considered.

However, under extra ordinary circumstances, the Vice-Chancellor shall have the powers to place any migration / transfer he deems fit in the Governing Council and get its approval for grant of permission for migration / transfer to candidates undergoing courses of study in affiliated Institutions of this University.

**TRAINING PERIOD AND TIME DISTRIBUTION**

1. Every student shall undergo a period of certified study extending over Three and a Half Academic years OR Six semesters, plus 6 months internship, from the date of commencement of his study for the subjects comprising the B.Sc. Medical Lab Technology curriculum to the date of completion of examination and followed by compulsory rotating internship. Each academic year shall consist of 180 days/each Semester of 90 days teaching of 8 hours each day college working time, including one hour of Lunch.
2. The period of Three & Half years is divided into phased as follows: -

**a) Phase-I- First year B.Sc. Medical Lab. Technology (One Year Duration-two Semesters)**

i)	Human Anatomy and Physiology	<b>BMLT-101</b>
ii)	Basic Pathology	<b>BMLT-102</b>
iii)	Clinical Biochemistry	<b>BMLT-103</b>
iv)	Preventive Medicine & Health Care	<b>BMLT-104</b>
v)	Microbial Biology	<b>BMLT-105</b>
vi)	Technical Methods in Microbial Biology	<b>BMLT-106</b>

**b) Phase-II- Second year B.Sc. Medical Lab. Technology (One Year Duration/Two Semesters)**

<b>i)</b>	<b>Clinical Biochemistry-I</b>	<b>BMLT-201</b>
<b>ii)</b>	<b>Clinical Biochemistry-II</b>	<b>BMLT-202</b>
<b>iii)</b>	<b>Medical Microbiology-I</b>	<b>BMLT-203</b>
<b>iv)</b>	<b>Medical Microbiology-II</b>	<b>BMLT-204</b>
<b>v)</b>	<b>Pathology &amp; Allied Sub.-I</b>	<b>BMLT-205</b>
<b>vi)</b>	<b>Pathology &amp; Allied Sub.-II</b>	<b>BMLT-206</b>

**c) Phase-III- Third year B.Sc. MLT (One Year Duration/Two Semesters)**

<b>i)</b>	<b>Clinical Biochemistry-I</b>	<b>BMLT-301</b>
<b>ii)</b>	<b>Clinical Biochemistry-II</b>	<b>BMLT-302</b>
<b>iii)</b>	<b>Medical Microbiology-I</b>	<b>BMLT-303</b>
<b>iv)</b>	<b>Medical Microbiology-II</b>	<b>BMLT-304</b>
<b>v)</b>	<b>Pathology &amp; Allied Sub.-I</b>	<b>BMLT-305</b>
<b>vi)</b>	<b>Pathology &amp; Allied Sub.-II</b>	<b>BMLT-306</b>

**d) Phase-Fourth year B.Sc. MLT (Six Months duration): Internship**

**Note:** Results of all University examination shall be declared before the start of teaching for next semesters.

# DISTRIBUTION OF MARKS TO VARIOUS DISCIPLINES

## I<sup>ST</sup> YEAR

S. No.	Theory Paper	Paper Code	Max Marks		
			Internal	External	Total
1.	Human Anatomy & Physiology	BMLT-101	30	70	100
2.	Basic Pathology	BMLT-102	30	70	100
3.	Clinical Biochemistry	BMLT-103	30	70	100
4.	Preventive Medicine & Health Care	BMLT-104	30	70	100
5.	Microbial Biology	BMLT-105	30	70	100
6.	Technical Methods in Microbial Biology	BMLT -106	30	70	100
7.	Lab – Human Anatomy & Physiology (course based on Paper 1 & 2)	BMLT-101 P	30	70	100
8.	Lab – Clinical Biochemistry (course based on Paper 3)	BMLT-103 P	30	70	100
9.	Lab - Microbial Biology (course based on Paper 5 & 6)	BMLT-105 P	30	70	100
10.		Total	270	630	900

**II<sup>ND</sup> YEAR**

S. No.	Theory Paper	Paper Code	Max Marks		
			Internal	External	Total
1.	Clinical Biochemistry – I (Separative & Instrumentation Technique)	BMLT-201	30	70	100
2.	Clinical Biochemistry-II (Metabolic & Blood Chemistry)	BMLT-202	30	70	100
3.	Medical Microbiology-I (Bacterial Pathogens & Associated Diseases)	BMLT-203	30	70	100
4.	Medical Microbiology-II (Lab Diagnosis of Bacterial Pathogens)	BMLT-204	30	70	100
5.	Pathology & Allied Subject-I (Haematology & Clinical Pathology)	BMLT-205	30	70	100
6.	Pathology & Allied Subject-II (Histopathology & Cytology Techniques)	BMLT -206	30	70	100
7.	Lab- Clinical Biochemistry (course based on Paper 1 & 2)	BMLT-201 P	30	70	100
8.	Lab- Medical Microbiology (course based on Paper 3 & 4)	BMLT-203 P	30	70	100
9.	Lab- Pathology and Allied Subjects (course based on Paper 5 & 6)	BMLT-205 P	30	70	100
10.		Total	270	630	900

**III<sup>RD</sup> YEAR**

S. No.	Theory Paper	Paper Code	Max Marks		
			Internal	External	Total
1.	Clinical Biochemistry-I (Biostatics Automation & Endocrinology)	BMLT-301	30	70	100
2.	Clinical Biochemistry-II (Diagnostic Enzymology)	BMLT-302	30	70	100
3.	Medical Microbiology-I (Pathogenic Viruses & Misc. Microbes)	BMLT-303	30	70	100
4.	Medical Microbiology-II (Applied Microbiology & Advanced Tech.)	BMLT-304	30	70	100
5.	Pathology & Allied Subject-I (Immunopathology & Transfusion Medicine)	BMLT-305	30	70	100
6.	Pathology & Allied Subject-II (Histopathology & Cytology)	BMLT -306	30	70	100
7.	Lab- Biostatics Automation & Endocrinology (course based on Paper 1 & 2)	BMLT-301 P	30	70	100
8.	Lab- Pathogenic Viruses & Misc. Microbes (course based on Paper 3 & 4)	BMLT-303 P	30	70	100
9.	Lab- Immunopathology & Transfusion Medicine (course based on Paper 5 & 6)	BMLT-305 P	30	70	100
10.		Total	270	630	900

**Note:** Course Structure (Teaching duration) will be of 2 hrs / week for Theory & 3 hrs /week for Practical's for each paper.

The minimum pass marks will be 40 % in individual subjects in theory and Practical and 50% in Aggregate.

The theory and practical papers will be of equal weightage with 30% in sessional and 70% in final University Examination.

The division will be determined on the basis of aggregate of the marks of all the courses/subjects prescribed for the degree as under:

- (i) Passed with honours will be rewarded on 75% and above only in first attempt.
- (ii) First Division will be marked on 60% and above.
- (iii) Second Division will be marked on 50% and above but less than 60%

Compartment/Supplementary/Back Paper

- (i) A student who obtains 40% of the marks individually but has failed in two Papers shall be permitted to appear in those papers only at the two consecutive examinations and if he/she passes at either of those examinations he/she will be deemed to have passed the examination and will be promoted to higher class. (Aggregate marks should be 50%)
- (ii) A student (s) appearing in back paper/supplementary shall be eligible to join the next higher class provisionally however any student who fails to pass I<sup>st</sup> year would not be admitted in 3<sup>rd</sup> year course.

Theory Examination: All the paper in each year carrying 100 marks out of which 30 marks will be internal Assessment and 70 marks for external assessment based on the question paper sent by the University the paper will be of 3 hrs. Each Paper will have 8 questions out of which the candidate will have to attempt 5 questions.

The Practical Examination: will be held with the final Examination. The Practical and Viva Voice in each subject will carry 30% marks as internal & 70% marks as external assessment (according to examination scheme) prescribed for the years.

#### **PHASE DISTRIBUTION AND TIMING OF EXAMINATIONS: -**

I<sup>st</sup> Annual examination (or at the end of second semester)

II<sup>nd</sup> Annual examination (or at the end of forth semester)

III<sup>rd</sup> Annual examination (or at the end 6<sup>th</sup> semester)

Six months Internship after third Annual examination

## EXAMINATION REGULATIONS

Essentialities for qualifying to appear in professional examinations. The performance in essential components of training is to be assessed, based on.

### ATTENDANCE:

75% of attendance in a subject for appearing in the examination is compulsory provided he/she has 80% attendance in non-lecture teaching i.e., seminars, group discussion tutorials, demonstrations, practical hospital (territory, secondary, Primary) Postings and bed side clinics etc.

### INTERNAL ASSESSMENT:

- (i) It shall be based on day today assessment (see note), evaluation of student assignment, preparation for seminar, clinical case presentation etc.
- (ii) Sessional examination shall be conducted throughout the course. The question of number of examinations is left to the institution.
- (iii) Day to day records should be given importance during internal assessment.
- (iv) Weightage for the internal assessment shall be 30% of the total marks in each subject.
- (v) Student must secure at least 40% marks of the total marks fixed for internal assessment in particular subject in order to be eligible to appear in final University examination of that subject.

**Note:** Internal Assessment shall relate to different ways in which student's participation in learning process during semesters is evaluated. Some examples are as follows:

- (i) Preparation of subject for student's seminar.
- (ii) Preparation of a clinical case for discussion.
- (iii) Clinical case study problem solving exercise.
- (iv) Participation in project for health care in the community (planning stage to evaluation).
- (v) Proficiency in carrying out a practical or a skill in small research project.
- (vi) Multiple choice question (MCQ) test after completion of a system/teaching.

Each item tested shall be objectively assessed and recorded. Some of the items can be assigned as home work/Vacation work.

## **UNIVERSITY EXAMINATIONS:**

Theory papers will be prepared by the examiners as prescribed. Nature of questions will be short answer type/objective type and marks for each part indicated separately.

Practical/clinical will be conducted in the laboratories or hospital wards. Objective will be to assess proficiency in skills. Conduct of experiment, interpretation of data and logical conclusion clinical cases should preferably include common diseases not esoteric syndromes or rare disorders. Emphasis should be on candidate's capability in eliciting physical signs and their interpretation.

Viva/oral includes evaluation of management approach and handling of emergencies candidate's skill in interpretation of common investigation data also is to be evaluated.

The examinations are to be designed with a view to ascertain whether the candidate has acquired necessary for knowledge, minimum skills along with clear concepts of the fundamentals, which are necessary for him to carry out his professional day to day work competently. Evaluation will be carried out on an objective basis.

Question paper should preferable be of short structure/objective type.

Clinical cases /practical shall take into account common diseases, which the student is likely to come in contact in practice.

During evaluation (both external and internal) it shall be ascertained if the candidate has acquired the skills.

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

Note: Results of all University examinations shall be declared before the start of teaching for next semesters.

## **DURATION OF EXAMINATION & QUESTIONS**

- (i) Each written paper will be of three hours duration having eight questions, only five questions to be attempted. No choice will be given in any questions.
- (ii) A Clinical/Practical examination in any subject for student shall not be for more than a day. In no case more than 20 students be examined for Clinical/Practical & Oral in a day.



## INTERNSHIP

### GENERAL

Internship is a phase of training wherein a graduate is expected to conduct actual practice of Medical Laboratory Technology and acquire skills under supervision so that he/she may become capable of functioning independently.

### SPECIFIC OBJECTIVES

At the end of internship training the graduate shall be able to:

- (i) Perform all the diagnostic techniques
- (ii) Use discretely the essential laboratory services
- (iii) Manage all type of clinical diagnostic methods
- (iv) Demonstrate skills in handling the modern equipment in Medical Microbiology
- (v) Develop leadership qualities to function effectively as a leader of the Laboratory environment.
- (vi) Render services to the Laboratory set up and to communicate effectively with the Doctors and the hospital management.

### INTERNSHIP TIME DISTRIBUTION

#### Main Objective

Development of skill and competency in data processing, reporting and maintenance of records, Laboratory investigations.

Total Period and Internship: 6 months

Histopathology & Cytology Lab.	-	1- <sup>1</sup> / <sub>2</sub> Months
Clinical Pathology & Haematology Lab.	-	1- <sup>1</sup> / <sub>2</sub> Months
Clinical Biochemistry Lab.	-	1- <sup>1</sup> / <sub>2</sub> Months
Medical Microbiology Lab.	-	1 Month
Transfusion Medicine/Blood Bank	-	15 days

## OTHER DETAILS

- (i) All Parts of internship shall be done as far as possible in the Hospitals or Medical College.
- (ii) Every Candidate will be required after passing the final B.Sc. (Medical Lab. Tech.) Examination to undergo compulsory rotator internship to the satisfaction of the college Authorities and University concerned for a period of 6 months so as to be eligible for the award of the degree of Bachelor of Science in Medical Laboratory Technology and registration.
- (iii) The University shall issue a provisional B.Sc. pass Certificate on passing the final examination.
- (iv) The state medical faculty and council for allied health profession will grant Provisional registration to the candidate on production of the provisional B.Sc. pass certificate. The Provisional registration will be for a period of 1year. In the event of shortage or unsatisfactory work, the period of provisional registration and the compulsory rotating internship may be suitable extended by the appropriate authorities.
- (v) The intern shall be entrusted with Laboratory responsibilities under direct supervision of Senior Medical Officer /Technician. They shall not be working independently.
- (vi) Interns will not issue certified Laboratory reports or other related documents under their signature.

## ASSESSMENT OF INTERNSHIP

- (i) The interns maintain the record of work, which is to be verified and certified by the senior Medical Officer/Technician under whom he/she works. Apart from scrutiny of the record of work, assessment and evaluation of training shall be undertaken by an objective approach using situation tests in knowledge, skills and attitude during and the end of training. Based on the record of work and date of evaluation the Director principal/Principal shall issue 'Certificate of Satisfactory Completion' of training following which the University shall award the B.Sc. (MLT) Degree of declare the candidate eligible for the same.
- (ii) Satisfactory completion shall be determined on the basis of the following:
  - (a) Proficiency of knowledge required for each Laboratory Techniques
  - (b) The competency in skills expected to manage each Laboratory Technique.
    - Competency for performance of self-performance

- Of having assistant in procedures
- Of having observed
- (c) Responsibility, Punctuality, work up of Laboratory Techniques, involvement in procedures, follow of report.
- (d) Capacity to work in a team (behaviour with colleagues nursing staff and relationship with Medical and Paramedical).
- (e) Initiating, participation in discussion, research aptitude.
- (f) Full registration shall only be given by the State Medical faculty and Council for Allied Health Professor on the award of B.Sc. (MLT) Degree by the University on its declaration that the candidate is eligible for it.

### **VACATION**

There shall be a minimum 30 days' vacation every year or as session requirement laid down by the Institute.

### **MEDIUM OF INSTRUCTION**

English shall be the Medium of Instructions for all the subjects of study and for examination of the Bachelor of Medical Laboratory Technology course.

### **WORKING DAYS IN AN ACADEMIC YEAR**

Each Academic year shall spread over a period of not less than 180 working days

### **CONDONATION OF LACK OF ATTENDANCE**

As per the existing rules and regulations of the H.N.B. Garhwal University, Srinagar Garhwal.

### **SUBMISSION OF RECORD NOTE BOOKS**

At the time of Practical examination, each candidate shall submit to the examiners the record books duly certified by the Head of the College as a bonafide record of work done by the candidate.

### **CLASSIFICATION OF SUCCESSFUL CANDIDATES**

### **REVALUATION OF ANSWER PAPERS**

The regulations as prescribed by the University for another undergraduate course shall be applicable.

### **AWARD OF MEDALS AND PRIZES**

The University shall award at its convocation medals and prizes to outstanding candidates, as and when instituted by the donors as per the schedule prescribed for the award.

### **UNIVERSITY RANKING**

First, second and third University ranks may be awarded to candidates, who have passed all the examinations in the first appearance and taking into consideration the aggregated marks obtained in all the subjects, in which the candidate had been examined during the entire course of study.

## **CURRICULUM (SUBJECT WISE)**

### **SYLLABUS FOR MEDICAL LAB. TECHNOLOGY**

#### **GOAL**

The broad goal of teaching of B.Sc. (Medical Lab. Technology) students in Allied Medical Science aims at providing comprehensive knowledge of structure, function and pathological changes of the organs and the basis for understanding the clinical correlation of diseases and the pathological basis for the disease presentation specially with respect to Microbial Pathology.

#### **OBJECTIVES**

##### **(A) Knowledge:**

At the end of course, student shall be able to comprehend the normal disposition, clinically relevant interrelationship, functional Anatomy of various structure in the body. Identify the microscopic structure and correlate elementary ultra-structure of various organs and tissues and correlate the structure with functions as a pre requisite for understanding the alter state in various disease processes specially with respect to physical pathology and microbial infections and infestations.

##### **(B) Skills:**

At the end of the course, student shall be able to Identify and locate all the structures of the body and mark the topography of the living anatomy. Identify the organs and tissues. Understand the principles of karyotyping, Understand clinical bases of common clinical procedures of diagnoses of Microbial infections and infestations.

##### **(C) Integration:**

From the Integrated teaching of other basic sciences, students shall be able to comprehend the regulation and integration of the functions of the organs and systems in the body and thus interpret the pathological, biomolecular & microbial basis of diseases including advanced diagnostic technology.

**EXAMINATION SCHEME:**

<b>Components</b>	<b>I<sup>st</sup> internal</b>	<b>II<sup>nd</sup> Internal</b>	<b>Presentation/ Assignment/ Project</b>	<b>External (ESE)</b>
<b>Weightage (%)</b>	<b>Marks</b>	<b>Marks</b>	<b>Marks</b>	<b>Marks</b>

**BMLT 1<sup>st</sup> year**

<b>Course code</b>	<b>: BMLT-101</b>
<b>Course Name</b>	<b>: Human Anatomy and Physiology</b>
<b>Semester /Year</b>	<b>: 1<sup>st</sup> year</b>

	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>02</b>		<b>01</b>	<b>03</b>

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

**Course Contents****2hrs/Week****(HUMAN ANATOMY & PHYSIOLOGY)**

**Unit I** Introduction to Medical Sciences. Organization of human body and integrated physiology. Cell organizations, fundamental tissues of body and organ system. Primary defence mechanism of human body against pathogenic microbes. Gross anatomy and histology of organs of respiratory system, organs of respiration, mechanism of respiration and factors controlling it. Gross anatomy and histology of organs of alimentary system, organs of digestive system, various glands associated with the digestive system, mechanism and physiology of digestion and absorption.

**Unit II Cells and organs of immune system:** Morphology and their distribution. Gross anatomy and physiology of reticulo – endothelial system. Secondary immune response of human body to external stimuli. Physiology of various body fluids: CSF, Peritoneal, Pericardial, Pleural and synovial fluids. Gross anatomy, history & physiology of excretory system. Gross anatomy and histology of organs of cardiovascular system, organs of the system, mechanism and physiology of blood flow through the cardiovascular system.

**Unit III** Gross Anatomy and histology of Musculo-skeletal system, classification & functions of bones and muscles. Physiology of muscular contraction and factor controlling them various types of joints and their physiology. Gross anatomy and histology of organs of nervous system, division of nervous system and mechanism of nerve impulse transmission & reflex arc, sensory and motor system, sensory & motor systems special sense organs. Gross Anatomy and histology of organs of reproductive system, mechanism of reproduction and factors controlling it. Gross anatomy and histology of organs of endocrine system, different glands of the system and their distribution. Mechanism of hormone production, factors controlling it and their mechanism of action. Gross anatomy and histology of organs of alimentary system, organs of digestive system, various glands associated with the digestive system, mechanism and physiology of digestion and absorption.

**Text Books:**

Text Book of Human Anatomy B D Chourasia's V Edition

**Reference Books:**

Atlas Of Human Anatomy by Frank H. Netter VII Edition

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

<b>CO1</b>	To outline introduction of medical science, organization and physiology of human body and primary defence mechanism of human body.
<b>CO2</b>	To interpret about gross anatomy and histology of respiratory system, digestive system, alimentary system, and physiology of digestion and absorption.
<b>CO3</b>	To examine morphology and distribution of cells and organs of immune system, Gross anatomy and physiology of reticulo-endothelial system and physiology of various body fluids.
<b>CO4</b>	To illustrate gross anatomy and physiology of excretory system, cardiovascular system.
<b>CO5</b>	To assess gross anatomy, histology and physiology of Musculo-skeletal system, nervous system.
<b>CO6</b>	To write about gross anatomy, histology and physiology of reproductive system, endocrine system.

**CO-PO Mapping**

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>CO1</b>												
<b>CO2</b>												
<b>CO3</b>												
<b>CO4</b>												
<b>CO5</b>												
<b>CO6</b>												

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



**BMLT 1<sup>st</sup> year**

<b>Course code</b>	<b>: BMLT-102</b>
<b>Course Name</b>	<b>: Basic Pathology</b>
<b>Semester /Year</b>	<b>: 1<sup>st</sup> year</b>

	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>02</b>		<b>01</b>	<b>03</b>

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

**Course Contents****2hrs/Week****(BASIC PATHOLOGY)**

**Unit I** Introduction to Haematology. Laboratory organization & Safety measures. Formation, Composition and functions of blood. Anticoagulants, mode of action of anticoagulants and their merits and demerits. Collection, preservation, transport and handling and disposal of blood samples. Basic haematology and estimation of haematocrit values, physiological variations, normal and absolute values and quality assurance in haematology.

**Unit II** Romanowsky dyes, preparation and staining procedure of blood smears Morphology of blood cells and their identifications. haemoglobinometry: Various methods, errors involved and standardization of instruments. Haemo-cytometry: Procedure of cell count, visual as well as electronic, red cell, leukocyte and platelet count. Errors involved and mean to minimize such errors. Determinations of innate immunity and its mechanism, phagocytosis the complement system, gross structure and development of cells concerned with antibody production, cellular processes involved in antibody formation.

**Unit III** Pathology of inflammation in response to microbial invasion. Pathology of localized and systematic infections. Various routes of transport of Microbes to human body and methods of defence. Invasive techniques for diagnosis of acute and chronic microbial infections. Pathology of specific chronic infective disorders: Tuberculosis, Leprosy, Syphilis, SABC (subacute bacterial endocarditis) and rheumatological disorders. Study of microbes responsible for pathogenesis of tumours and their oncogenesis. Immuno- histopathology & Immuno – histochemistry (Basic Principles of Procedures and applications) Introduction to blood banking technology.

**Text Books:**

Text Book of Pathology Harsh Mohan VIII Edition Bloom Taxonomy

Text Book of Pathology by Dr. A K Mandal

**Reference Books:**

Clinical Pathology Haematology &amp; Blood Banking IV Edition

Exam Oriented Pathology by K Mukhopadhyay

**Course outcomes (COs):**

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

<b>CO1</b>	To describe the concepts of haematology.
<b>CO2</b>	To explain the basics of haematology and quality assurance.
<b>CO3</b>	To demonstrate the methods of histopathological staining, haemoglobinometry and haemo-cytoglobinometry.
<b>CO4</b>	To analyse the various types of immunity and mechanisms of antigen and antibody reactions.
<b>CO5</b>	To evaluate the pathology of microbial infections, pathogenesis of tumours and oncogenesis.
<b>CO6</b>	To develop an understanding of immunohistopathology, immunohistochemistry and blood banking technology.

**CO-PO Mapping**

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>CO1</b>												
<b>CO2</b>												
<b>CO3</b>												
<b>CO4</b>												
<b>CO5</b>												
<b>CO6</b>												

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

**BMLT 1<sup>st</sup> year**

<b>Course code</b>	<b>: BMLT-103</b>
<b>Course Name</b>	<b>: Clinical Biochemistry</b>
<b>Semester /Year</b>	<b>: 1<sup>st</sup> year</b>

	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>02</b>		<b>01</b>	<b>03</b>

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

**Course Contents****2hrs/Week****(CLINICAL BIOCHEMISTRY)**

**Unit I** Introduction to Clinical Biochemistry and role of medical Lab Technologist, ethics responsibility, safely measure and hazards in clinical biochemistry lab and first aid in laboratory accidents. Basic awareness of laboratory in respect to equipment & glassware's. (Unit of measurements and calibration of volumetric apparatus. Colorimetry, spectrophotometer, flame-photometry, hot air oven, waterbath, incubator etc. (Principles Instrumentations & applications). Preparation and storage of reagents, standard solutions, buffer solutions and pH determination. Biophysics, techniques – osmosis, dialysis, surface tension, sedimentation and viscosity – principles & applications. Henderson – Hassalbach equation and its clinical applications. Acid base disturbances and their clinical significance. Acid-base- buffer and pH – simple calculations. Concept of clinical sensitivity and specificity and factors affecting the clinical results. Collection of blood specimens avoiding Haemolysis, de- proteinization & separation of serum /Plasma. Biochemical composition of body fluids and their physiological variations.

**Physical and Biochemical Examination of Urine Samples:** Qualitative tests of inorganic Urinary ingredients: Chlorides, phosphate, sulphur compounds, sodium, Potassium, calcium and magnesium and their clinical significance. Qualitative tests for glycosuria, pentosuria, Galactosuria, proteinuria, microalbuminuria and Bence Jones Proteinuria and their clinical significance. Qualitative test of urine for uric acid, urea and creatinine. Quantitative estimation of 24 hours urine for albumin and their clinical significance. Pathological changes in composition of body fluids and their clinical correlation. Qualitative test of urine for ketone bodies, bile salts, bile – pigments and urobilinogen and their clinical significance.

**Unit II**

1. **Carbohydrates:** Structure, classification and their function in biological system.
2. **Lipids:** General structure of Fatty Acids and classification of Lipids.
3. **Proteins:** Classification, structural organization and function of proteins.
4. **Enzymes:** Definition, classification of Enzyme, concept of active sites and general mode of action of enzymes.
5. **Nucleic acids:** Structure function and types of DNA and RNA. Nucleotides, Nucleosides, Nitrogen bases and role of Nucleic Acid.

**Text Books:**

Text Book of Biochemistry for Medical Students by DM Vasudevan IX Edition Bloom  
Taxonomy

**Reference Books:**

Biochemistry by U Satyanarayana & U Chakrapani

**Course outcomes (COs):**

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

<b>CO1</b>	To define concepts and principles of biochemistry, correlations of biomolecules: carbohydrates, proteins, lipids, Nucleic acids with cellular and molecular processes involved in health and in disease states for clinical problem solving.
<b>CO2</b>	To express fundamental aspects of enzymology with mode of action, clinical application
<b>CO3</b>	To determine basics of clinical Biochemistry and medical lab technology in safety and
<b>CO4</b>	To correlate the normal ranges and abnormal ranges of biochemical components and Interpretation of principle of biochemical Clinical biochemistry tests, samples collection
<b>CO5</b>	To evaluate an analytical judgment, interpreting technical/principles of laboratory instruments: Colorimeter, spectrophotometer, flame photometer, hot air oven, water bath, incubator
<b>CO6</b>	To discuss the concept of application of biophysics, clinical sensitivity, specificity.

**CO-PO Mapping**

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>CO1</b>												
<b>CO2</b>												
<b>CO3</b>												
<b>CO4</b>												
<b>CO5</b>												
<b>CO6</b>												

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

**BMLT 1<sup>st</sup> year**

<b>Course code</b>	<b>: BMLT-104</b>			
<b>Course Name</b>	<b>: Preventive Medicine and Healthcare</b>			
<b>Semester /Year</b>	<b>: 1<sup>st</sup> year</b>			
	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>02</b>		<b>01</b>	<b>03</b>

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

**Course Contents****2hrs/Week****(PREVENTIVE MEDICINE AND HEALTHCARE)**

**Unit I: Water, air and noise pollution:** Removal of water hardness, purification of water and standards of water quality. Air and noise pollution and their prevention. Housing and air conditioning.

**Hygiene and Sanitation:** Sanitation barriers, excreta disposal and disposal of hospital waste. Incineration and disinfection.

**Infection and control:** Microbial Pathogenicity, source and spread of infections in community, Pathogenesis, toxigenicity, invasiveness, variations and virulence. Host factors controlling infections to men, mode of spread and their control by physical & chemical agents.

**Unit II: Epidemiology:** Epidemiology, surveillance and control of community infections. Role of laboratory in community and hospital infections. Emergence of drug resistance. Methods of prevention & control – isolation of patients, quarantine & incubation periods of various infectious diseases. Management of patient's infectious diseases hospital (IDH).

**Prophylactic immunization:** Rationale of immunization, immune response and duration of immunity. Controlled studies of prophylactic vaccines and hazards immunization. Reproductive, family planning & Child Health Care Programs.

**Unit III: Bacteriology of water, milk, food and air:** Bacteriological examination of water collection of specimens, presumptive coliform count, cloakroom test, colony count and interpretation of results. Bacterial examination of sewage and sewage effluents. Bacteriological examination and control of swimming bath, membrane filter technique and isolation of pathogens. Bacteriological examination milk, bacterial standards and various tests for pasteurized milk. Bacterial examination of ice-cream, shellfish and canned foods, milk bottles, crockery and cutlery. Examination of food stuff in cases of outbreak of food poisoning. Bacteriological examination of air and environment dust.

**Health care by balance diet and yoga:** Normal constituents of diet, various diet programs, balance diet and factors responsible for aetiology of various nutritional disorders. Carcinogens in food. Role of regular exercise & yoga in prevention & management of various diseases.

**Health Planning & Management:** Health planning, Planning Cycle, Malaria eradication & various other National Health policy & Programs.

**Text Books:**

Text Book of Preventive &amp; Social Medicine by K Park

**Reference Books:**

Review of Preventive &amp; Social Medicine by Vivek Jain XIII Edition

**Course outcomes (COs):**

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

<b>CO1</b>	To Introduce the air and noise pollution and removal of water hardness, purification.
<b>CO2</b>	To associate Sanitation barriers, excreta disposal and disposal of hospital waste, Incineration and disinfection.
<b>CO3</b>	To determine the emergence of drug resistance. Methods of prevention & control-isolation of patients, quarantine & incubation periods of various infectious diseases.
<b>CO4</b>	To divide Various national immunization programs and vaccine schedules.
<b>CO5</b>	To detect health care by balance diet and yoga.: Normal constituents of diet, various diet programs
<b>CO6</b>	To program health planning & management.

**CO-PO Mapping**

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>CO1</b>												
<b>CO2</b>												
<b>CO3</b>												
<b>CO4</b>												
<b>CO5</b>												
<b>CO6</b>												

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

**BMLT 1<sup>st</sup> year**

<b>Course code</b>	<b>: BMLT-105</b>			
<b>Course Name</b>	<b>: Microbial Biology</b>			
<b>Semester /Year</b>	<b>: 1<sup>st</sup> year</b>			
	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>02</b>		<b>01</b>	<b>03</b>

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

**Course Contents****2hrs/Week****(MICROBIAL BIOLOGY)****Unit I**

**Microbiology & Medicine:** Introduction to Medical Microbiology, Discovery of micro-organisms, Contribution of Robert Koch, Antony Van Leeuwen hook, Louis Pasteur, Bordet, Paul Ehrlich, Alexander Fleming, Metchnikoff, Needham, Tyndall Jenson, Joseph lister, Karl's Landsteiner etc. Scope & relevance and Safety measures of Medical Microbiology, Role of medical microbiology in identification and management of various infectious diseases.

**Morphology & Nature of bacteria:** Anatomy of bacterial cell, intracellular components and their functions bacterial reproduction, morphological study of bacteria and its appendages – flagella, fimbriae, pili, capsule, spore and cysts.

**Classification and identification of bacteria:** Biological groups, morphological and biological classification, DNA composition as a basis of classification system of identification-morphology, staining reactions, cultural characters, biochemical reactions & antigenic characters etc.

**Sterilization and disinfection:** Various physical methods of sterilization – heat UV radiation, ionizing radiation, character affecting sterilization, auto clave control and sterilization indicators. Chemical disinfectants – phenol and its compounds, aldehyde, gaseous compound. Use and abuse of disinfectants.

**Unit II**

**Cultural Media:** Liquid and solid media, container for medias distribution of media in tubes, bottles and Petri dishes. Common ingredients of cultural Medias. Synthetic media, peptone water, nutrient agar and broth, chocolate and blood agar, meat extract broth milk agar etc. Special Medias for Neisseria, Corynebacterium, mycobacterium & Enterobacteriaceae group etc.

**Cultivation of bacteria:** Instruments used, inoculation hood, laminar flow, culture procedure, incubation (Aerobic and Anaerobic). Isolation of pure culture and its preservation. Suspending media for freeze drying of bacteria. Blood culture.

**Pure cultures:** Maintenance & preservation of pure cultures. Collection, transport processing & storage of clinical samples for microbiological Analysis.

**Growth and Nutrition of Bacteria:** Typical growth, curve, various phases of growth, physiology of bacteria – catabolism and anabolism. Nutrition of microbes and physical condition required for growth. Effect of Carbon, Nitrogen, Growth factors, Vitamins, Temperature, pH, Osmotic pressure, Oxygen and Carbon Di oxide on microbial growth.

**Unit III**

Lab. Organization, Management, Recording of Results and Quality Control in Medical Microbiology. Principles of Staining Techniques, Preparation Stains and their storage.

**Introduction to Virology, Mycology & Parasitology:** (Characteristic, morphology, classification, nomenclature, pathogenesis).

**Antimicrobial agents and antibiotic:** Disinfectants, antiseptics, chemotherapeutic agents' chemotherapeutic index, development of chemotherapy, antibiotics and effect of antibiotics on protein & nucleic acid synthesis and cytoplasmic membrane. Future development of chemotherapy.

### Text Books:

Text Book of Microbiology by Dr. C P Baveja VIII Edition

Text Book of Microbiology by Apurba S Sastry & Sandhya Bhat

### Reference Books:

Prescott's Microbiology by Joanne Willey, Kathleen Sandman XI Edition

Essentials of Microbiology & Immunology by S K Mohanty & K Sai Leela & Dipti Pattanaik

### Course outcomes (COs):

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

<b>CO1</b>	To Introduce the Discovery of micro-organism. Contribution of various scientist.
<b>CO2</b>	To associating the anatomy of bacterial cell, bacterial reproduction, morphological study of bacteria.
<b>CO3</b>	To determine the culture media and its type (liquid and solid media). Common ingredients of cultural media. Cultivation of bacteria.
<b>CO4</b>	To divide Maintenance & Preservation of pure cultures. Collection, transport processing & storage of clinical samples for Microbiological Analysis.
<b>CO5</b>	To measure immunological tests, antigen test, antibodies reaction and antigen antibody reaction.
<b>CO6</b>	To Formulate disinfectants, antiseptics chemotherapeutic agents: Future development of chemotherapy.



**CO-PO Mapping**

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>CO1</b>												
<b>CO2</b>												
<b>CO3</b>												
<b>CO4</b>												
<b>CO5</b>												
<b>CO6</b>												

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

**BMLT 1<sup>st</sup> year**

<b>Course code</b>	<b>: BMLT-106</b>
<b>Course Name</b>	<b>: Technical Methods in Microbial Biology</b>
<b>Semester /Year</b>	<b>: 1<sup>st</sup> year</b>

	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>02</b>		<b>01</b>	<b>03</b>

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

**Course Contents****2hrs/Week****(TECHNICAL METHODS IN MICROBIAL BIOLOGY)****Unit I**

**Microscopy:** Study of compound microscope-magnifying, numerical aperture, resolution and components of microscope. Dark ground illumination care of microscope and common difficulties. Micrometry Study of phase contrast, interference, fluorescent an electron microscope. Preparation of smear for electron microscope.

**Study of pH in Microbiology:** Methods for measurements pH meter. Preparation, dilution and chemistry of suspension fluid. Oxidation-reduction redox) potential.

**Preparation of stains:** Making of films, staining methods, mounting media. Gram's stain-Preparation of stain and staining methods. Special stains for AFB, Diphtheria, spores, capsule, intracytoplasmic lipids, polysaccharides, nuclear material, field's stain, stain for amoeba, fungi and rickettsia.

**Unit II**

Study of instruments used in medical microbiology-

**General Instruments:** Distillation plant, centrifuge Machine, Analytical Balance, Hotplate, Magnetic Stirrer, Water Bath, Automatic Dispensers and diluters, De-iodizer etc.

**Microbiological Instruments:** Autoclave, Incubator, Hot air oven, Laminar Air flow, Colony Counter, Muffle furnace, Refrigerator, Incubator, Mac-Intos, Intos field- jar etc.

**Instruments used in immunology:** Electrophoresis, Immunodiffusion, starplate, chromatography, Elisa reader, automatic washer and RIA equipment etc.

**Care and management of experimental animals:** General directions for the care of animals, material inoculated, necropsy common diseases and experimental procedures. **Safety measures in Microbiology Laboratory:** Occurrence of Lab infections, route of infection in laboratory, safety measure precautions in use of Pathogens in teaching lab organization, management, recording of results and quality control in medical microbiology.

**Culture and drug sensitivity test:** Isolation and identification of pathogens from urine, pus, sputum and recording of their results.

**Text Books:**

Text Book of Microbiology by Dr. C P Baveja VIII Edition

Text Book of Microbiology by Apurba S Sastry & Sandhya Bhat

**Reference Books:**

Prescott's Microbiology by Joanne Willey, Kathleen Sandman XI Edition

Essentials of Microbiology & Immunology by S K Mohanty & K Sai Leela & Dipti Pattanaik

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

<b>CO1</b>	To define study of Microscope & its types.
<b>CO2</b>	To compare preparation of Stains, making of Films, Staining Methods, Mounting Media, Stains (Gram stains, AFB Stains, Capsule, Spores Stains.)
<b>CO3</b>	To examine the various Microbiological Instruments. Instruments used in Immunology.
<b>CO4</b>	To discuss the principle and working of significant instrumentation.
<b>CO5</b>	To measure Safety Measure in Microbiology Laboratory
<b>CO6</b>	To investigate culture, Isolation & Identification of Pathogens & Drug Sensitivity test.

**CO-PO Mapping**

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>CO1</b>												
<b>CO2</b>												
<b>CO3</b>												
<b>CO4</b>												
<b>CO5</b>												
<b>CO6</b>												

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

## Practicals

### BMLT 1<sup>st</sup> year

<b>Course code : BMLT-101 P</b>				
<b>Course Name : Human Anatomy &amp; Physiology (Lab course based on Paper 1 &amp; 2)</b>				
<b>Semester /Year : 1<sup>st</sup> year</b>				
	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>-</b>	<b>-</b>	<b>02</b>	<b>01</b>

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

<b>S. No</b>	<b>Practicals</b>
<b>1.</b>	Demonstration of major organs through models.
<b>2.</b>	Demonstration of parts of circulatory system from models.
<b>3.</b>	Demonstration of parts of respiratory system from models.
<b>4.</b>	Demonstration of digestive system from models.
<b>5.</b>	Demonstration of excretory system from models.
<b>6.</b>	Demonstration of nervous system from models.
<b>7.</b>	Demonstration of structural differences between skeletal, smooth and cardiac muscles.
<b>8.</b>	Demonstration of various bones.
<b>9.</b>	Demonstration of various joints.
<b>10.</b>	To measure blood pressure.
<b>11.</b>	Demonstration of microscope.
<b>12.</b>	To perform Hemoglobin by Sahli's method.
<b>13.</b>	To perform Hemoglobin by CMG method.
<b>14.</b>	To perform Total erythrocyte count.
<b>15.</b>	To perform total leucocyte count.
<b>16.</b>	To perform differential leucocyte count.

\*Course out comes of above practical is covered in their respective theory courses.

**BMLT 1<sup>st</sup> year**

<b>Course code</b>	<b>: BMLT-103 P</b>
<b>Course Name</b>	<b>: Clinical Biochemistry (Lab course based on paper 3)</b>
<b>Semester /Year</b>	<b>: 1<sup>st</sup> year</b>

	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>-</b>	<b>-</b>	<b>02</b>	<b>01</b>

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

<b>S. No</b>	<b>Practicals</b>
<b>1.</b>	To study general laboratory safety rules.
<b>2.</b>	To demonstrate glass wares, apparatus and plastic wares used in laboratory
<b>3.</b>	To make 1.0 M solution of NaCl
<b>4.</b>	To identify abnormal constituents of the urine
<b>5.</b>	To identify normal constituents of the urine
<b>6.</b>	Demonstration of colorimeter
<b>7.</b>	To identify the type of carbohydrate in the given sample
<b>8.</b>	To identify between protein and amino acid
<b>9.</b>	Demonstration of pH meter
<b>10.</b>	Preparation of different percentage solutions

\*Course out comes of above practical is covered in their respective theory courses.

**BMLT 1<sup>st</sup> year**

<b>Course code</b>	<b>: BMLT-105 P</b>
<b>Course Name</b>	<b>: Microbial biology (Lab course based on paper 5 &amp; 6)</b>
<b>Semester /Year</b>	<b>: 1<sup>st</sup> year</b>

	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	-	-	<b>02</b>	<b>01</b>

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

<b>S. No</b>	<b>Practicals</b>
<b>1.</b>	Safety rules of working in microbiology lab.
<b>2.</b>	Demonstration of working of microbiology laboratory instruments.
<b>3.</b>	To perform simple staining.
<b>4.</b>	To perform Gram's staining.
<b>5.</b>	To perform negative staining.
<b>6.</b>	To perform AFB/ ZN staining.
<b>7.</b>	To perform spore staining.
<b>8.</b>	To perform capsule staining.
<b>9.</b>	Media preparation and its sterilization (selective/differential Regular). a) Nutrient Agar b) Chocolate Agar c) MacConkey Agar d) UTI Agar e) SDA Agar
<b>10.</b>	To perform motility Test by hanging drop method.

\*Course out comes of above practical is covered in their respective theory courses.

**BMLT II<sup>nd</sup> year**

<b>Course code</b>	<b>: BMLT-201</b>
<b>Course Name</b>	<b>: Clinical Biochemistry-I</b>
<b>Semester /Year</b>	<b>: II<sup>nd</sup> year</b>

	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>02</b>		<b>01</b>	<b>03</b>

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

**Course Contents**

<b>(SEPARATIVE &amp; INSTRUMENTATION TECHNIQUE)</b>	
<b>Unit I</b>	Chromatography: Thin layer chromatography, gas liquid chromatography. Electrophoresis-Paper and gel electrophoresis for haemoglobin, urinary proteins, serum CSF & LDH. Atomic absorption spectroscopy.
<b>Unit II</b>	Immunochemical, Immunoprecipitation, Immunofixation and radial immunodiffusion test Osmometry: Principle, procedure and applications. Semi auto-analyser, diluters & dry chemistry analyser: Principle, Procedure and applications.
<b>Unit III</b>	Principal Procedure and Application Of: Coulter counters. Enzyme Linked Immunosorbent Assay (ELISA) Reader. Radio-Immunoassay. (RIA) Polymerase chain reaction (PCR).

**Text Books**

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

**Reference Books:**

1. Styrrer. *Biochemistry*. 9<sup>th</sup> edition. MacMillan
2. Harper. *Illustrated Biochemistry*. 32<sup>nd</sup> Edition. McGraw Hill.

**Course outcomes (COs):**

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

<b>CO1</b>	To highlights the basics of separative and instrumental techniques applied in clinical Biochemistry and medical lab technology.
<b>CO2</b>	To infer concepts and principles of lab techniques like chromatography, electrophoresis with protocols and specific tests implementations in healthy and disease states for clinical diagnosis.
<b>CO3</b>	To articulate fundamental aspects of atomic absorption spectroscopy with clinical application and daily maintenance.
<b>CO4</b>	To correlate the normal ranges and abnormal ranges of biochemical components, interpreting principles of Clinical biochemistry tests to be processed by applying above lab techniques and procedure.
<b>CO5</b>	To review an analytical judgment, interpreting technical/principles of laboratory instrumentation in Immuno-chemistry, osmometry etc.,
<b>CO6</b>	To build the concepts, principles and applications of molecular lab instrumentation like Coulter counters, ELISA, RIA and PCR.

**CO-PO Mapping**

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>CO1</b>												
<b>CO2</b>												
<b>CO3</b>												
<b>CO4</b>												
<b>CO5</b>												
<b>CO6</b>												

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



**BMLT II<sup>nd</sup> year**

<b>Course code</b>	<b>: BMLT-202</b>
<b>Course Name</b>	<b>: Clinical Biochemistry-II</b>
<b>Semester /Year</b>	<b>: II<sup>nd</sup> year</b>

	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>02</b>		<b>01</b>	<b>03</b>

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

**Course Contents****(METABOLIC & BLOOD CHEMISTRY)**

**Unit I** Carbohydrate metabolism, glycolysis, TCA, HMP Shunt pathway, gluconeogenesis and their clinical importance, glucose tolerance test (GTT). Protein metabolism-urea cycle and its biomedical significance, transamination and deamination. Lipid metabolism, Beta-oxidation of fatty acids, ketone bodies, metabolic changes in liver and adipose tissues during starvation, lipid profile.

**Unit II** Principle, assay procedures and clinical significance of following: Glucose, proteins, A.G, urea, BUN, uric acid, creatinine cholesterol, Bilirubin (Direct & Indirect). Electrolytes: Quantitative estimation of sodium, potassium, calcium, chloride, and their clinical significance.

**Unit III** Acid base balance test, insulin tolerance test, Urea and creatinine clearance tests and their significance. Renal function tests and their clinical interpretation. Glycosylated Hb & Liver function tests. Principle technique and clinical significance.

**Text Books:**

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

**Reference Books:**

1. Styrer. *Biochemistry*. 9<sup>th</sup> edition. MacMillan
2. Harper. *Illustrated Biochemistry*. 32<sup>nd</sup> Edition. Mc Graw Hill.

**Course outcomes (COs):**

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

<b>CO1</b>	To highlight the basics of Metabolic and Blood Chemistry techniques applied in the Clinical Biochemistry Lab.
<b>CO2</b>	To associate fundamental aspects of metabolic pathways carried by biomolecules like carbohydrates, protein, and lipids with their clinical implication for dysfunction.
<b>CO3</b>	To determine pathways of the intermediary metabolism along with their individual and integrated regulation and relate that to insightful functioning of the body.
<b>CO4</b>	To attribute the principles, procedures and clinical implications of biochemical daily routine tests components such as glucose, protein, urea, creatinine, bilirubin, and electrolytes classified as pivotal diagnostic/prognostic markers.
<b>CO5</b>	To measure with all the advanced biochemical tests and clinical importance of acid-base balance, insulin tolerance test, Urea and creatinine clearance tests.
<b>CO6</b>	To lead the importance of Organ Functions Tests in integrating and correlating the quality of diagnostic outcomes.

**CO-PO Mapping**

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>CO1</b>												
<b>CO2</b>												
<b>CO3</b>												
<b>CO4</b>												
<b>CO5</b>												
<b>CO6</b>												

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

**BMLT II<sup>nd</sup> year**

<b>Course code</b>	<b>: BMLT-203</b>
<b>Course Name</b>	<b>: Medical Microbiology-I</b>
<b>Semester /Year</b>	<b>: II<sup>nd</sup> year</b>

	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>02</b>		<b>01</b>	<b>03</b>

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

**Course Contents****(BACTERIAL PATHOGENS & ASSOCIATED DISEASES)**

**Unit I** Normal microflora of human body: Skin, Respiratory system and Genitourinary tracts. Source of infection, mode of spread and portal of entry. Description, Pathogenicity, mode of infection, incubation period and toxigenicity of: -

Staphylococcus	Neisseria
Streptococcus	Bordetella
Pneumococcus	Haemophilus

**Unit II**

Host Parasite interaction in bacterial infections. Pathogenic properties of bacteria (colonization of surfaces, invasion of tissue, production of exo and endo toxins). Anti-bacterial defence of the host. Description, Pathogenicity, mode of infection, incubation period and toxigenicity of:

1. Corynebacterium, Erysipelothrix, listeria
2. Mycobacteria
3. Atypical Mycobacteria
4. Anthrax bacillus
5. Brucella
6. Yersenia, Pasteurella & francisella

**Unit III**

**Physiology & Biochemistry of bacteria:** Protein, Carbohydrate, lipids and nucleic acid as antigens.

Description, Pathogenicity, mode of infection, incubation period and toxigenicity of:

- |               |                              |
|---------------|------------------------------|
| 1. Salmonella | 4. Pseudomonas, Loefflerella |
| 2. Shigella   | 5. vibrio                    |
| 3. Proteus    | 6. Clostridia                |

**Text Books:**

Text Book of Microbiology by Dr. C P Baveja VIII Edition

Text Book of Microbiology by Apurba S Sastry & Sandhya Bhat

**Reference Books:**

Prescott's Microbiology by Joanne Willey, Kathleen Sandman XI Edition

Essentials of Microbiology & Immunology by S K Mohanty & K Sai Leela &

Dipti Pattanaik

**Course outcomes (COs):**

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

<b>CO1</b>	To recall the pathogenicity, mode of infection and toxigenicity of normal microflora of the Human Body (Skin, Respiratory, Gastrointestinal, genitourinary tracts).
<b>CO2</b>	To understand the host-parasite interaction in bacterial infection.
<b>CO3</b>	To illustrate the pathogenic role of certain bacteria.
<b>CO4</b>	To differentiate the bacteria on the basis of description, Pathogenicity, mode of infection etc. <i>Corynebacteria</i> , <i>Anthrax bacillus</i> , <i>a typical Mycobacteria</i> etc.,
<b>CO5</b>	To evaluate the biochemistry of antigens.
<b>CO6</b>	To investigate the bacterial pathogenicity in terms of toxigenicity, mode of infection and incubation period.

**CO-PO Mapping**

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>CO1</b>												
<b>CO2</b>												
<b>CO3</b>												
<b>CO4</b>												
<b>CO5</b>												
<b>CO6</b>												

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

**BMLT II<sup>nd</sup> year**

<b>Course code</b>	<b>: BMLT-204</b>
<b>Course Name</b>	<b>: Medical Microbiology-II</b>
<b>Semester /Year</b>	<b>: II<sup>nd</sup> year</b>

	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>02</b>		<b>01</b>	<b>03</b>

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

**Course Contents****(LAB DIAGNOSIS OF BACTERIAL PATHOGENS)**

**Unit I** The role of laboratory in the diagnosis and control of infection: Management and quality control of medical microbiology laboratory.

- a) Specimen collection from patients, clinics and hospitals.
- b) Specimen collection for epidemiological investigations.
- c) Training of medical microbiologist to handle epidemics.

Morphology, Staining, Cultural Character of Bacteria. Selective cultural media, identification by special tests, biochemical reactions and sero-typing of:

- a) Grams positive Cocci: - Cluster forming, chain forming and diplo cocci.
- b) Neisseria, Bordetella and haemophilus. Pathogenesis and Pathology of infections caused by 2 (a) and 2 (b).

**Unit II** Isolation of pure culture and its preservation. Morphology, Staining Cultural Character, Selective cultural media, identification by special tests, biochemical reactions and serotyping of: -

- |                           |                              |
|---------------------------|------------------------------|
| 1. Corynebacterium        | 4. Anthrax bacillus          |
| 2. Mycobacterium          | 5. Brucella                  |
| 3. Atypical Mycobacterium | 6. Yersenia and Pasteurella. |

Pathogenesis and Pathology of infections caused by 2 (1 to 6)

**Unit III** Microbial drug sensitivity tests and its clinical interpretation: Morphology, Staining, Cultural Character, Selective cultural media, identification by special tests, biochemical reactions and serotyping of: -

- |                |                      |
|----------------|----------------------|
| 1. Salmonella  | 5. Vibrio            |
| 2. Shigella    | 6. Escherichia coli. |
| 3. Proteus     | 7. Clostridia        |
| 4. Pseudomonas |                      |

Pathogenesis and Pathology of infections caused by 2 (1 to 7).

- |               |                              |
|---------------|------------------------------|
| 4. Salmonella | 4. Pseudomonas, Loefflerella |
| 5. Shigella   | 5. vibrio                    |
| 6. Proteus    | 6. Clostridia                |

**Text Books:**

Text Book of Microbiology by Dr. C P Baveja VIII Edition

Text Book of Microbiology by Apurba S Sastry & Sandhya Bhat

**Reference Books:**

Prescott's Microbiology by Joanne Willey, Kathleen Sandman XI Edition

Essentials of Microbiology & Immunology by S K Mohanty & K Sai Leela &

Dipti Pattanaik

**Course outcomes (COs):**

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

<b>CO1</b>	The examine the role of laboratory in the diagnosis, control of infection, Management and quality control of medical microbiology laboratory.
<b>CO2</b>	To discuss the cultural characteristics, staining properties and biochemical properties of Gram positive and Gram negative bacteria.
<b>CO3</b>	To demonstrate the isolation techniques and preservation methods of bacteria.
<b>CO4</b>	To analyze the pathogenic characters of bacteria and pathology of infections.
<b>CO5</b>	To Evaluate the microbial drug sensitivity and its clinical interpretation.
<b>CO6</b>	To prepare the list of pathogenesis caused by bacteria and their pathology.

**CO-PO Mapping**

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>CO1</b>												
<b>CO2</b>												
<b>CO3</b>												
<b>CO4</b>												
<b>CO5</b>												
<b>CO6</b>												

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

**BMLT II<sup>nd</sup> year**

<b>Course code</b>	<b>: BMLT-205</b>			
<b>Course Name</b>	<b>: Pathology and Allied Subject-I</b>			
<b>Semester /Year</b>	<b>: II<sup>nd</sup> year</b>			
	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>02</b>		<b>01</b>	<b>03</b>

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

**Course Contents****(HEMATOLOGY & CLINICAL PATHOLOGY)**

**Unit I** Coagulation: Mechanism of coagulation, coagulation regulation hyper coagulable states, coagulation disorders. Bleeding disorders: Various types, vascular abnormalities, role of platelets in haemostasis, Platelet disorders, thrombosis and thrombus haemorrhagic disorders. Anaemias: Definition, various types of anaemia, causes of anaemia, changes in the blood morphology due to anaemia.

**Unit II** Leucocytosis, neutropenia & pancytopenia their causes & significance, Infectious mononucleosis. Haematological malignancies: Various types of malignancies such as leukaemia Lymphomas including multiple myeloma. Their identification & clinical features. Lab investigations in haematological malignancies.

**Unit III** Haematological Changes in systematic disorders. Their microscopic picture with identification and clinical features. Haematological aspects of paediatric and Geriatric age groups. Haematological disorders in pregnancy and their blood picture. Haematological changes in AIDS. Various parasites in blood and their clinical significance. Lab Investigations and methods of identification. Organization, Planning and management of blood bank. Donor selection and its various aspects. Selection of blood and the guidelines for transfusion practice. Quality control and safety and basic management of blood bank.

**Text Books:**

Text Book of Pathology by Harsh Mohan VIII Edition

Text Book of Pathology by Dr. A K Mandal

**Reference Books:**

Clinical Pathology Haematology &amp; Blood Banking IV Edition Nanda Maheshwari

Exam Oriented Pathology by K Mukhopadhyay

**Course outcomes (COs):**

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

<b>CO1</b>	To describe the coagulation disorders and bleeding disorders with its mechanism.
<b>CO2</b>	To explain the mechanism of platelet disorders and types of anaemia.
<b>CO3</b>	To illustrate the causes and significance of Leucocytosis and neutropenia.
<b>CO4</b>	To compare the identification features and types of malignancies.
<b>CO5</b>	To evaluate the haematological changes leading to haematological disorders.
<b>CO6</b>	To design the basic procedures to maintain the quality control, safety and management of blood bank.

### CO-PO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>CO1</b>												
<b>CO2</b>												
<b>CO3</b>												
<b>CO4</b>												
<b>CO5</b>												
<b>CO6</b>												

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



<b>Course code</b>	<b>: BMLT-206</b>
<b>Course Name</b>	<b>: Pathology and Allied Subject-II</b>
<b>Semester /Year</b>	<b>: II<sup>nd</sup> year</b>

	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>02</b>		<b>01</b>	<b>03</b>

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

### Course Contents

<p align="center"><b>(HISTOPATHOLOGY &amp; CYTOLOGY TECHNIQUES)</b></p> <p><b>Unit I</b> Reception recording and labelling of histology specimens. Fixation and various fixatives. Processing of histological tissues for Paraffin embedding. Embedding and embedding media. Decalcification – various methods. Microtomes – various types their working principle and maintenance.</p> <p><b>Unit II</b> Section cutting- faults and remedies. Microtome knives and knife sharpening. Dye chemistry theory and practice of staining. Routine Staining procedures H and E mounting and mounting media. Solvents mordents accelerators and accentuators.</p> <p><b>Unit III</b> Uses of controls in various staining procedures. Special staining procedures for Connective tissues Carbohydrates Amyloids and pigments Meta Chroma Sia and Meta chromatic dyes. Museum techniques.</p>
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### Text Books:

Text Book of Pathology by Harsh Mohan VIII Edition

Text Book of Pathology on MLT & Paramedical courses by Dr. I Clement

### Reference Books:

Clinical Pathology Haematology & Blood Banking IV Edition by Nanda Maheshwari

Exam Oriented Pathology by K Mukhopadhyay

### Course outcomes (COs):

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

<b>CO1</b>	To identify the various histopathological steps in recording and labelling the specimens.
<b>CO2</b>	To Understand the working principle and maintenance of decalcification of specimen and microtome preparation.
<b>CO3</b>	To illustrate the importance of methods and equipments involved in microtome preparation.
<b>CO4</b>	To classify the staining techniques used in histopathology lab.
<b>CO5</b>	To evaluate the role of controls used in staining procedures carried in histopathology lab.
<b>CO6</b>	To plan the various methods such as autoradiography museum techniques, specimen photography and microphotography.

**CO-PO Mapping**

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>CO1</b>												
<b>CO2</b>												
<b>CO3</b>												
<b>CO4</b>												
<b>CO5</b>												
<b>CO6</b>												

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

**BMLT 2<sup>nd</sup> year**

<b>Course code</b>	<b>: BMLT-201 P</b>
<b>Course Name</b>	<b>: Clinical Biochemistry (Lab course based on paper 1 &amp; 2)</b>
<b>Semester /Year</b>	<b>: 2<sup>nd</sup> year</b>

	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>-</b>	<b>-</b>	<b>02</b>	<b>01</b>

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

<b>S. No</b>	<b>Practicals</b>
<b>1.</b>	Demonstration of Paper electrophoresis.
<b>2.</b>	Demonstration of Paper chromatography.
<b>3.</b>	Demonstration of ELISA.
<b>4.</b>	Demonstration of RIA.
<b>5.</b>	Demonstration of PCR
<b>6.</b>	Demonstration of autoanalyser
<b>7.</b>	Demonstration of immunodiffusion
<b>8.</b>	To estimation of blood glucose by GOD-POD method
<b>9.</b>	To estimation of blood urea by urease method
<b>10.</b>	To estimation of serum creatinine by alkaline picrate method method
<b>11.</b>	To estimation of serum uric acid by uricase method
<b>12.</b>	To estimation of serum total cholesterol by CHOD-POD method

\*Course out comes of above practical is covered in their respective theory courses.

**BMLT 2<sup>nd</sup> year**

<b>Course code</b>	<b>: BMLT-203 P</b>
<b>Course Name</b>	<b>: Medical Microbiology (Lab course based on paper 3 &amp; 4)</b>
<b>Semester /Year</b>	<b>: 2<sup>nd</sup> year</b>

	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>-</b>	<b>-</b>	<b>02</b>	<b>01</b>

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

<b>S. No</b>	<b>Practicals</b>
<b>1.</b>	Safety rules of working in microbiology lab.
<b>2.</b>	Isolation of bacterial pathogens from different clinical specimens.
<b>3.</b>	Identification of bacteria by Gram's Staining.
<b>4.</b>	Characterization of bacterial isolates using biochemical test.
<b>5.</b>	Isolation of bacterial isolates in pure form and it's preservation.
<b>6.</b>	To perform drug susceptibility testing.
<b>7.</b>	To perform urine/ Pus culture.
<b>8.</b>	To perform motility Test by hanging drop method.
<b>9.</b>	Isolation of pathogens from hospital, Ward, Instrument, Hospital bed, patient wounds and cotton pads and their biochemical characterization.
<b>10.</b>	To perform acid fast staining

\*Course out comes of above practical is covered in their respective theory courses.

**BMLT 2<sup>nd</sup> year**

<b>Course code</b>	<b>: BMLT-205 P</b>
<b>Course Name</b>	<b>: Pathology and Allied Subjects (Lab course based on paper 5 &amp; 6)</b>
<b>Semester /Year</b>	<b>: 2<sup>nd</sup> year</b>

	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>-</b>	<b>-</b>	<b>02</b>	<b>01</b>

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

<b>S. No</b>	<b>Practicals</b>
<b>1.</b>	Determination of PCV and ESR.
<b>2.</b>	Determination of red cell indices.
<b>3.</b>	Demonstration of microcytic hypochromic slide.
<b>4.</b>	To study of general blood picture.
<b>5.</b>	To perform differential leucocyte count.
<b>6.</b>	To perform PT and Calculate INR
<b>7.</b>	To perform APTT
<b>8.</b>	Demonstration of glassware's and equipment used in histopathology lab.
<b>9.</b>	To prepare alcohol of different concentration.
<b>10.</b>	To prepare formalin from stock solution.
<b>11.</b>	To sharp knife by honing and stropping.
<b>12.</b>	Grossing of tissue
<b>13.</b>	To perform tissue processing and section cutting of tissue.
<b>14.</b>	To perform hematoxylin and eosin staining.
<b>15.</b>	Mounting and preservation of slide

\*Course out comes of above practical is covered in their respective theory courses.

**BMLT III<sup>rd</sup> year**

<b>Course code</b>	<b>: BMLT-301</b>
<b>Course Name</b>	<b>: Clinical Biochemistry-I</b>
<b>Semester /Year</b>	<b>: III<sup>rd</sup> year</b>

	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>02</b>		<b>01</b>	<b>03</b>

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

**Course Contents****(BIOSTATISTICS AUTOMATION & ENDOCRINOLOGY)**

**Unit I** Basic bio-statistics for clinical quality control. Standard deviation, standard error, coefficient of variation, normal distribution, t-test and chi-square test. Establishment and maintenance of quality control for laboratory tests based upon medical usefulness. Terminology of quality control and quality control charts.

**Unit II** Normal ranges of various bio-metabolites and their confidence limits. Automation: Handling of automatic analysers, organization and management of hospital laboratory.

**Unit III** Toxicology: Alcohol, heavy metals (Zinc, Hg etc.) salicylates, drug abuse, screening and drug interference with laboratory findings. Endocrinology: Hormones, classification and their mechanism of action, Estimation of growth hormone, ACTH, sex hormone binding globulin, aldosterone, parathormone, cortisol and 17 – hydroxyprogesterone and their clinical significance

**Text Books:**

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

**Reference Books:**

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

**Course outcomes (COs):**

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

<b>CO1</b>	To outline knowledge and concepts of biostatistics for evaluation and interpretation of quality Controls.
<b>CO2</b>	To infer tools and rules applied for accessing and maintaining quality Control for clinical diagnosis.
<b>CO3</b>	To present skills for clinical diagnosis, testing, understanding of biochemical conditions and diagnostic service with reference to normal ranges of various bio-metabolites.
<b>CO4</b>	To illustrate skills in Automation techniques, its advantages with impetus on its working and managing hospital laboratory.
<b>CO5</b>	To review an analytical judgment, interpreting the clinical significance of lab findings on toxicology and drug abuse.
<b>CO6</b>	To build the concepts, principles and role of Endocrinology in clinical diagnosis and prognosis of diseases.

**CO-PO Mapping**

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>CO1</b>												
<b>CO2</b>												
<b>CO3</b>												
<b>CO4</b>												
<b>CO5</b>												
<b>CO6</b>												

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

**BMLT III<sup>rd</sup> year**

<b>Course code</b>	<b>: BMLT-302</b>
<b>Course Name</b>	<b>: Clinical Biochemistry-II</b>
<b>Semester /Year</b>	<b>: III<sup>rd</sup> year</b>

	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>02</b>		<b>01</b>	<b>03</b>

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

**Course Contents****(DIAGNOSTIC ENZYMOLOGY)****(principle of assay, procedure and clinical significance)****Unit I**

1. Principles of enzyme activity determination. Units for expressing enzyme activity. Factors affecting enzyme activity. Mechanisms responsible for abnormal enzyme levels, Enzyme Inhibition, types of inhibitors of enzyme
2. Isoenzymes –serum CPK, CK-MB, LDH, SGOT (AST), SGPT (ALT), cholinesterase, amylase, alpha amylase, lipase.

**Unit II**

1. Alkaline and acid phosphatases.
2. Fructosamine test in semen.
3. Analysis of renal biliary and prostatic stones. Tests for foetal well-being by amniotic fluid. Analysis for alpha-foetoprotein and their clinical significance.

**Unit III**

1. Gastric analysis, free and total acidity, pentagastrin test, histamine and caffeine stimulation tests.
2. Thyroid function test: T3, T4, TSH, Free T3, Free T4, protein bound iodine (PBI) thyroglobulin and LATES.
3. Infertility profile: TSH, FSH, LH, testosterone, oestrogen, prolactin and DHEA sulphate.

**Text Books:**

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

Edition 1, Jaypee Brothers, New Delhi.

**Reference Books:**

1. Styrrer. *Biochemistry*. 9<sup>th</sup> edition. MacMillan
2. Harper. *Illustrated Biochemistry*. 32<sup>nd</sup> Edition. Mc Graw Hill.



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

<b>CO1</b>	To highlight the basics of clinical techniques and tests applied in Clinical Biochemistry Lab.
<b>CO2</b>	To summarize fundamental aspects of enzymology, regulatory factors, and mechanism affecting enzyme activity.
<b>CO3</b>	To determine the clinical importance of Isoenzymes and interpretation.
<b>CO4</b>	To attribute the importance of advanced tests in clinical Lab like Fructosamine test in semen, analysis of renal biliary and prostatic stones, alpha-foetoprotein and their clinical significance.
<b>CO5</b>	To review knowledge about recent advances and trends in research in the field of clinical Biochemistry with all the advanced biochemical tests and clinical importance of infertile, thyroid profiles.
<b>CO6</b>	To collaborate the principles of teaching-learning technology towards application. Take interactive classroom lectures, conduct small group discussions, Seminars and research presentations.

**CO-PO Mapping**

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>CO1</b>												
<b>CO2</b>												
<b>CO3</b>												
<b>CO4</b>												
<b>CO5</b>												
<b>CO6</b>												

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

**BMLT III<sup>rd</sup> year**

<b>Course code</b>	<b>: BMLT-303</b>
<b>Course Name</b>	<b>: Medical Microbiology-I</b>
<b>Semester /Year</b>	<b>: III<sup>rd</sup> year</b>

	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>02</b>		<b>01</b>	<b>03</b>

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

**Course Contents****(PATHOGENIC VIRUSES AND MISC. MICROBES)****Unit I**

1. Misc. microbes: Actinomyces, Nocardia, Donovanias, Treponema, Chlamydia, Rickettsia, Mycoplasma and pathogenic fungi. Pathogenesis, Pathology and lab diagnosis.
2. Pox-viruses: Smallpox, Vaccinia, Molluscum contagiosum.
3. Herpes Virus: H Simplex, Chickenpox-Zoster, CMV, IMN and Burkitt's Lymphomas.
4. Adenoviruses: Pharyngeal infections Respiratory infections and conjunctival infections.

**Unit II**

1. Orthomyxoviruses (Influenza Types A, B, C, etc.): Influenza.
2. Paramyxovirus: Respiratory infections, mumps and measles.
3. Miscellaneous Viruses: Rubella, Corona viruses: Rubella common cold lymphocytic choriomeningitis.
4. Picorna Viruses: Enteroviruses poliomyelitis Aseptic meningitis and Epidemic Myalgia, Rhinoviruses-common cold.

**Unit III**

1. Hepatitis Viruses: Infectious and Serum Hepatitis.
2. Arbo Viruses: Encephalitis Yellow fever, Dengue fever.
3. Rhabdo Viruses: Rabies
4. Slow and oncogenic Viruses: Scrapie Kuru and animal virus tumours.
5. Cell Culture and observation of effect of viruses on cell: Technique, procedure and interpretation of results.

**Text Books:**

Text Book of Microbiology by Dr. C P Baveja VIII Edition

Text Book of Microbiology by Apurba S Sastry &amp; Sandhya Bhat

**Reference Books:**

Prescott's Microbiology by Joanne Willey, Kathleen Sandman XI Edition

Essentials of Microbiology &amp; Immunology by S K Mohanty &amp; K Sai Leela &amp; Dipti Pattanaik.

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

<b>CO1</b>	To describe the pathogenesis, lab diagnosis and pathology of bacteria.
<b>CO2</b>	To explain the pathogenic role of adenovirus, herpesvirus.
<b>CO3</b>	To apply the conceptual knowledge on the topic: pathogenicity of orthomyxovirus and paramyxovirus.
<b>CO4</b>	To distinguish the viruses on the basis of their multiplication cycle, lab diagnosis and treatment.
<b>CO5</b>	To evaluate the infectivity of hepatitis, Arbo and Rhabdo virus.
<b>CO6</b>	To develop an understanding of Cell Culture and observation of effect of viruses on cell: Technique, procedure and interpretation of results.

**CO-PO Mapping**

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>CO1</b>												
<b>CO2</b>												
<b>CO3</b>												
<b>CO4</b>												
<b>CO5</b>												
<b>CO6</b>												

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

**BMLT III<sup>rd</sup> year**

<b>Course code</b>	<b>: BMLT-304</b>
<b>Course Name</b>	<b>: Medical Microbiology-II</b>
<b>Semester /Year</b>	<b>: III<sup>rd</sup> year</b>

	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>02</b>		<b>01</b>	<b>03</b>

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

**Course Contents****(APPLIED MICROBIOLOGY & ADVANCE TECH.)****Unit I**

1. Preparation of container and swabs for collections of specimens for microbial examinations.
2. Portal regulation and transport of specimen.
3. Flowchart of lab diagnostic procedures.
4. Documentation of specimen in laboratory.
5. Preservation of Micro-organisms: Periods subculture method, cold storage, freezing, deep freezing, lyophilization methods. Total and viable counts of bacteria.

**Unit II**

1. Human parasitology: Protozoa, Rhizopoda and helminths.
2. Immunology and sero-diagnosis.
3. Prophylactic mass immunization
4. Nosocomial infection and sterility testing of I.V. fluids and processing of various samples for various hospital infections.

**Unit III**

1. Pathology, Lab-diagnosis and control of common infections and infestations.
2. Cell, tissue and organ culture.
3. Specific serological methods of diagnosis.
4. Test for bacterial sensitivity to antimicrobial agents and their interpretation.
5. Specific culture and drug sensitivity methods.
6. Advanced diagnostic techniques in Medical Microbiology: Torch profile, mycodot, IgG, IgA, IgM and IgE testing, Australia Ag (HBsAg) etc.

**Text Books:**

Text Book of Microbiology by Dr. C P Baveja VIII Edition

Text Book of Microbiology by Apurba S Sastry & Sandhya Bhat

**Reference Books:**

Prescott's Microbiology by Joanne Willey, Kathleen Sandman XI Edition

Essentials of Microbiology & Immunology by S K Mohanty & K Sai Leela & Dipti Pattanaik

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

<b>CO1</b>	CO1: To examine the microbial specimens, their collection technique and lab diagnostic procedures.
<b>CO2</b>	CO2: To describe the process of documentation and preservation of microorganisms.
<b>CO3</b>	CO3: To illustrate the parasitology of Protozoa, Rhizopoda and helminths.
<b>CO4</b>	CO4: To analyse in detail the epidemiology markers of micro-organisms, passive prophylactic mass immunization and nosocomial infections.
<b>CO5</b>	CO5: To evaluate the diagnosis, treatment and control of common infections and manifestations.
<b>CO6</b>	CO6: To design the specific serological methods for diagnosis and drug sensitivity methods.

**CO-PO Mapping**

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>CO1</b>												
<b>CO2</b>												
<b>CO3</b>												
<b>CO4</b>												
<b>CO5</b>												
<b>CO6</b>												

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

**BMLT III<sup>rd</sup> year**

<b>Course code</b>	<b>: BMLT-305</b>
<b>Course Name</b>	<b>: Pathology and Allied Subject-I</b>
<b>Semester /Year</b>	<b>: III<sup>rd</sup> year</b>

	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>02</b>		<b>01</b>	<b>03</b>

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

**Course Contents****(IMMUNOPATHOLOGY & TRANSFUSION MEDICINE)****Unit I**

1. Introduction and antigens.
2. Cells and organs of the immune system.
3. Immunoglobulin and antibodies.
4. Humoral & Cellular immune response.
5. Detection of various allergic agents and immunopathology of allergy.
6. Rheumatological diseases: Pathogenesis and Lab diagnosis.

**Unit II**

1. Infection, inflammation and the immune system.
2. Cancer immunology & Tumour markers.
3. Tissue typing for kidney transplant & bone marrow transplant.
4. Laboratory tests for demonstration of antigen-antibody reaction and cell mediated immunity.
5. Laboratory investigations in megaloblastic anaemias (Iron deficiency, megaloblastic, haemolytic).

**Unit III**

1. Pathogenesis and laboratory investigation in Leukaemia's.
2. Laboratory investigation in coagulation disorder, bleeding disorder, disseminated intravascular coagulation (DIC), Platelet functions etc.
3. Cytogenetics in haematology.
4. Radioisotopes and their applications.

**Text Books:**

Text Book of Pathology by Harsh Mohan VIII Edition

Text Book of Pathology by Dr. A K Mandal

**Reference Books:**

Clinical Pathology Haematology &amp; Blood Banking IV Edition Nanda Maheshwari

Exam Oriented Pathology by K Mukhopadhyay

**Course outcomes (COs):**

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

<b>CO1</b>	To gain knowledge on the concept of antigen and antibodies.
<b>CO2</b>	To develop an understanding on types of immune response, allergic reactions and rheumatological diseases.
<b>CO3</b>	To illustrate the mechanisms of Infectious cycle, Cancer immunology, Tumour markers.
<b>CO4</b>	To analyse the role of cell-mediated immune response and Laboratory investigations in megaloblastic anaemias.
<b>CO5</b>	To evaluate the
<b>CO6</b>	Create. design. compose. create. plan.

### CO-PO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>CO1</b>												
<b>CO2</b>												
<b>CO3</b>												
<b>CO4</b>												
<b>CO5</b>												
<b>CO6</b>												

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

**BMLT III<sup>rd</sup> year**

<b>Course code</b>	<b>: BMLT-306</b>
<b>Course Name</b>	<b>: Pathology and Allied Subject-II</b>
<b>Semester /Year</b>	<b>: III<sup>rd</sup> year</b>

	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>02</b>		<b>01</b>	<b>03</b>

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

**Course Contents****(HISTOPATHOLOGY & CYTOLOGY)****Unit I**

1. Types of tissue seen in histopathology i.e., Connective tissue, epithelial tissue, glandular, Begin malignant Tumour tissue, Bone tissue etc.
2. Handling of fresh histological specimen (Tissues) cryo/frozen sections of fresh and fixed tissues, freezing drying.
3. Lipids, identifications and demonstration.
4. Micro-organism in the tissue-various staining, techniques for their demonstration and identifications.
5. Nucleic acids DNA and RNA special stains and procedures.

**Unit II**

1. Cytoplasmic constituents and their demonstration.
2. Tissues requiring special treatment i.e. eyeball B.M. biopsy, undecalcified bones.
3. Neuropathological techniques.
4. Enzyme histochemistry demonstration of phosphates, dehydrogenases, oxidase and peroxidases. etc.
5. Electron microscope, working principles, components and allied techniques for electron microscopy, ultra-microtomy.

**Unit III**

1. Immunohistochemistry.
2. Cervical cytology-basis of detection of malignant and pre-malignant lesions.
3. Hormonal assessment with cytological techniques.
4. Demonstration of sex chromatin
5. Aspiration cytology principles indication and utility of the techniques with special emphasis on role of cytotechnician in FNAC clinics

**Text Books:**

Text Book of Pathology by Harsh Mohan VIII Edition

Text Book of Pathology by Dr. A K Mandal

**Reference Books:**

Clinical Pathology Haematology &amp; Blood Banking IV Edition Nanda Maheshwari

Exam Oriented Pathology by K Mukhopadhyay



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

<b>CO1</b>	Knowledge. define. identify. describe. label. list.
<b>CO2</b>	Understand. explain. describe. interpret. paraphrase. summarize. ...
<b>CO3</b>	Apply. solve. apply. illustrate. modify. Use
<b>CO4</b>	Analyze. analyze. compare. classify. contrast. Distinguish
<b>CO5</b>	Evaluate. reframe. criticize. evaluate. order. Appraise Create. design. compose. create. plan.
<b>CO6</b>	Create. design. compose. create. plan.

**CO-PO Mapping**

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>CO1</b>												
<b>CO2</b>												
<b>CO3</b>												
<b>CO4</b>												
<b>CO5</b>												
<b>CO6</b>												

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

**BMLT 3<sup>rd</sup> year**

<b>Course code</b>	<b>: BMLT-301 P</b>
<b>Course Name</b>	<b>: Clinical Biochemistry (Lab course based on paper 1 &amp; 2)</b>
<b>Semester /Year</b>	<b>: 3<sup>rd</sup> year</b>

	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>-</b>	<b>-</b>	<b>02</b>	<b>01</b>

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

<b>S. No</b>	<b>Practicals</b>
<b>1.</b>	Demonstration of cortisol estimation
<b>2.</b>	Demonstration of growth hormone estimation
<b>3.</b>	Demonstration of CSF analysis
<b>4.</b>	Demonstration of 17-hydroxyprogesterone estimation
<b>5.</b>	Demonstration of ACTH estimation
<b>6.</b>	Demonstration of semi auto analyzer
<b>7.</b>	Estimation of serum Triglycerides by end point reaction enzymatic method
<b>8.</b>	To estimation of serum bilirubin by jendrassic and grof method
<b>9.</b>	To estimation of serum SGPT activity by (transaminases) by UV – kinetic method
<b>10.</b>	To estimation of serum SGOT activity by (transaminases) by UV – kinetic method
<b>11.</b>	To estimation of serum ALP activity by P - nitrophenyl phosphate (PNP) method
<b>12.</b>	To estimation of serum Total Protein by biuret method
<b>13.</b>	Estimation of serum Albumin by bromocresol green (BCG) method.

\*Course out comes of above practical is covered in their respective theory courses.

**BMLT 3<sup>rd</sup> year**

<b>Course code</b>	<b>: BMLT-303 P</b>
<b>Course Name</b>	<b>: Medical Microbiology (Lab course based on paper 3 &amp; 4)</b>
<b>Semester /Year</b>	<b>: 3<sup>rd</sup> year</b>

	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>-</b>	<b>-</b>	<b>02</b>	<b>01</b>

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

<b>S. No</b>	<b>Practicals</b>
<b>1.</b>	To perform widal test. a) Qualitative b) Quantitative
<b>2.</b>	To perform HIV tri dot.
<b>3.</b>	To perform dengue test.
<b>4.</b>	To identify the parasites by permanent slides.
<b>5.</b>	To prepare swabs for specimen collection.
<b>6.</b>	To perform Drug Susceptibility testing.
<b>7.</b>	To isolate actinomycetes on characterstic culture media.
<b>8.</b>	To isolate patogenic fungi on SDA.
<b>9.</b>	To perform Drug Susceptibility testing using MIC assay.
<b>10.</b>	To isolate and identify nosocomial pathogens from hospitals

\*Course out comes of above practical is covered in their respective theory courses.

**BMLT 3<sup>rd</sup> year**

<b>Course code</b>	<b>: BMLT-305 P</b>
<b>Course Name</b>	<b>: Pathology and Allied Subjects (Lab course based on paper 5 &amp; 6)</b>
<b>Semester /Year</b>	<b>: 3<sup>rd</sup> year</b>

	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>-</b>	<b>-</b>	<b>02</b>	<b>01</b>

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

<b>S. No</b>	<b>Practicals</b>
<b>1.</b>	To perform coomb's test (Direct & Indirect).
<b>2.</b>	To perform cross matching (Major & Minor).
<b>3.</b>	To study weak D- antigen by given sample.
<b>4.</b>	To study of general blood picture for hemolytic anemia.
<b>5.</b>	To perform field stain for malaria parasite.
<b>6.</b>	To study of LE cell
<b>7.</b>	Grossing of tissue
<b>8.</b>	To perform tissue processing and section cutting by manual method.
<b>9.</b>	To perform van gieson staining.
<b>10.</b>	To perform gram's staining.
<b>11.</b>	To perform hematoxylin and eosin staining.
<b>12.</b>	To perform PAS staining.
<b>13.</b>	To perform AFB staining
<b>14.</b>	To perform PAP staining
<b>15.</b>	To perform sudan staining
<b>16.</b>	To demonstrate FNAC technique

\*Course out comes of above practical is covered in their respective theory courses.