STUDY & EVALUATION SCHEME

OF

B.Sc. Medical Laboratory Technology (B.Sc. MLT)

[APPLICABLE W.E.F. ACADEMIC SESSION 2017-18 TILL REVISED]

TEERTHANKER MAHAVEER UNIVERSITY

Delhi Road, Moradabad, Uttar Pradesh

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TEERTHANKER MAHAVEER UNIVERSITY

(Established under Govt. of U.P. Act No.30, 2008) Delhi Road, Moradabad (U.P)

Study & Evaluation Scheme
Of
Bachelor of Science in Medical Laboratory Technology (B.Sc. MLT)

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

Duration: Three year (06 Semester) full time and Six Months Internship.

Medium: English

Minimum Attendance Required: 75%

Maximum Credits: 161

Minimum Credits: 153

Assessment:

	Internal	External	Total
Theory	40	60	100
Practical	50	50	100

Internal Evaluation (Theory papers):

Class Test-I	Class Test-II	Class Test-III	Attendance	Assignment / work book assignments &viva	Total
Best Two out of Three CTs					
10	10	10	10	10	40

Evaluation Practical's/Dissertations/Project Reports:

Internal	External	Total
50	50	100

Duration of Examinations:

Internal	External
1.5 Hrs	03Hrs

To qualify the course a student is required to secure a minimum of 45% marks in aggregate including the semester examination and teachers continuous evaluation. (i.e. both internal and external). A candidate who secures less than 45% of marks in a course shall be deemed to have failed in that course. The student should have secured at least 50% marks in aggregate to clear the semester.

The subject marked with asterisk (*) in I &II Semesters are noncore papers.

Assessment:

	Internal	External	Total
Theory	40	60	100
Practical	50	50	100

English External Evaluation & Assessment: The students will be evaluated on all four parameters of LSRW

External Exam	Internal Assessment	Total
50	50	100

Internal Practical Evaluation (50 marks)

The Internal evaluation would also be done by the Internal Examiner based on the experiment performed during the internal examination

Experiment	Attendance	Viva+Record	Total Internal
(30 MARKS)	(10 MARKS)	(10 MARKS)	(50 MARKS)

External Practical Evaluation (50 marks)

The external evaluation would also be done by the External Examiner based on the experiment performed during the external examination.

Experiment	File work	Viva	Total
			External
30 Marks	10 marks	10 Marks	50 marks

Internal Theory Assessment: 40

Best 2 out of Three CTs	Attendance	Assignments	Total
20Marks	10 marks	10 Marks	40 marks

English Internal Theory Assessment: 50

Best 2 out of Three CTs	Attendance	Workbook Assignments & Viva	Total
20	10	10+10	50

Viva to be carried out by external English faculty from within the university

Question Paper Structure (Theory External Examination):

Max. Marks in each theory paper will be of 60 marks. The question paper shall consist of 6 questions. Out of which first question shall be of short answer type (not exceeding 50 words) and will be compulsory. Question No. 1 shall contain 8 parts representing all units of the syllabus and students shall have to answer any five (weightage 2 marks each). Out of the remaining five questions, the long answer pattern will have internal choice with unit wise questions with internal choice in each unit. In units having numerical, weightage and information should be available both in the syllabus and the paper pattern. The weightage of Question No. 2 to 6 shall be 10 marks each.

Admission to the Next Semester: As per the university norms.

Internship Time Period

Internship for Qualifying B.Sc. MLT programme will be of six months. Minimum 720 hours of internship should be completed by the candidate to be awarded the degree.

Students have to undertake the rotational postings during which students have to work under supervision of an experienced staff in the following areas:

Sl. No	Postings	Duration
1.	Haematology & Clinical Pathology	1 Month
2.	Biochemistry	1 Month
3.	Blood Banking	1 Month
4.	Microbiology & Serology	1 Month
5.	Histopathology	1 Month
6.	Cytology	1 Month

Other Details:

- Entire internship shall be done in a Hospital or Medical College approved by the University.
- Every candidate will be required after passing the final B.Sc. (Medical Lab. Tech.) Examination to undergo compulsory rotatory internship to the satisfaction of the college Authorities and University concerned for a period of six months so as to be eligible for the award of the degree of Bachelor of Science in Medical Laboratory Technology and registration.
- The University shall issue a provisional degree of Bachelor of Science in Medical Laboratory Technology on passing the final examination and after the completion of internship on demand by the candidate.
- The internee shall be entrusted with laboratory responsibilities under direct supervision of Senior Medical Officer/Technician. They shall not be working independently.
- Internee will not issue any certified copy of investigation reports or other related documents under their signature.

Assessment of Internship:

The Internee shall 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 record of work, assessment and evaluation of training shall be undertaken by an objective approach using situation tests in knowledge, skills and attitude during at the end of training. Based on the record of work and date of evaluation The Director/Principal shall issue certificate for satisfactory completion of training following which the university shall award the degree of Bachelor of Science in Medical Laboratory Technology.

Satisfactory completion shall be determined on the basis of the following:

- Proficiency of knowledge required for each Laboratory Techniques
- The competency and skills expected to manage each laboratory technique.
- Responsibility, punctuality, works up of laboratory techniques, involvement in special procedures and preparation of reports.
- Capacity to work in a team (behaviour with colleagues, nursing staff and relationship with medical and paramedical.
- Initiating, participating in discussions and developing research aptitude.
- Only twelve leave are allowed to an internee during the period of his/her internship. If he/she extend his/her leave in the duration of internship, the period the internship shall be extended by double the days for which the student was absent.

Internship Log Book:

Duly signed and completed Internship log book is compulsory to submit in the department/college to obtain internship completion and course completion letter/certificates.

Study & Evaluation Scheme

B.Sc. MLT- I Semester (I Year)

S. No.	Course Code	Subject	Period			Credit	Evaluation Scheme		
			L	T	P		Internal	External	Total
1	BML-S- 101	Human Anatomy-I	3	-	-	3	40	60	100
2	BML -S- 102	Human Physiology-I	3	-	-	3	40	60	100
3	BML-S- 103	Basic Haematology & Clinical Pathology-I	4	-	-	4	40	60	100
4	BML-S- 104	Fundamentals of Biochemistry-I	4	-	-	4	40	60	100
5	BML -S-105	Preventive Medicine & Community Health Care	3	-	-	3	40	60	100
6*	*BML -S-199	*English Communication & Soft skills-I	3	-	2	4	50	50	100
7	BML-S- 151	Practical: Human Anatomy-I	-	-	2	1	50	50	100
8	BML-S- 152	Practical: Human Physiology-I	-	-	2	1	50	50	100
9	BML -S-153	Practical: Basic Haematology & Clinical Pathology-I	-	-	2	1	50	50	100
10	BML -S-154	Practical: Fundamentals of Biochemistry-I	-	-	2	1	50	50	100
11	BML-S-155	Hospital Posting	-	-	4	2	50	50	100
		Total	20	00	14	27	500	600	1100

Note: Two lectures per week are designated for Library/ Seminar/Group Discussion.
Subject marked with asterisk (*) is non-core paper.

Study & Evaluation Scheme

B.Sc. MLT- II Semester (I Year)

S. No.	Course Code	Subject	Period			Credit	Evaluation Scheme		
			L	T	P		Internal	External	Total
1	BML –S-201	Human Anatomy-II	3	-	-	3	40	60	100
2	BML –S-202	Human Physiology-II	3	-	-	3	40	60	100
3	BML –S-203	Basic Haematology & Clinical Pathology-II	4	-	-	4	40	60	100
4	BML–S- 204	Fundamentals of Biochemistry-II	4	-	-	4	40	60	100
5	BML–S- 205	Fundamentals of Computer	3	-	-	3	40	60	100
6 *	*BML –S-299	*English Communication & Soft skills-I	3	-	2	4	50	50	100
7	BML –S-251	Practical: Human Physiology-II	-	-	2	1	50	50	100
8	BML –S-252	Practical: Basic Haematology & Clinical Pathology-II	-	-	2	1	50	50	100
9	BML –S-253	Practical: Fundamentals of Biochemistry-II	-	-	2	1	50	50	100
10	BML –S-254	Practical : Fundamentals of Computer	-	-	2	1	50	50	100
11	BML–S-255	Hospital posting	-	-	4	2	50	50	100
		Total	20	00	14	27	500	600	1100

Note: Two lectures per week are designated for Library/ Seminar/Group Discussion.
Subject marked with asterisk (*) is non-core paper.

Study & Evaluation Scheme

B.Sc. MLT- III Semester (2 Year)

S. No.	Course Code	Subject	Period			Credit	Evaluation Scheme		
			L	T	P		Internal	External	Total
1	BML–S- 301	Clinical Haematology-I	3	-	-	3	40	60	100
2	BML–S- 302	Clinical Biochemistry-I	3	-	-	3	40	60	100
3	BML–S- 303	Fundamentals of Microbiology-I	2	-	-	2	40	60	100
4	BML –S- 304	Immunology & Serology-I	2	-	-	2	40	60	100
5	BML–S- 305	Histopathology & Histotechniques -I	3	-	-	3	40	60	100
6	BML –S- 399	English Communication & Soft skills-III	3	-	2	4	50	50	100
7	BML –S- 307	Environmental Sciences	4	-	-	4	40	60	100
8	BML–S- 351	Practical: Clinical Haematology-I	-	-	2	1	50	50	100
9	BML –S- 352	Practical: Clinical Biochemistry-I	-	-	2	1	50	50	100
10	BML–S- 353	Practical: Fundamentals of Microbiology-I & Immunology- I	-	-	2	1	50	50	100
11	BML –S- 354	Practical: Histopathology & Histotechniques -I	-	-	2	1	50	50	100
12	BML–S- 355	Hospital Posting	-	-	6	3	50	50	100
		Total	20	0	16	28	540	660	1200

Study & Evaluation Scheme

B.Sc. MLT- IV Semester (II Year)

S. No.	Course Code	Subject	Period			Credit	Evaluation Scheme		
			L	T	P		Internal	External	Total
1	BML–S- 401	Clinical Haematology-II	3	-	-	3	40	60	100
2	BML–S- 402	Clinical Biochemistry-II	3	-	-	3	40	60	100
3	BML–S- 403	Fundamentals of Microbiology-II	3	-	-	3	40	60	100
4	BML–S- 404	Immunology & Serology-II	2	-	-	2	40	60	100
5	BML –S- 405	Histopathology & Histotechniques -I	2	-		2	40	60	100
6	BML –S- 499	English Communication & Soft skills-III	3	-	2	4	50	50	100
7	BML–S- 407	General Pathology	2	-	-	2	40	60	100
8	BML –S- 451	Practical: Clinical Haematology-II	-	-	2	1	50	50	100
9	BML –S- 452	Practical: Clinical Biochemistry-II	-	-	2	1	50	50	100
10	BML–S- 453	Practical: Fundamentals of Microbiology-II	-	-	2	1	50	50	100
11	BML–S- 454	Practical: Immunology & Serology -II	-	-	2	1	50	50	100
12	BML–S- 455	Practical: Histopathology & Histotechniques -I	-	-	2	1	50	50	100
13	BML–S- 456	Hospital Posting	-	-	6	3	50	50	100
		Total	18	0	18	27	590	710	1300

Study & Evaluation Scheme

B.Sc. MLT- V Semester (III Year)

S. No.	Course Code	Subject	Period			Credit	Evaluation Scheme		
			L	T	P		Internal	External	Total
1	BML –S- 501	Immunohematology & Blood Banking	3	-	-	3	40	60	100
2	BML –S- 502	Clinical Enzymology & Automation	3	-	-	3	40	60	100
3	BML–S- 503	Medical Microbiology-I	3	-	-	3	40	60	100
4	BML –S- 504	Parasitology	3	-	-	3	40	60	100
5	BML–S- 505	Diagnostic Cytology	3	-	-	3	40	60	100
6	BML –S- 506	Principles of Laboratory Management	3	-	-	3	40	60	100
7	BML –S- 551	Practical: Immunohematology & Blood Banking	-	-	2	1	50	50	100
8	BML–S- 552	Practical: Clinical Enzymology	-	-	2	1	50	50	100
9	BML –S- 553	Practical: Medical Microbiology-I	-	-	2	1	50	50	100
10	BML–S- 554	Practical: Parasitology	-	-	2	1	50	50	100
11	BML–S- 555	Practical: Diagnostic Cytology-I	-	-	2	1	50	50	100
12	BML–S- 556	Hospital Posting	-	-	6	3	50	50	100
		Total	18	00	16	26	540	660	1200
Note: Two lectures per week are designated for Library/ Seminar/Group Discussion.									

Study & Evaluation Scheme

B.Sc. MLT- VI Semester (III Year)

S. No.	Course Code	Subject	Period			Credit	Evaluation Scheme		
			L	T	P		Internal	External	Total
1	BML–S- 601	Clinical Endocrinology & Toxicology	3	-	-	3	40	60	100
2	BML–S- 602	Advance Diagnostic Techniques	3	--	-	3	40	60	100
3	BML–S- 603	Diagnostic Molecular Biology	3	-	-	3	40	60	100
4	BML–S- 604	Medical Microbiology-II	3	-	-	3	40	60	100
5	BML –S- 605	Clinical Virology	3	-	-	3	40	60	100
6	BML –S- 606	Biostatistics & Research Methodology	3	-	-	3	40	60	100
7	BML–S- 651	Practical: Clinical Endocrinology & Toxicology	-	-	2	1	50	50	100
8	BML–S- 652	Practical: Advance Techniques in Clinical Diagnosis	-	-	2	1	50	50	100
9	BML–S- 653	Practical: Diagnostic Molecular Biology	-	-	2	1	50	50	100
10	BML–S- 654	Practical: Medical Microbiology-II	-	-	2	1	50	50	100
11	BML–S- 655	Practical: Clinical Virology	-	-	2	1	50	50	100
12	BML –S- 656	Hospital Posting	-	-	6	3	50	50	100
		Total	18	0	16	26	540	660	1200

Note: Two lectures per week are designated for Library/ Seminar/Group Discussion.

B.Sc. MLT- I Semester (I Year)

Course/ Paper: BML-S-101 (Human Anatomy-I)

Course Code: BML-S-101

L	T	P	C
3	0	2	4

Learning Objective: The prime concern of this syllabus is to learn the terminology of the subject and basic knowledge of cells & tissues and to understand anatomy of human body. This subject will develop an understanding of the structure and function of organs and organ systems in normal human body.

Unit -1

Terminology and General Plan of the Body, Body Parts and Areas,

Terms of Location and Position, Body Cavities and Their Membranes, Dorsal cavity, Ventral cavity, Planes and Sections

Unit –II

Cells: Structure, function and location, Prokaryotic and eukaryotic cells, Cell organelles, Cell division

Tissue, Types, Structure, Location and Function of Epithelial Tissue, Connective Tissue, Muscle Tissue, Nerve Tissue, Membranes, Glandular tissue

The Integumentary System: structure and function of The Skin, Subcutaneous Tissue

Unit-III

Musculoskeletal System: Basic anatomy of important muscles and bones

Unit-IV

Respiratory system: Basic anatomy of nose, larynx, trachea, bronchi and lungs

Unit – V

Digestive system: basic anatomy of oesophagus, stomach, small intestine, large intestine, liver, gall bladder, pancreas

Learning Outcome: Students will develop a vocabulary of appropriate terminology to effectively communicate information related to anatomy and recognize the anatomical structures included in syllabus.

Suggested Readings:

1. Ross & Wilson,(2014),Anatomy & Physiology in health & illness,11th edition, Elsevier Publications
2. Chaurasia B D, (2016), Human Anatomy, 7th edition, CBS publishers
3. Gerard J. Tortora and Bryan H.Derrickson,(Principles of Anatomy and Physiology,14th edition,Wiley Publications

B.Sc. MLT- I Semester (I Year)

Course/Paper: Human Physiology-I

Course Code: BML-S-102

L	T	P	C
3	0	2	4

Learning Objective: The prime concern of this syllabus is to integrate basic knowledge of cells, tissues, blood, physiological functions and diseases of system included in syllabus.

Unit-I
Cell physiology: Structure, membrane, transport across cell membrane, Active, Passive, Organization of the Body, Body Composition, Body Fluid Volumes and its measurement, Diffusion, Osmosis, Tonicity, Homeostasis

Unit-II
Blood-composition, function, cellular component & their function, haemoglobin & anaemia, blood groups and coagulation
Lymphatic system-Composition & function of lymph, lymphatic tissue, Immunity with the role of thymus

Unit-III
Cardiovascular system-general arrange, heart, arteries, veins and capillaries, heart structure and function, cardiac cycle, heart sounds, heart rate, blood pressure, mechanism of circulation, definition of hypertension & shock

Unit-IV
Respiratory system: parts of respiratory system, mechanism of respiration, pulmonary function, pulmonary circulation, lungs volume, Gas transport between lungs and tissues,
Definition of hypoxia, dyspnoea, cyanosis, asphyxia and obstructive airways diseases

Unit- V
Gastrointestinal physiology: Organs of GIT and their structure & function, secretion, digestion, absorption and assimilation, gastrointestinal hormones, physiology of digestion of carbohydrates, proteins & lipids, Structure & function of liver, spleen, gall bladder & pancreas, Jaundice, Cirrhosis & Pancreatitis

Learning Outcome: This subject will develop an understanding of the function of organs and organ systems in normal human body. Students will able to explain the physiological systems of body and also understand the basis of diseases.

Suggested Readings:

1. Ross & Wilson,(2014),Anatomy & Physiology in health & illness,11th edition,Elsevier Publications
2. Sujit Chaudhury,(2011),Concise Medical Physiology,6th edition, NCBA
3. Sembulingam k,(2012),Essentials of Medical Physiology,6th edition, Jaypee Publications
4. Guyton and Hall,(2011) Textbook of Medical Physiology,12th Edition,Saunder/Elsevier
5. Gerard J. Tortora and Bryan H.Derrickson,(Principles of Anatomy and Physiology,14th edition,Wiley publications

B.Sc. MLT- I Semester (I Year)

Course/Paper: Basic Haematology and Clinical Pathology-I

Paper Code: BML-S-103

L	T	P	C
4	0	2	5

Learning Objective: The curriculum of haematology aims to prepare the students in basic understanding of the composition of blood, waste management, instrumentation, techniques and methods of estimating different parameters .

Unit- I

Introduction to Haematology, Organization of laboratory and safety measures, Laboratory Safety guidelines, Biomedical waste management, BMW – Segregation, collection, transportation, treatment and disposal (including colour coding), Personal Protective Equipment,
The Microscope and its parts, care and maintenance, monocular and binocular microscope, Corrective Actions in Light Microscopy, Important equipment used in haematology lab

Unit-II
Haematopoiesis, Erythropoiesis, Leucopoiesis, Thrombopoiesis, Mechanism of hemopoiesis, stages of cell development, sites of hemopoiesis, Blood and its composition, plasma and its composition, RBC, WBC, Platelets, Anticoagulants, mechanism of action, types and uses, merits and demerits, effect of storage on blood cells

Unit-III
Collection, Transport, Preservation, and Processing of various clinical Specimens, Blood collection for hematological investigations, Venipuncture, Capillary blood, Arterial blood, Vaccutainer, its type and uses, sample acceptance and rejection criteria.

Unit-IV
Hemoglobin, structure ,function and types , Hemoglobinometry , Haemoglobin estimation by various methods, advantages and disadvantages, physiological and pathological variations on blood parameters
Hemocytometry, visual and electronic method, neubauer counting chamber, RBC count, WBC count, Platelets count, absolute eosinophil count, principle, procedure, calculation , significance, precautions involved during counting, absolute count of various WBCs. Physiological and pathological changes in values

Unit-V
Preparation of thin and thick smears, staining of smears, Romanowsky dyes, preparation and staining procedures of blood smears, Morphology of normal blood cells and their identifications, differential leucocytes count by manual and automated method, physiological and pathological variations in value
Learning Outcome: Students will able to collect, process and preserve the blood samples and can efficiently perform routine investigations in clinical haematology laboratory.

Suggested Readings:

1. Godkar.B. Praful,(2016) Textbook of MLT,3rd edition,Bhalani Publications
2. Singh Tejinder,(2014),Atlas & Textbook of Haematology,3rd edition,Avichal Publications
3. Ochei J & Kolhatkar A(2000),Medical Laboratory Science: Theory & Practice, 3rd edition,Mcgraw Hill Education
4. Mukherjee .L.K(2017), Medical Laboratory Technology,Vol.1-3,3rd edition, Tata Mcgraw Hill
5. Sood Ramnik,(2015), Text book of Medical Laboratory Technology,2nd edition, Jaypee Publications

B.Sc. MLT- I Semester (I Year)

L	T	P	C
4	0	2	5

Course/Paper: Fundamentals of Biochemistry-I)

Course Code: BML-S-104

Learning Objective: This syllabus has been formulated to impart basics knowledge of biochemistry, apparatus, units, equipment, and volumetric analysis in the Clinical Biochemistry.

Unit-I

Introduction to Clinical Biochemistry and role of Medical Lab Technologist , ethics, responsibility, safety measure and hazards in clinical biochemistry lab and first aid in laboratory accidents. Glassware's & plastic ware's used in lab, calibration of volumetric apparatus, cleaning& care and maintenance

Unit II

Principle, working, care & maintenance and calibration of Weighing balance, Hotplate, Magnetic stirrer, Centrifuges, Incubator, Hot air oven, Colorimeter, Spectrophotometer, Water distillation plant, Deionizers Henderson Hassel balch equation, pH paper, pH meter, method of pH measurement,

Unit-III

Preparation of solution and reagents, normal solution, molar solutions, percent solution, buffer solution, dilutions, w/v, v/v, standard solution, aqueous solutions, concepts of acid and base
Units of measurement: SI unit, reference range, conversion factor, units for measurement of bio metabolite, enzymes, protein, drugs, hormones, vitamins

Unit-IV

Specimen collection and processing of blood, urine & CSF, separation of serum and plasma, deproteinization of sample, Handling of specimens for testing, preservation of specimen, transport of specimen, factors affecting the clinical results, effect of storage on sample

Unit- V

Physical, chemical and microscopic examination of urine, Bence Jones Proteinuria and its clinical significance, qualitative test of urine for reducing sugars, protein, ketone bodies, bile Salt, bile pigments, urobilinogen, occult blood, uric acid, urea and Creatinine, quantitative estimation of 24 hrs urine for protein and their clinical significance.

Learning Outcome: Students will know the basics of reagent preparation, instrument handling and can perform common analytical in Clinical Biochemistry.

Suggested Readings:

1. D M Vasudevan, (2011),Text book of Medical Biochemistry,6th edition Jaypee Publishers
2. M N Chatterjea & Rana Shinde,(2012),Text book of Medical Biochemistry,8th edition,Jayppe Publications
3. Singh & Sahni,(2008),Introductory Practical Biochemistry,2nd edition, Alpha science
4. Lehninger,(2013),Principles of Biochemistry,6th edition, W H Freeman
5. U Satyanarayan,(2008), Essentials of Biochemistry,2nd edition, Standard Publishers

B.Sc. MLT- I Semester (I Year)

Course/Paper: Preventive Medicine & Community Health Care

Course Code: BML-S-105

L	T	P	C
3	0	0	3

Learning Objective: This curriculum impart the knowledge of various types of diseases and functioning of various programmes.

Unit- I

Definition and concepts of health, important public health acts, health problems of developed and developing countries, environment and health.

Definition and concepts of epidemiology, diseases, types and use of epidemiology. Basic emergency care and first aid

Unit-II

Epidemiology, aetiology, pathogenesis and control of communicable disease like malaria, cholera, tuberculosis, leprosy, diarrhoea, poliomyelitis, viral hepatitis, measles, dengue, rabies, AIDS

Unit-III

National Health Policy and Programs, DOTS, National AIDS control programme, National cancer control programme, universal immunization programme etc.

Nutrition and major nutritional problems, etiology, manifestations and prevention, components of RCH care. Examination of water, food adulteration, role of regular exercise and yoga in prevention and management of various diseases.

Unit-IV

Population, problems of population growth, birth rates, death rates, fertility rates, MMR.,CPR, Approaches and methods of contraception, Reproductive and child health. Hygiene and sanitation, sanitation barriers, excreta disposal

Unit-V

Immunization programme, various national immunization programs and vaccine schedules, Family welfare and planning, communicable and non-communicable disease,

Health planning in India including various committees, national health policy and health goals. Objectives and goals of WHO, UNICEF, Indian Red Cross Society, UNFPA, FAO, ILO

Learning Outcome: Upon completion of this syllabus student's can analyze etiologies, risk factors, underlying pathologic process, epidemiology for medical conditions and determine the appropriate health care setting.

Suggested Readings:

1. K.Parks & Sunder Lal, (2015),Textbook of Preventive Social Medicine ,3rd edition, Bhanot Publications
2. Harshmohan (2017), Textbook of Pathology,7th edition, Jaypee Publications

B.Sc. MLT- Ist Semester (Ist Year)

Course/Paper: English Communication & Soft Skills-I

Course Code: BML-S-199

L	T	P	C
3	0	2	4

Learning Objective: To comprehend and communicate in simple English.

Module -1: Introduction to English language (4 Lectures)

a) Role and significance of English language in the present scenario
b) English Language: Its relevance for the Indian industry
c) Introduction to Listening, Speaking, Reading, Writing (LSRW) and benchmarking of the class
[Note: As part of classroom activity, a guest lecture from an industry representative/Director (CRC) and maintaining progress card for each student on LSRW for future reference]

Module -2: Phonetics& Functional Grammar (14 Lectures)

a) Pronunciation and daily usage correction (speak with differences between p/b, s/sh, f/ph, t/d, v/w sounds)
b) Parts of speech, articles, tenses, verbs and modals
c) Practice of daily use words, numerals and tongue twisters
d) Vocabulary building, Construction of simple sentences: Basic sentence pattern, subject and Predicate
[Note: As part of classroom activity, language games, tongue & jaw exercises, simple passages from the newspapers for oral drills in the classroom and practice tests (written and oral)]

Module -3: English Communication- About Myself (14 Lectures)

a) Let's talk, making conversation, meeting and greeting
b) Introducing myself, my family and my friends
c) My opinions, my likes and dislikes
d) Life at college, hostel and workplace
[Note: As part of classroom activity, use the Workbook for reference for classroom and home assignments, carry out practice tests (written and oral)]

Module -4: Personality Development-I (8 Lectures)

a) First impression: Dressing sense, good manners, speaking well and respectably
b) Positive Attitude: Being happy and alert, a good listener and a good friend
c) Consultation among peers: Soliciting advice and giving advice
d) Goal setting, confidence building& handling rejection
[Note: As part of classroom activity, refer Workbook for classroom and home assignments, carry out practice tests (written and oral)]

First Semester Outcome:

1. Students will realise the significance of English for their career progression

2. Benchmarking the students in the first semester to observe their progression in terms of LSRW

3. Students will be able to understand distinct sounds and improve pronunciation

4. Students will improve their English vocabulary of daily usage

5. Students will be able to form simple sentences to talk about themselves, friends and relatives.

6. Students will be able to imbibe the pre-requisites of personality development.

Reference Books:

1. ILFS Bi-lingual Course in Basic English, ILFS Skill Development Corporation
2. English Grammar Composition & Usage by J.C. Nesfield, Macmillan Publishers
3. The Business letters by Madan Sood, Goodwill Publishing House, New Delhi
4. Communication Skills by Sanjay Kumar &PushpLata, Oxford University Press

B.Sc. MLT-I Semester (I Year)

BML-S-151(Practical Human Anatomy-I)

1. Demonstration of Major organs through models and permanent slides.
2. Demonstration of parts of circulatory system from models.
3. Demonstration of parts of respiratory system from models.
4. Demonstration of digestive system from models.
5. Demonstration of excretory system from models.
6. Demonstration of nervous system from models.
7. Structure of eye and ear
8. Demonstration of structural differences between skeletal, smooth and cardiac muscles.
9. Demonstration of various bones
10. Demonstration of various joints
11. Demonstration of various parts of male & female reproductive system from models

BML-S-152(Practical Human Physiology-I)

1. To measure pulse rate
2. To measure blood pressure
3. Demonstration of ECG
4. To perform Hemoglobin by Sahli's Method
5. To perform Hemoglobin by CMG method.
6. Haemoglobin by CMG method.
7. To perform Total RBC count.
8. To perform total leucocyte count.
9. To perform differential leucocyte count.
10. To perform PCV
11. To calculate Red cell indices.

BML-S-153(Practical Basic Haematology & Clinical Pathology-I)

1. To learn general laboratory safety rules.
2. To demonstrate glasswares, apparatus and plasticwares used in laboratory.
3. To prepare EDTA, Sod. Citrate & Sod. Fluoride anticoagulants and bulbs/vials used in laboratory.
4. Demonstration of Vaccutainer.
5. To demonstrate method of blood collection.
6. To separate serum and plasma.
7. Demonstration of microscope
8. Determination of Hemoglobin by various methods.
9. Determination of TLC
10. Preparation of thick and thin smear
11. Determination of DLC
12. Determination of Total RBC
13. Determination of total platelet count
14. Determination of absolute leucocyte count

BML-S-154(Practical Fundamentals of Biochemistry-I)

1. To study general laboratory safety rules.
2. To demonstrate glasswares,apparatus and plasticwares used in laboratory.
3. Collection of blood sample
4. To separate serum and plasma.
5. Preparation of different percentage solutions
6. Preparation of normal and molar solutions.(0.1 N NaOH, 0.2N HCl,0.1 M H_2SO_4)
7. Demonstration of photocolorimeter
8. Demonstration of spectrophotometer
9. Demonstration of pH meter
10. Deproteinization of blood sample

BML-S-155: Hospital Posting:

Students shall be deputed to various labs of Pathology department wherein they shall undergo practical training of handling patients, collection and processing of blood, urine, sputum stool and body fluids samples. Identification of patient's particulars based on CR number, Lab Number and transfer of samples from collection centres to different labs. Process of performing various tests in different labs. Each student is required to maintain a logbook of the various posting. Student's performance shall be evaluated on continuous basis by the faculty posted in various sections. The faculty shall submit the assessment records of each student posted in his/her section on monthly basis to the HOD. Marks will be awarded out of 100.

B.Sc. MLT- II Semester (I Year)

L	T	P	C
3	0	0	3

Course/Paper: Human Anatomy-II

Course Code: BML-S-201

Learning Objective: This syllabus is extension of the part-I. The syllabus justifiably divides the body systems into two semesters to ensure complete and comprehensive knowledge of all functionalities of the body.

Unit-I

Cardiovascular system: Basic anatomy of heart and important blood vessels
Brief introduction about Lymphatic System

Unit –II

The Nervous System: Basic anatomy of brain and spinal cord, meninges and cerebrospinal fluid, Cranial Nerves

Unit-III
Endocrine System: Brief anatomy of Pituitary, Thyroid, Parathyroid, Pancreas, Adrenal

Unit-IV
Special Senses: Basic anatomy of eye, ear and nose

Unit-V
Genitourinary system: Basic anatomy of kidney and associated organs, male reproductive organs, female reproductive organs

Learning Outcome: This curriculum can stimulate the students to understand the basic anatomy of included system and the resultant unified organization thereupon.

Suggested Readings:

1. Ross & Wilson,(2014),Anatomy & Physiology in health & illness,11th edition,Elsevier Publications
2. Chaurasia B D, (2016), Human Anatomy, 7th edition,CBS publishers
3. Gerard J. Tortora and Bryan H.Derrickson,(Principles of Anatomy and Physiology,14th edition,Wiley publications

B.Sc. MLT- II Semester (I Year)

L	T	P	C
3	0	2	4

Course/Paper: Human Physiology-II

Course Code: BML-S-202

Learning Objective: This subject imparts the knowledge of the structure and function of included organs and organ systems in normal human body.

Unit- I

Organs of Excretory System: Kidneys, Nephron, Mechanism of Excretion, Urine formation (Glomerular filtration and Tubular reabsorption), Electrolytes: their balances and imbalances
Introduction of acidosis and alkalosis

Unit-II

Muscle nerve physiology, types of muscles, their gross structural and functional difference with reference to properties

Unit-III

Nervous system- general organization of CNS, function of important structure and spinal cord, neuron, nerve impulse, type of nerves according to function, Autonomic nervous system- organization & function
Special senses-general organization & functions

Unit- IV

Endocrine System: Brief introduction about endocrine glands and their secretion, common endocrinological disorder such as diabetes mellitus, hyper & hypothyroidism, dwarfism, gigantism, tetany.

Unit-V

Reproductive System: male & female reproductive organs, sex hormones, secondary sexual characteristics, puberty, spermatogenesis, oogenesis, menstrual cycle, pregnancy, menopause, contraceptive measures.

Learning Outcome: Students will able to understand functioning of various systems included in syllabus as well as diseases mentioned.

Suggested Readings:

1. Ross & Wilson,(2014),Anatomy & Physiology in health & illness,11th edition,Elsevier Publications
2. Sujit Chaudhury,(2011),Concise Medical Physiology,6th edition, NCBA
3. Sembulingam k,(2012),Essentials of Medical Physiology,6th edition, Jaypee Publications
4. Guyton and Hall,(2011) Textbook of Medical Physiology,12th Edition,Saunder/Elsevier
5. Gerard J. Tortora and Bryan H.Derrickson,(Principles of Anatomy and Physiology,14th edition,Wiley publications

B.Sc. MLT- II Semester (I Year)

L	T	P	C
4	0	2	5

Course/Paper: Basic Haematology & Clinical Pathology -II

Course Code: BML-S-203

Learning Objective: The unique preposition of this paper is that the students learn the basic haematological technique with clotting mechanism, blood banking techniques and automation.

Unit- I
Erythrocyte sedimentation rate, manual and automated method, factor affecting ESR, packed cell volume, red cell indices (MCV, MCH, MCHC), Physiological and pathological variations in value

Unit-II
Complete blood count, determination by automated method and significance of each parameter, Reticulocyte count, routine examination of CSF, semen, sputum and stool.

Unit –III
Mechanism of coagulation, coagulation factors, Bleeding time, clotting time, platelet count, protamine sulphate test, clot retraction test

Unit-IV
Introduction to immuno hematology and blood banking technology, antigen, antibody, complements,ABO & Rh blood group system, method of determination, other blood group system, Donor selection, blood collection, anticoagulants, additive systems, blood bags, its labelling , storage and transportation

Unit- V
Uses, care & maintenance and calibration of Coulter counter, coagulometer, automatic ESR analyzer, urine analyzer, point of care testing.
Pre and Post analytical variables, automation in hematology

Learning Outcome: Students can perform the various type of tests involved in hematology, immunohematology, coagulation profile and can handle automated instruments.

Suggested Readings:

1. Godkar.B. Praful,(2016) Textbook of MLT,3rd edition,Bhalani Publications
2. Singh Tejinder,(2014),Atlas & Textbook of Haematology,3rd edition,Avichal Publications
3. Ochei J & Kolhatkar A(2000),Medical Laboratory Science: Theory & Practice, 3rd edition,Mcgraw Hill Education
4. Mukherjee .L.K(2017), Medical Laboratory Technology,Vol.1-3,3rd edition, Tata Mcgraw Hill
5. Sood Ramnik,(2015), Text book of Medical Laboratory Technology,2nd edition, Jaypee Publications

B.Sc. MLT- II Semester (I Year)

Course/Paper: Fundamentals of Biochemistry -II

Course Code: BML-S-204

L	T	P	C
4	0	2	5

Learning Objective: This paper is extension of BML-S-104 and which aims at understanding the chemical properties of the bio molecules, their functions and biomedical importance.

Unit-I

Carbohydrates: Classification, function, importance, structure, digestion & absorption.
Proteins: Classification, function, importance, structure, digestion & absorption.

Unit-II
Amino acids: Classification, Structure, Properties and Biological functions.
Lipids: Classification of lipids, Classification of fatty acids, Saturated & Unsaturated fatty acids, their biological functions, digestion and absorption, introduction of lipoproteins

Unit-III
Enzymes : Definition, Classification of enzyme, Cofactor & Coenzymes, Concept of active sites and general mode of action of enzymes, units for measuring enzyme activity, factor affecting enzyme activity, factor responsible for abnormal enzyme secretion

Unit-IV
Nucleic acids: Structure, Function and types of DNA and RNA, Nucleotides, Nucleosides, Nitrogen bases, purines and pyrimidines and role of Nucleic acid.

Unit-V
Vitamins: classification, function and disease associated with vitamins.
Minerals and ions: Requirement, function and biological importance of Calcium, Iron, Iodine, Zinc, Phosphorus, Copper, Sodium and Potassium

Learning Outcome: Students will understand the chemistry, function, and biological importance of carbohydrates, proteins, lipids, nucleic acids, enzymes, vitamins and minerals.

Suggested Readings:

1. D M Vasudevan, (2011),Text book of Medical Biochemistry,6th edition Jaypee Publishers
2. M N Chatterjea & Rana Shinde,(2012),Text book of Medical Biochemistry,8th edition,Jayppe Publications
3. Singh & Sahni,(2008),Introductory Practical Biochemistry,2nd edition, Alpha science
4. Lehninger,(2013),Principles of Biochemistry,6th edition, W H Freeman
5. U Satyanarayan,(2008), Essentials of Biochemistry,2nd edition, Standard Publishers

B.Sc. MLT- II Semester (I Year)

L	T	P	C
3	0	2	4

Course/Paper: Fundamental of Computers

Course Code: BML-S-205

Learning Objective: The objective of this course is to acknowledge, appreciate and effectively incorporate the basic of computers with its applications.

Unit-I

Introduction to computer: Introduction, characteristics of computer, block diagram of computer, generations of computer, computer languages. Input output devices: Input devices(keyboard, point and draw devices, data scanning devices, digitizer, electronic card reader, voice recognition devices, vision-input devices), output devices(monitors, pointers, plotters, screen image projector, voice response systems).

Processor and memory: The Central Processing Unit (CPU), main memory. Storage Devices: Sequential and direct access devices, magnetic tape, magnetic disk, optical disk, mass storage devices.

Unit-II

Introduction of windows: History, features, desktop, taskbar, icons on the desktop, operation with folder, creating shortcuts, operation with windows (opening, closing, moving, resizing, minimizing and maximizing, etc.).

Unit-III

Introduction to MS-Word: introduction, components of a word window, creating, opening and inserting files, editing a document file, page setting and formatting the text, saving the document, spell checking, printing the document file, creating and editing of table, mail merge.

Introduction to Excel: introduction, about worksheet, entering information, saving workbooks and formatting, printing the worksheet, creating graphs.
Introduction to power-point: introduction, creating and manipulating presentation, views, formatting and enhancing text, slide with graphs.

Unit-IV

Introduction of Operating System: introduction, operating system concepts, types of operating system, Computer networks: introduction, types of network (LAN, MAN, WAN, Internet, Intranet), network topologies (star, ring, bus, mesh, tree, hybrid), components of network.
Electronic Payment Systems: Introduction, Types of Electronic Payment Systems, Digital Token-Based, Electronic Payment Systems, Smart Card and Electronic Payment Systems, Credit Card- Based Electronic Payment Systems, Risk and Electronic Payment Systems.

Unit-V

Internet and its Applications: definition, brief history, basic services (E-Mail, File Transfer Protocol, telnet, the World Wide Web (WWW)), www browsers, use of the internet.
Application of Computers in clinical settings.

Learning Outcome: Students will able to understand the hardware, software and applications of computer in clinical settings.

Suggested Readings:

1. P.K.Sinha,(2006), Fundamentals of Computers,6th edition SPB Publications
2. Sanders, D.H., Computers Today,4th edition, McGraw Hill.
3. Trainer, T.N., Computers, McGraw-Hill.
4. Anshuman Sharma,(2016), Information technology ,3rd edition,Lakhanpal Publishers

B.Sc. MLT- IInd Semester (Ist Year)

Course/Paper: English Communication & Soft Skills-II

Course Code: BML-S-299

L	T	P	C
3	0	2	4

Objective: To build vocabulary, make simple sentences and communicate freely in simple English and overall professional development.

Module -1: Basic Communication & Soft Skills (6 Lectures)

a) Reading comprehension
b) Building conversational skills
c)Verbal & Non-verbal communication
[Note: As part of classroom activity, review and recap the last semester and carry out (oral and written) practice test to update the progress card of each student, refer to the Workbook]

Module -2: Vocabulary: Building Blocks (10 Lectures)

a) Word Formation: Prefix, suffix, conversion and compounding
b) Homophones and one-word substitution
c) Words often confused and misused
d) Idiomatic phrase, Antonyms and Synonyms
[Note: As part of classroom activity, organise and learning language games, initiate the learning of 5 new words per class]

Module-3: English Communication: World around Me (12 Lectures)

a) Market place, Bus stop, Bank, Post Office
b) Village, Town and City
c) Eating out: Stall, Dhaba and Restaurant
[Note: As part of classroom activity, refer Work book for classroom and home assignments, carry out practice tests (written and oral)]

Module -4: Personality Development-II (12 Lectures)

a) Etiquettes: Telephone, e-mail and at a wedding or social gathering
b) Public dealing: Making enquiries and requesting for help, handling difference of opinion, giving directions, instructions and getting assistance
c) Expressions: Giving compliments, making complaints, Feeling sorry and saying thank you
d) Entertainment: Radio, music, television, and computers
[Note: As part of classroom activity, refer Workbook for classroom and home assignments, carry out practice tests (written and oral)]

Second Semester Outcome:

1. Gradual but significant improvement in student's progression in terms of LSRW to be noted

2. Students will improve their English vocabulary of daily usage

3. Students will be able to understand the world around them and communicate in diverse situations

4. Students will be able to imbibe the requisites of personality development for demonstrating good manners in society

5. Students will be able to exhibit basic etiquettes of personal communication

Reference Books:

1. ILFS Bi-lingual Course in Basic English, ILFS Skill Development Corporation
2. English Grammar Composition & Usage by J.C. Nesfield, Macmillan Publishers
3. The Business letters by Madan Sood, Goodwill Publishing House, New Delhi
4. Communication Skills by Sanjay Kumar &PushpLata, Oxford University Press
5. Newspapers

Practical syllabus

B.Sc. MLT-II Semester (I Year)

BML-S-251(Practical Human Physiology-II)

1. To perform total platelet count.
2. To perform bleeding time.
3. To perform clotting time.
4. To study about CSF examination.
5. To study about intrauterine contraceptive devices.
6. To demonstrate microscopic structure of bones with permanent slides.
7. To demonstrate microscopic structure of muscles with permanent slides.

BML-S-252(Practical Basic Haematology & Clinical Pathology-II)

1. To perform ESR by Various methods.
2. To perform PCV
3. To determine red cell indices
4. To perform routine stool examination
5. To perform bleeding time
6. To perform clotting time
7. To perform blood grouping by slide method
8. To perform blood grouping by tube method
9. To demonstrate cell counter
10. To demonstrate coagulometer.

BML-S-253(Practical Fundamentals of Biochemistry-II)

1. To identify carbohydrates in given solution by various methods.
2. To determine protein by Biuret method.
3. To perform protein test by various methods.
4. Physical examination of urine
5. Urine sugar determination by Benedict's metod.
6. Protein by heat and acetic method
7. Bile salt, Bile pigments and Urobilinogen determination
8. Determination of Ketone bodies
9. Determination of various parameters of urine by uristik method.
10. Preparation of hemolysate

BML-S-254 (Practical: Basics of Computer)

Computer fundamental and internet lab

1. Using basic DOS commands.
2. Using external DOS commands
3. Creating a email account
4. Using web browser for searching and surfing.
5. Creating and formatting a document in MS office
6. Using autocorrect, auto text and spell check operation in MS office .
7. Create tables in MS Word.
8. Inserting different kinds of object in MS word.
9. Use main merge options in MS office.
10. Create a Excel work sheet with following options rows and columns alignment..
11. Using excel formulas.
12. Create a graph with available data in MS excel.
13. Create a PPT presentation using auto content wizard.
14. Use Clip art animation effects and word art galleries in presentations.
15. Using transition and setting timings for slide show.
16. Use MS access to create data base and tables.

BML-S-255: Hospital Posting:

Students shall be deputed to various labs of Pathology department wherein they shall undergo practical training of handling patients, collection and processing of blood, urine, sputum stool and body fluids samples. Identification of patient's particulars based on CR number, Lab Number and transfer of samples from collection centres to different labs. Process of performing various tests in different labs. Each student is required to maintain a logbook of the various posting. Student's performance shall be evaluated on continuous basis by the faculty posted in various sections. The faculty shall submit the assessment records of each student posted in his/her section on monthly basis to the HOD. Marks will be awarded out of 100.

B.Sc. MLT- III Semester (II Year)

L	T	P	C
3	0	2	4

Course/paper: Clinical Haematology-I

Paper Code: BML-S-301

Learning Objective: This course has been designed to understand the blood disorders, its lab diagnosis and various type of laboratory test.

Unit –I

RBCs, formation, morphology, cytoskeleton, anisocytosis, poikilocytosis, metabolism, role of 2, 3-BPG and oxygen dissociation curve.

Anaemia and its classification, Morphological and etiological, pathogenesis, laboratory investigations and management,

Iron deficiency anaemia, metabolism of iron, pathogenesis, laboratory investigations and management, principle and procedure of special test

Megaloblastic anaemia, pernicious anaemia, pathogenesis, laboratory investigations

Unit-II

Haemoglobin, its synthesis and types, normal and abnormal hemoglobins, extravasccular and intravascular hemolysis.

Haemolytic anaemia, pathogenesis and laboratory investigations, principle and procedure of special test, G-6-PD

Unit –III

Leukopoiesis , Stages of Leukocyte Maturation, Features of Cell Identification, leucocytosis and leucocytopenia , neutrophilia , eosinophilia, basophilia, monocytosis, lymphocytosis, neutropenia, lymphopenia, causes and significance, toxic granulation, Morphological alterations in neutrophil, effect of HIV on blood cell parameter

Unit-IV

Overview of hemostasis and coagulation, Stages of platelets development, Primary and Secondary hemostasis, Role of platelets, Role of coagulation factors, Coagulation inhibitory system, Fibrinolysis

Unit-V

General blood picture, estimation of iron, TIBC, Transferrin, Ferritin, Plasma haemoglobin,Vit.B12, Folic acid, FIGLU test, Schiling test, Parietal cell antibodies,G-6-PD, Osmotic fragility test, Heinz bodies, Perls Prussian staining, Platelet count, Platelet aggregation test, PT, INR APTT, Mixing experiments in PT and APTT, Thrombin time.

Learning Outcome: Students will learn the differential diagnosis and appropriate diagnostic evaluation of common hematologic abnormalities.

Suggested Readings:

1. Mukherjee .L.K(2017), Medical Laboratory Technology,Vol.1-3,3rd edition, Tata Mcgraw Hill
2. Sood Ramnik,(2015), Text book of Medical Laboratory Technology,2nd edition, Jaypee Publications
3. Wintrobe's Clinical Haematology,(2014),13th edition, Lippincott Williams & Wilkins
4. De Gruchy's Clinical Haematology in Medical Practice,(2012),Sixth edition, Wiley Publications
5. Dacie & Lewis Practical Haematology, (2011),11th edition, Elsevier Publications

B.Sc. MLT- III Semester (II Year)

Course/Paper: Clinical Biochemistry -I

Paper Code: BML-S-302

L	T	P	C
3	0	2	4

Learning Objective: This course emphasizes on metabolism, metabolic disorders, laboratory test and instruments used in Clinical Biochemistry.

Unit-I

Basics of Metabolism, metabolism of Carbohydrates, Glycolysis, bioenergetics,regulation of blood sugar, Introduction and significance of gluconeogenesis, glycogenesis, glycogenolysis, HMP Pathway, Role of G-6-PD.

Unit-II

Fate of Pyruvate, TCA cycle and its significance, Electron transport Chain

Diabetes, types, clinical features, diabetic profile test, HbA1C, GTT, Types of sugar, Hyperglycemia and Hypoglycemia, Ketone bodies, Introduction of carbohydrate metabolism

Unit-III

Digestion and Absorption of Proteins, Metabolism of Proteins , Formation of ammonia, Transamination, Deamination, Urea Cycle, Significance of Urea, Estimation of total protein, Albumin ,Globulin and A/G ratio, Aminoaciduria, 24 hrs of urinary proteins

Unit-IV

Digestion and absorption of fatty acids, Metabolism of fatty acids, Beta oxidation of fatty acids, Ketone bodies and ketosis,

Cholesterol, Plasma lipids, Lipoproteins, Lipid profile Test, Triglycerides, HDL, VLDL, LDL, Risk factors, Hyperlipidemia and Dyslipidemia

Unit-V

Principle, application, calibration and maintenance of photcolorimeter, spectrophotometer, Blood Chemistry analyzer, Flame photometer, Turbidimetry

Learning Outcome: Students can understand the principles and applications of the analytical instruments used in the routine clinical laboratory & can perform and interpret the various parameters.

Suggested Readings:

1. D M Vasudevan, (2011),Text book of Medical Biochemistry,6th edition Jaypee Publishers
2. M N Chatterjea & Rana Shinde,(2012),Text book of Medical Biochemistry,8th edition,Jayppe Publications
3. Singh & Sahni,(2008),Introductory Practical Biochemistry,2nd edition, Alpha science

B.Sc. MLT- IIIrd Semester (IInd Year)

L	T	P	C
2	0	2	3

Course/Paper: Fundamentals of Microbiology-I

Paper Code: BML-S-303

Learning Objective: This subject gives a general insight into the history, basics of microbiology and imparts knowledge about equipment used in microbiology.

Unit-I

Development of microbiology as a discipline, Contributions of Anton von Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister, Alexander Fleming, Edward Jenner

Introduction to bacterial taxonomy, Classification of Bacteria, Morphology based on size, shape, arrangement, motility, flagella, spores, capsules, cell wall, plasma membrane, pili, ribosomes.

Unit-II

Microscopy: Study of compound microscope – magnification, numerical aperture, resolution and components of microscope. Dark ground illumination, care of microscope and common difficulties micrometry. Bright Field Microscope, Dark Field Microscope, Phase Contrast Microscope, Fluorescence Microscope, Transmission Electron Microscope, Scanning Electron Microscope

Unit-III

Cell size, shape and arrangement, cell-wall, composition and detailed structure of Gram-positive and Gram-negative cell walls, Cell Membrane: Structure, function and chemical composition of bacterial cell membranes. Cytoplasm: Ribosome, mesosomes, inclusion bodies, nucleoid, chromosome and plasmids, Endospore: Structure, formation

Unit-IV

General safety measures used in Microbiology laboratory, Sterilization and disinfection: Various physical methods of sterilization – heat, UV radiation, ionizing radiation, filtration, characters affecting sterilization, auto clave control and sterilization indicators.

Biomedical waste management in a Medical Microbiology laboratory: Types of the waste generated, Segregation, Treatment, Disposal

Unit-V

Antiseptics & Disinfectants: Definition, types and properties, mode of action, use, qualities of good disinfectants

Chemical disinfectants – phenol and its compounds, alcohol, halogen, heavy metals and quaternary ammonium compounds, aldehyde, gaseous compound. use and abuse of disinfectants. precautions while using the disinfectants.

Learning Outcome: This course make the students to know handling of instruments and sterilization techniques.

Suggested Readings:

1. Ananthanarayan R. and Paniker C.K.J. (2009) Textbook of Microbiology. 8th edition, University Press Publication
2. Brooks G.F., Carroll K.C., Butel J.S., Morse S.A. and Mietzner, T.A. (2013)
3. Adelberg's Medical Microbiology. 26th edition. McGraw Hill Publication
4. Goering R., Dockrell H., Zuckerman M. and Wakelin D. (2007) Mims' Medical Microbiology. 4th edition. Elsevier
5. Willey JM, Sherwood LM, and Woolverton CJ. (2013) Prescott, Harley and Klein's Microbiology. 9th edition. McGraw Hill Higher Education
6. Goldsby RA, Kindt TJ, Osborne BA. (2007). Kuby's Immunology. 6th edition W.H. Freeman and Company, New York.

B.Sc. MLT- III Semester (II Year)

Course/Paper: Immunology & Serology -I

Paper Code: BML-S-304

L	T	P	C
2	0	0	2

Learning Objective: This course has been formulated to impart basic aspects of immunity, antigens, antibodies, various serological reactions, techniques and their utility in laboratory diagnosis of human diseases.

Unit-I

Historical background, general concepts of the immune system, innate and adaptive immunity; active and passive immunity; primary and secondary immune response.

Cell and organs of immune system, Phagocytosis

Unit-II

Antigens and haptens : Properties ,foreignness, molecular size, heterogeneity, B and T cell epitopes; T dependent and T independent antigens.

Antibodies: Historical perspective of antibody structure; structure, function and properties of the antibodies; different classes, subclasses and biological activities of antibodies; concepts of antibody diversity, isotype, allotype, Introduction of hybridoma technology, monoclonal antibodies, polyclonal antibody

Unit-III

Mechanism of humoral and cell mediated immune response.

Introduction of Major Histocompatibility Complex, organization of MHC and inheritance in humans; Antigen presenting cells, antigen processing and presentation

Complement system and complement fixation test.

Unit-IV

Laboratory tests for demonstration of antigen – antibody reaction such as agglutination, precipitation, ELISA, RIA, Immunofluorescence,

Unit-V

Rheumatological diseases, etiology and pathogenesis and lab investigations

Learning Outcome: The students will learn scientific approaches/techniques that are used to investigate various diseases.

Suggested Readings:

1. *Abbas AK, Lichtman AH, Pillai S. (2007). Cellular and Molecular Immunology. 6th edition Saunders Publication, Philadelphia.*
2. *Delves P, Martin S, Burton D, Roitt IM. (2006). Roitt's Essential Immunology.11th edition Wiley-Blackwell Scientific Publication, Oxford.*
3. *Goldsby RA, Kindt TJ, Osborne BA. (2007). Kuby's Immunology. 6th edition W.H. Freeman and Company, New York.*
4. *Murphy K, Travers P, Walport M. (2008). Janeway's Immunobiology. 7th edition Garland Science Publishers, New York.*
5. *Peakman M, and Vergani D. (2009). Basic and Clinical Immunology. 2nd edition Churchill Livingstone Publishers, Edinberg.*
6. *Richard C and Geiffrey S. (2009). Immunology. 6th edition. Wiley Blackwell Publication.*

B.Sc. MLT- III Semester (II Year)

Course/Paper: Histopathology & Histotechniques-I

Paper Code: BML-S-305

L	T	P	C
3	0	2	4

Learning Objective: Students will learn about various histotechniques, handling and processing of tissue specimens as well as staining procedures.

Unit-I

Introduction of histopathology, cytology & histotechniques, laboratory organization, care & maintenance of equipments used in histotechnology lab ,Safety measures in histotechnology lab

Reception, Recording, Labelling and transportation of tissue specimens,Basic concepts of fixation and various types of fixative used in histopathology and cytopathology

Unit-II

Tissue and its types, Location and function,Grossing of tissues, whole mount, sections, smears, tissue processing and its steps, manual and automated method, components & principle of automatic tissue processor

Decalcification, decalcification methods, types of decalcifying fluid, Processing of bones and teeth, Embedding media, its type and properties

Unit-III

Microtome, its type and working, various type of microtome,Microtome knives, its type and knife sharpening,Section cutting, fault and remedies,Section adhesive

Unit-IV

Cryostat, frozen sections of fresh, fixed and unfixed tissue, freeze drying, rapid frozen sections and staining for emergency diagnosis

Dye chemistry, Stains and dyes, natural dye, acidic dye, basic dye, neutral dyes, fluorescence dye, mordant, accelerators, accentuators, metachromasia, metachromatic dyes

Unit- V

Progressive, regressive, vital, supravital staining, types of hematoxylin, Haematoxylin and eosin staining, use of control sections in tissue staining, mounting and mounting media, advantages & disadvantages, refractive index

Learning Outcome: Students would able to carry out tissue processing and general staining.

Suggested Readings:

1. Bancroft's Theory and Practice of Histological Techniques, 7th Edition, Elsevier Publications
2. Harshmohan (2017), Textbook of Pathology,7th edition, Jaypee Publications
3. Godkar.B. Praful,(2016) Textbook of MLT,3rd edition,Bhalani Publications
4. C F A Culling,(1974),Handbook of Histopathological and Histochemical Techniques: Including Museum Techniques,3rd edition,Butterworths Publishers

B.Sc. MLT- III Semester (II Year)

Course/Paper: English Communication & Soft Skills-III

Paper Code: BML-S-399

L	T	P	C
3	0	2	4

Learning Objective: To learn job oriented, presentation and interview skills and business correspondence.

Module -1 Functional Grammar-II (8 Lectures)

a) Sentence construction: Simple, Complex and Compound
b) Application writing
c) Paragraph writing, essay writing and precis writing
d) Pre-testing of oral and writing skills
[Note: As part of classroom activity, Review and recap of last semester and update progress of each student refer Module 3 of Workbook]

Module-2 Professional Skills (14 Lectures)

a) Biodata, CV and resume writing
b) Joining Letter, Cover Letter & Resignation letter
c) Inter-Office Memo, Formal Business Letter, Informal Notes
d) Minutes of the Meeting, Reporting Events, Summary Writing

[Note: As part of classroom activity, use of standard templates and scenario buildings, practice sessions in classroom and homework assignments, refer to Workbook]

Module -3Presentation Skills (10Lectures)

a) Power-point presentations & presentation techniques
b) Body language
c) Describing people, places and events
d) Extempore speech and Just-a minute sessions

[Note: As part of classroom activity, practice sessions carried out in class on different topics of the domain expertise, refer to Workbook]

Module -4Interview Skills (8 Lectures)

a) Developing skill to (a) Debate (b)Discussion, Basics of GD &styles of GD
b) Discussion in groups and group discussion on current issues
c) Steps to prepare for an interview and mock interviews

[Note: As part of classroom activity, language games, extensive coverage of contemporary issues for GDs, facing mock interview sessions with faculty, respective TPOs and Director CRC]

Third Semester Outcome:

1. Considerable improvement in student's progression in terms of LSRW to be noted.
2. Students will improve their writing skills for official communication.
3. Students will be able to give presentation and extempore speech on select topics.

4. Students will be able to discuss among peers and participate in group discussions on current issues.

Reference Books*:

1. ILFS Bi-lingual Course in Basic English, ILFS Skill Development Corporation
2. Communication Skills for Engineers and Scientists by Sangeeta Sharma &Binod Mishra, PHI Learning Private Limited, New Delhi.
3. Professional Communication by Malti Agarwal, Krishna Prakashan Media (P) Ltd., Meerut.
4. Communication Skills by Sanjay Kumar &PushpLata, Oxford University Press
5. The Business letters by Madan Sood, Goodwill Publishing House, New Delh

B.Sc. MLT- III Semester (II Year)

L	T	P	C
4	0	0	4

Course/Paper: Environmental Science

Course Code: BML-S-307

Learning Objective: The student will be made aware of our environment in general, natural resources, ecosystems, environmental pollution and social issues related to environment.

Unit I **(Lectures 08)**

Definition and Scope of environmental studies, multidisciplinary nature of environmental studies, Concept of sustainability & sustainable development.

Ecology and Environment: Concept of an Ecosystem-its structure and functions, Energy Flow in an Ecosystem, Food Chain, Food Web, Ecological Pyramid& Ecological succession, Study of following ecosystems: Forest Ecosystem, Grass land Ecosystem & Aquatic Ecosystem & Desert Ecosystem.

Unit II **(Lectures 08)**

Natural Resources: Renewable & Non-Renewable resources; Land resources and land use change; Land degradation, Soil erosion & desertification. **Deforestation**: Causes & impacts due to mining, Dam building on forest biodiversity & tribal population. **Energy Resources**: Renewable & Non-Renewable resources, Energy scenario & use of alternate energy sources, Case studies.
Biodiversity: Hot Spots of Biodiversity in India and World, Conservation, Importance and Factors Responsible for Loss of Biodiversity, Biogeographical Classification of India

Unit III **(Lectures 08)**

Environmental Pollutions: Types, Causes, Effects & control; Air, Water, soil & noise pollution, Nuclear hazards & human health risks, Solid waste Management; Control measures of urban & industrial wastes, pollution case studies

Unit IV **(Lectures 08)**

Environmental policies & practices: Climate change & Global Warming (Green house Effect),Ozone Layer -Its Depletion and Control Measures, Photochemical Smog, Acid Rain Environmental laws: Environment protection Act; air prevention & control of pollution act, Water Prevention & Control of Pollution Act, Wild Life Protection Act, Forest Conservation Acts, International Acts; Montreal & Kyoto Protocols & Convention on biological diversity, Nature reserves, tribal population & Rights & human wild life conflicts in Indian context

Unit V **(Lectures 08)**

Human Communities & Environment:

Human population growth;impacts on environment, human health & welfare, Resettlement & rehabilitation of projects affected person: A case study, Disaster Management; Earthquake, Floods & Droughts, Cyclones & Landslides, Environmental Movements; Chipko, Silent Valley, Vishnoi's of Rajasthan, Environmental Ethics; Role of Indian & other regions & culture in environmental conservation, Environmental communication & public awareness; Case studies.

Field Work:

1. Visit to an area to document environmental assets; river/forest/flora-fauna etc.
2. Visit to a local polluted site: urban/ rural/industrial/agricultural.
3. Study of common plants, insects, birds & basic principles of identification.
4. Study of simple ecosystem; pond, river etc.

Learning Outcome: Students will understand / evaluate / develop technologies on the basis of ecological principles and environmental regulations which in turn help in sustainable development.

Text Books:

1. "Environmental Chemistry", De, A. K., New AgePublishers Pvt.Ltd.
2. "Introduction to Environmental Engineeringand Science", Masters, G. M., PrenticeHall India Pvt. Ltd.
3. "Fundamentals of Ecology",Odem, E. P., W. B. Sannders Co.

ReferenceBooks:

1. "BiodiversityandConservation",Bryant, P. J., Hypertext Book
2. "Textbook of Environment Studies", Tewari, Khulbe&Tewari,I.K. Publication

Practical syllabus

B.Sc. MLT- III Semester (II Year)

BML-S-351 (Practical Clinical Haematology-I)

1. Determination of haemoglobin by various methods.
2. Determination of Total RBC count.
3. Determination of PCV
4. Determination of red cell indices
5. Demonstration of hypochromic microcytic slide.
6. General blood picture
7. Determination of G-6-PD
8. Differential Leucocute Count.
9. Absolute leucocyte count
10. Demonstration of toxic granulation of neutrophil
11. To perform PT and Calculate INR
12. To perform APTT
13. To perform sickling test
14. Determination of Plasma Hemoglobin
15. To perform reticulocyte count.

BML-S-352(Practical Clinical Biochemistry-I)

1. To determine glucose conc. By GOD-POD method.
2. To determine HbA1C by ion exchange method.
3. To determine protein conc. by Biuret method.
4. To determine Albumin by BCG method and calculation of Globulin & A/G ratio.
5. To determine Urea by DAM/ urease method.
6. To determine creatinine by alkaline picrate method.
7. To determine uric acid
8. To determine total cholesterol by CHOD-POD method.
9. To determine triglyceride method
10. To determine HDL-Cholesterol.
11. To determine LDL, VLDL and risk factor.
12. To perform urine sugar by Benedict's/uristik method.
13. To perform urine ketone
14. Demonstration of semi autoanalyzer
15. Demonstration of flame photometer.

BML-S- 353(Fundamentals of Microbiology & Immunology-I)

1. Demonstration of Microscope and its parts
2. Demonstration of glassware used in microbiology.
3. Demonstration of autoclave and sterilization of glass wares.
4. Demonstration of Hot air oven and sterilization of glass wares.
5. To perform Gram staining
6. To perform Acid fast staining (Zeihl Neelsen staining)
7. To perform Indian ink staining
8. To perform Hanging drop method
9. Demonstration of capsule
10. Staining of bacterial spores
11. To demonstrate agglutination reaction.
12. To perform RA test
13. To perform WIDAL test
14. To perform RPR test.
15. To perform CRP test.

BML-S-354(Histopathology & Histotechniques-I)

1. Demonstration of glass wares and equipment used in histopathology lab.
2. To prepare alcohol of different concentration.
3. To prepare formalin from stock solution.
4. To sharp knife by honing and stropping.
5. Grossing of tissue
6. To perform tissue processing by manual method.
7. To perform section cutting of paraffin embedded tissue.
8. To fix the smear on glass slide.
9. To perform hematoxylin and eosin staining.
10. Mounting and preservation of slide.

BML-S-355: Hospital Posting:

Students shall be deputed to various labs of Pathology department wherein they shall undergo practical training of handling patients, collection and processing of blood, urine, sputum stool and body fluids samples. Identification of patient's particulars based on CR number, Lab Number and transfer of samples from collection centres to different labs. Process of performing various tests in different labs. Each student is required to maintain a logbook of the various posting. Student's performance shall be evaluated on continuous basis by the faculty posted in various sections. The faculty shall submit the assessment records of each student posted in his/her section on monthly basis to the HOD. Marks will be awarded out of 100.

B.Sc. MLT- IV Semester (IIYear)

Course/Paper: Clinical Haematology-II

Paper Code: BML -S-401

L	T	P	C
3	0	2	4

Learning Objective: This paper encompasses the basic study and understanding of the various haematological disorders as well as their laboratory investigations.

Unit- I

Aplastic anaemia, Anaemia of chronic disorders, Sideroblastic anaemia, Haemolytic Anaemia, etiology, pathogenesis, clinical features, laboratory investigations,

Bone marrow examination, composition & functions, aspiration techniques, processing and staining

Unit-II

Hemoglobinopathies, qualitative and quantitative

Sickle cell anaemia, sickle cell trait,etiology, pathogenesis, clinical features, and laboratory investigations,Disease management and prognosis, Sickling test

Thalassaemia, classification, etiology, pathogenesis, clinical features, laboratory investigations, haemoglobin electrophoresis

Unit-III

Leukemia and its classification, WHO and FAB classification, AML, ALL, CML, CLL, its etiology, clinical features, laboratory investigations

Cytochemistry involved in diagnosis of various types of leukemia.

Unit-IV

Qualitative and quantitative disorders of platelets, hypercoaguable test, Disorders of secondary hemostasis, hemophilia and its lab diagnosis,Von-Willebrand disease, Disseminated intravascular coagulation, thrombosis, Disorder of fibrinogen, test for bleeding & coagulation disorders, correction studies for factor deficiency, quantitative factor assay

Unit- V

LE cells, its demonstration and significance, lupus anticoagulants, Blood parasites, Malaria, Trypanosomes, Filariasis, Leishmania

Learning Outcome: This course made the students competent enough to perform various laboratory test related to acute and chronic haematological disorders.

Suggested Readings:

1. Wintrobe's Clinical Hematology,(2014),13th edition, Lippincott Williams & Wilkins
2. De Gruchy's Clinical Haematology in Medical Practice,(2012),Sixth edition, Wiley Publications
3. Dacie & Lewis Practical hematology, (2011),11th edition, Elsevier Publications
4. R N Makroo, (2009),Compendium of Trasfusion medicine,2nd edition, Career Publications

B.Sc. MLT- IV Semester (II Year)

Course/Paper: Clinical Biochemistry-II

Paper Code: BML -S-402

L	T	P	C
3	0	2	4

Learning Objective: This paper gives brief understanding about various type of function test, acidosis and alkalosis.

Unit-I

Liver function tests: Introduction, bile pigment metabolism, jaundice and its types, Estimation of Bilirubin, Bile salt, Bile pigments, urobilinogen, SGPT/ALT, SGOT/AST, ALP, GGT, Viral Hepatitis

Unit-II

Renal Function Test: Introduction, Glomerular filtration rate, renal threshold, Urea, Creatinine, Uric Acid, Sodium, Potassium, Creatinine Clearance test, Urea clearance test, examination of renal calculi

Unit-III

Cardiac Function test: Introduction, myocardial infarction, CHD, Biochemical markers of Heart diseases, Role of laboratory in monitoring heart diseases

Unit-IV

Gastric function Test: Introduction, gastric secretions, total and free acid, stimulation test, physical & chemical examination of gastric secretions.

Tumour markers: Introduction, types, applications

Unit-V

Acid base balance, action of buffer system, Hb buffers, respiratory and metabolic acidosis, respiratory and metabolic alkalosis, arterial blood gas analysis, blood gas analyzer.

Learning Outcome: Students will know basics and procedure of different parameters used to assess organ function.

Suggested Readings:

1. D M Vasudevan, (2011),Text book of Medical Biochemistry,6th edition Jaypee Publishers
2. M N Chatterjea & Rana Shinde,(2012),Text book of Medical Biochemistry,8th edition,Jayppe Publications
3. Singh & Sahni,(2008),Introductory Practical Biochemistry,2nd edition, Alpha science
4. Lehninger,(2013),Principles of Biochemistry,6th edition, W H Freeman
5. U Satyanarayan,(2008), Essentials of Biochemistry,2nd edition, Standard Publishers
6. Teitz,(2007),Fundamentals of Clinical Chemistry,6th edition,Elsevier Publications

B.Sc. MLT- IV Semester (II Year)

Course/Paper: Fundamentals of Microbiology-II

Paper Code: BML -S-403

L	T	P	C
3	0	2	4

Learning Objective: This paper is designed to know occurrence, spread & control of infections, culture methods required to perform different microbiological tests in clinical microbiology lab and biomedical waste management.

Unit-I

Lab organization, management, recording of results and quality control in Medical Microbiology Lab. Safety measures in Microbiology Laboratory, Occurrence of lab infections, route of infections in laboratory, safety measures precaution in use of pathogens in teaching.

Unit-II

Host pathogen interaction: Definitions - Infection, Invasion, Pathogen, Pathogenicity, Virulence, Toxigenicity, Carriers and their types, Opportunistic infections, Nosocomial infections. Transmission of infection

Unit-III

Principle, working, use, care & maintenance of Laminar air flow, Centrifuge, Autoclave, hot air Oven, Incubator, Colony Counter, Muffle Furnace, Mac-intos Field-jar etc.
Sterility testing of I/v fluids, Collection, transportation and processing of I/v fluids for bacterial contamination, Recording the result and interpretation

Unit-IV

Hospital acquired infection, Specimen collection from patients, clinics and hospitals, Specimen collection for epidemiological investigations, role of microbiology laboratory in control of nosocomial infection

Unit-V

Antimicrobial agents and Antibiotics: Introduction, mechanism of action, classification and uses, Antibiotic susceptibility testing in bacteriology, Culture medium used for Antibiotic susceptibility testing, Preparation and standardization of inoculums, Control bacterial strains, Choice of antibiotics MIC and MBC: Concepts and methods for determinationVarious methods of Antibiotic susceptibility testing with special reference to Stokes and Kirby-Bauer method

Learning Outcome: This course makes the students to understand basics of microbiology and can independently process the sample, culture, isolation and anti-biotic sensitivity testing.

Suggested Readings:

1. Ananthanarayan R. and Paniker C.K.J. (2009) Textbook of Microbiology. 8th edition, University Press Publication
2. Brooks G.F., Carroll K.C., Butel J.S., Morse S.A. and Mietzner, T.A. (2013)
3. Adelberg's Medical Microbiology. 26th edition. McGraw Hill Publication
4. Goering R., Dockrell H., Zuckerman M. and Wakelin D. (2007) Mims' Medical Microbiology. 4th edition. Elsevier
5. Willey JM, Sherwood LM, and Woolverton CJ. (2013) Prescott, Harley and Klein's Microbiology. 9th edition. McGraw Hill Higher Education

B.Sc. MLT- IV Semester (IIYear)

L	T	P	C
2	0	2	3

Course/Paper: Immunology & Serology-II

Paper Code: BML -S-404

Learning Objective: This paper will provide knowledge of serological techniques, autoimmune disorders their markers and vaccines.

Unit- I

Western blotting, Immunodiffusion, Immunoelectrophoresis, Hypersensitivity and its types
Introduction to Allergy and its laboratory test

Unit-II
Introduction of transplant immunology, graft rejection, tissue typing for kidney and bone marrow transplant, Laboratory test for transplant.

Unit –III

Autoimmune disorders, pathogenesis, organ specific and systemic autoimmune disorders and its markers such parietal cell antibody, anti sperm antibody, lupus anticoagulants, anti mitochondrial antibody, ANA, ds DNA, HLA-B27, ASMA, anti CCP

Unit-IV
Immunological disorders: primary and secondary immunodeficiency, SCID, AIDS,
Tumour, types of tumours, Various Tumour Markers, their significance and method of estimation.

Unit-V
Vaccines, classification and applications, Active and passive immunization, Immunoprophylaxis schedule in neonates, children and in pregnancy

Learning Outcome: Students will able to carry out differential diagnosis of disease by the help of serological techniques.

Suggested Readings:

1. Abbas AK, Lichtman AH, Pillai S. (2007). Cellular and Molecular Immunology. 6th edition Saunders Publication, Philadelphia.
2. Delves P, Martin S, Burton D, Roitt IM. (2006). Roitt's Essential Immunology.11th edition Wiley-Blackwell Scientific Publication, Oxford.
3. Goldsby RA, Kindt TJ, Osborne BA. (2007). Kuby's Immunology. 6th edition W.H. Freeman and Company, New York.
4. Murphy K, Travers P, Walport M. (2008). Janeway's Immunobiology. 7th edition Garland Science Publishers, New York.
5. Peakman M, and Vergani D. (2009). Basic and Clinical Immunology. 2nd edition Churchill Livingstone Publishers, Edinberg.
6. Richard C and Geiffrey S. (2009). Immunology. 6th edition. Wiley Blackwell Publication.

B.Sc. MLT- IV Semester (II Year)

L	T	P	C
2	0	2	3

Course/Paper: Histopathology & Histotechniques-II

Paper Code: BML -S-405

Learning Objective: This paper aims to understand the principle, procedure & demonstration of various tissue constituents and advance tools.

Unit-I

Staining of carbohydrates: preparation of Schiff reagent, PAS staining, Alcian blue, staining of glycogen, Amyloid, other staining method

Connective tissue & its staining: Trichrome staining, verhoeff stain, Weigert Resorcin stain, Gordon's and Sweet stain, Gomori's method, von Geison stain, PTAH stain

Unit-II

Demonstration of minerals and pigments in tissue sample, Demonstration and identification of lipids, Demonstration of enzymes, diagnostic application and the demonstration of phosphatases, dehydrogenases, oxidases and peroxidases, Demonstration of microorganism on tissue specimens, Bacteria, AFB, Actinomyces, spirochetes, fungi

Unit-III

Demonstration of nucleic acids, Processing and staining of bone marrow sample.
Fixation, Processing and section cutting of bones, eye ball, Techniques in neuropathology: Neurons staining, Myelin, Neuropathology lab specimen handling

Unit-IV

Demonstration of sex chromatin, Museum techniques

Electron microscopy: Principle and working, fixation, processing and staining of tissue

Fluorescence Microscope: Principle and working

Unit- V

Immunohistochemistry: principle, types, applications, antigen retrieval, APAAP, PAP Staining, Quality control in histopathology

Learning Outcome: Students would be able to perform various staining techniques and understand principle and application of various techniques.

Suggested Readings:

1. Bancroft's Theory and Practice of Histological Techniques, 7th Edition, Elsevier Publications
2. Harshmohan (2017), Textbook of Pathology,7th edition, Jaypee Publications
3. Godkar.B. Praful,(2016) Textbook of MLT,3rd edition,Bhalani Publications
4. C F A Culling,(1974),Handbook of Histopathological and Histochemical Techniques: Including Museum Techniques,3rd edition,Butterworths Publishers

B.Sc. MLT- IV Semester (II Year)

Course/Paper: English Communications & Soft Skills

Paper Code: BML-S- 499

L	T	P	C
3	0	2	4

Learning Objective: To inculcate behavioural skills in students for the Corporate World.

Module -1Fundamentals of Time Management & Managing Change (12 Lectures)

a) Time Management
b) Managing People and managing change
c) Team building, Leadership and taking decisions
d) Stress Management

[Note: As part of classroom activity, refer to the Workbook, guest lecture by management faculty]

Module -2Public Speaking (8 Lectures)

a) Art of public speaking
b) Welcome speech
c) Farewell Speech
d) Vote of thanks

[Note: As part of classroom activity, extensive practice sessions in class and home assignments]

Module -3Personality Development-III (8 Lectures)

a) Rude vs Polite Behaviour
b) Ethics and human values
c) Concern for environment
d) Crisis Management

[Note: As part of classroom activity, refer to the Workbook, guest lecture by management faculty and industry representative]

Module -4Oral Practice (12 Lectures)

a) Debate
b) Just-a-minute
c) Group Discussions
d) Mock Interviews

[Note: As part of classroom activity, extensively test the oral skills and update the progress card of each student]

Learning Outcome:

1. Notable improvement in student's progression in terms of LSRW.
2. Students will be able to imbibe good practices of self-discipline and professionalism required in the corporate world.
3. Students will be able to develop the art of public speaking.
4. Students will be able to learn behavioural skills suitable for the corporate world.

Reference Books*:

1. ILFS Bi-lingual Course in Basic English, ILFS Skill Development Corporation
2. Communication Skills for Engineers and Scientists by Sangeeta Sharma &Binod Mishra, PHI Learning Private Limited, New Delhi.
3. Professional Communication by Malti Agarwal, Krishna Prakashan Media (P) Ltd., Meerut.
4. Communication Skills by Sanjay Kumar &PushpLata, Oxford University Press
5. The Business letters by Madan Sood, Goodwill Publishing House, New Delhi

B.Sc. MLT- IV Semester (II Year)

L	T	P	C
2	0	0	2

Course/Paper: General Pathology

Paper Code: BML-S- 407

Learning Objective: The curriculum of pathology aims at preparing the students in basic understanding of diseases and their pathogenesis. The syllabi of pathology compliments and supplements the necessary knowledge students have gained in Physiology.

Unit I

Introduction & History of pathology, Basic definitions and familiarization with the common terms used in pathology, Causes and mechanisms of cell injury, reversible and irreversible injury, Introduction of hyperplasia, hypoplasia, hypertrophy, atrophy, metaplasia, necrosis and apoptosis

Unit II

General features of acute and chronic inflammation: Vascular changes, cellular events,
Cells and mediators of inflammation, Phagocytosis and its mechanism

Unit III

Tissue Renewal and Repair, healing and fibrosis, cirrhosis, introduction of oedema, hyperaemia, congestion, haemorrhage, haemostasis, thrombosis, embolism, infarction, shock and hypertension.

Unit IV

Protein energy malnutrition, deficiency diseases of vitamins and minerals, nutritional excess and imbalances. Role and effect of metals (Zinc, Iron and Calcium) and their deficiency diseases,
Aetiology and pathophysiology of diabetes, arteriosclerosis, myocardial infarction, respiratory diseases (COPD), Parkinson disease
Infectious Diseases: pathogenesis & overview of modes of infections, prevention and control with suitable examples like Typhoid, Dengue

Unit V

Cancer: Definitions, nomenclature, characteristics of benign and malignant neoplasm, metastasis, Carcinogens and cancer, concept of oncogenes, tumour suppressor genes, DNA repair genes and cancers stem cells.

Learning Outcome: This curriculum will provide an introductory nature and build the concepts of how human system work in altered and diseased stage under the influence of various internal and external stimuli to the students.

Suggested Readings:

1. Harshmohan (2017), Textbook of Pathology,7th edition, Jaypee Publications
2. Robbins,(2012), Text book of Pathology, 3rd edition, Elsevier Publications

Practical syllabus

B.Sc. MLT- IV Semester (II Year)

BML-S-451(Clinical Haematology-II)

1. Staining of bone marrow
2. To perform sickling test.
3. To determine fetal haemoglobin
4. To perform Heinz bodies
5. Demonstration of leukemic slides
6. To perform LAP scoring
7. To determine total platelet count
8. To perform PT
9. To perform APTT
10. To perform thrombin time.
11. To perform D-dimer test.
12. To determine fibrinogen conc.
13. General blood Picture
14. To demonstrate malarial slide
15. Haemoglobin electrophoresis
16. Demonstration of hemoparasites like trypanosomes , Filaria, Malaria

BML-S-452(Clinical Biochemistry-II)

1. To determine total, direct and indirect bilirubin.
2. To determine SGOT conc.
3. To determine SGPT conc.
4. To determine ALP Conc.
5. To determine total and free acidity.
6. To perform CPK test
7. To perform CK-MB test.
8. To determine serum sodium conc.
9. To determine serum potassium conc.
10. To determine uric acid conc.
11. To determine phosphorus conc.

BML-S-453 (Fundamentals of Microbiology-II)

1. Demonstration of Autoclave and sterilization of media
2. Demonstration of Laminar air flow and media preparation
3. Preparation of culture plates
4. Demonstration of Centrifuge.
5. Demonstration of hot air Oven and sterilization of glassware's
6. Demonstration of Incubator and preservation of cultures

7. Preparation of media
8. Antibiotic sensitivity test.
9. Microscopic examination of urine
10. Examination of urine
11. Examination of sputum

BML-S-454 (Immunology & Serology-II)

1. To perform HIV Tridot test.
2. To perform radial immunodiffusion test.
3. To perform immunoprecipitation method.
4. To perfrom HBsAg rapid test.
5. To perform ASO test
6. To perform ELISA test.
7. To perform TB IgG & IgM test
8. To perform Dengue IgG & IgM test
9. To perform typhidot test.
10. Introduction of Allergy panel
11. Montoux test

BML-S-455 (Histopathology & Histotechniques-II)

1. Grossing of tissue
2. To perform tissue processing by manual method.
3. To perform section cutting of paraffin embedded tissue.
4. To fix the smear on glass slide.
5. To perform hematoxylin and eosin staining.
6. To perform PAS staining.
7. To perform AFB staining.

BML-S-456: Hospital Posting:

Students shall be deputed to various labs of Pathology department wherein they shall undergo practical training of handling patients, collection and processing of blood, urine, sputum stool and body fluids samples. Identification of patient's particulars based on CR number, Lab Number and transfer of samples from collection centres to different labs. Process of performing various tests in different labs. Each student is required to maintain a logbook of the various posting. Student's performance shall be evaluated on continuous basis by the faculty posted in various sections. The faculty shall submit the assessment records of each student posted in his/her section on monthly basis to the HOD. Marks will be awarded out of 100.

B.Sc. MLT- V Semester (III Year)

Course/Paper: Immunohematology & Blood Banking

Paper Code: BML -S-501

L	T	P	C
3	0	2	4

Learning Objective: The prime concern of this subject to learn about the concept of blood grouping, blood collection, infectious markers determination, compatibility testing and quality control involved in blood transfusion services.

Unit-I

Basic Principles of Blood Banking, Antigen, Antibody, naturally occurring antibody, Complement, ABO & Rh blood group system, Methods of blood group determination, Forward and Reverse grouping, Slide & Tube method, Gel method,

Unit-II

Other blood group system such as Lewis, MNS, Kell Duffy etc

Anticoagulants and preservative used in blood bank

Donor selection criteria, Blood collection and processing

Unit-III

Transfusion transmissible infectious disease screen, Coomb'test, Cross matching, Compatibility testing, Antibody Screening & Identification, Grading of Reaction/Agglutination

Unit-IV

Blood components and its preparation, preservation, storage and transportation

Indications for different blood component transfusion, Blood transfusion reaction and its type, HDN

Introduction of stem cell banking and bone marrow transplantation.

Unit-V

Apheresis, indications of hemapheresis, plasmapheresis, plateletspheresis, plasmapheresis

Quality control of reagents, equipments, blood components used in transfusion medicine.

Role of NACO, Indian Red Cross Society, DGHS and blood transfusion services.

Learning Outcome: Students would understand the basics of transfusion medicine, laboratory testing, quality control and apheresis techniques.

Suggested Readings:

1. Godkar.B. Praful,(2016) Textbook of MLT,3rd edition,Bhalani Publications
2. Ochei J & Kolhatkar A(2000),Medical Laboratory Science: Theory & Practice, 3rd edition,Mcgraw Hill Education
3. Mukherjee .L.K(2017), Medical Laboratory Technology,Vol.1-3,3rd edition, Tata Mcgraw Hill
4. Sood Ramnik,(2015), Text book of Medical Laboratory Technology,2nd edition, Jaypee Publications
5. Wintrobe's Clinical Hematology,(2014),13th edition, Lippincott Williams & Wilkins

B.Sc. MLT- V Semester (III Year)

L	T	P	C
3	0	2	4

Course/Paper: Clinical Enzymology & Automation

Paper Code: BML -S-502

Learning Objective: This course has been formulated to impart comprehensive knowledge of enzymes and automation in Clinical Laboratory.

Unit-I

Introduction to enzymes, Classification of Enzymes, Isoenzymes, Concept of lock and key and induced fit theory, concept of activation energy and binding energy. Factors affecting enzyme activity

Unit-II

Coenzyme: Classification, various types and function, structure of NAD+, NADP+, FAD and FMN, PPP

Units for measuring enzyme activity, factors affecting enzyme level in serum/ plasma.
Clinical assay & its type, kinetic assay and end point assay for the enzymes

Unit-III

Enzyme kinetics, the Michaelis-Menten equation and its physiological significances,
Enzyme Inhibition, types of inhibitors of enzyme

Unit-IV

Isoenzymes, their tissue distribution and clinical significance: ALT, AST, ALP, GGT, CPK, CK-MB, LDH,Troponin, Myoglobin, Amylase, Lipase, ACP,

Unit-V

Basic Concepts of Automation, principle, working and maintenance of various clinical chemistry analyzers, point of care testing, Hospital Laboratory Management

Learning Outcome: Students would be able to understand contemporary methods and practical approaches that are used in the clinical laboratories for the investigation of the diseased state as well as application of automation in laboratory.

Suggested Readings:

1. D M Vasudevan, (2011),Text book of Medical Biochemistry,6th edition Jaypee Publishers
2. M N Chatterjea & Rana Shinde,(2012),Text book of Medical Biochemistry,8th edition,Jayppe Publications
3. Singh & Sahni,(2008),Introductory Practical Biochemistry,2nd edition, Alpha science
4. Lehninger,(2013),Principles of Biochemistry,6th edition, W H Freeman
5. U Satyanarayan,(2008), Essentials of Biochemistry,2nd edition, Standard Publishers
6. Teitz,(2007),Fundamentals of Clinical Chemistry,6th edition,Elsevier Publications
7. Bishop(2013),Clinical Chemistry,7th edition, WileyPublications

B.Sc. MLT- V Semester (III Year)

Course/Paper: (Medical Microbiology-I)

Paper Code: BML-S- 503

L	T	P	C
3	0	2	4

Learning Objective: This subject will give information about the different types of bacterial culture procedures, staining procedures and biochemical tests used for identification of bacteria. The students will learn the morphology cultural characteristics, biochemical characteristics & laboratory diagnosis of various bacteria.

Unit-I

Cultural Medias: Liquid and solid medias, containers for medias, distribution of medias 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. Selective media

Unit – II

Collection, transport, processing, storage of various samples for microbiological analysis such as urine, blood, pus, sputum, skin scraping, stool etc.
Pure culture isolation and preservation: Streaking, serial dilution and plating methods; cultivation, maintenance and preservation/stocking of pure cultures; cultivation of anaerobic bacteria.

Unit-III

Growth and Nutrition of Bacteria: various phases of growth, typical growth curve, 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-IV

Preparation of container and swabs for collections of specimens for microbial examinations.
Preservation of Micro-organisms: Periodic subculture method, cold storage, freezing, deep freezing, lyophilisation methods. Total and viable counts of bacteria.
Flowchart of lab diagnostic procedures. documentation of specimen in laboratory.

Unit-V

Specific serological methods of diagnosis, Test for bacterial sensitivity to antimicrobial agents and their interpretation, Specific culture and drug sensitivity methods.

Advanced diagnostic techniques in Medical Microbiology

Learning Outcome: Students would be able to perform and demonstrate different types of bacterial culture procedures, staining procedures and biochemical tests used for identification of bacteria.

Suggested Readings:

1. Ananthanarayan R. and Paniker C.K.J. (2009) Textbook of Microbiology. 8th edition, University Press Publication
2. Adelberg's Medical Microbiology. 26th edition. McGraw Hill Publication
3. Goering R., Dockrell H., Zuckerman M. and Wakelin D. (2007) Mims' Medical Microbiology. 4th edition. Elsevier
4. Willey JM, Sherwood LM, and Woolverton CJ. (2013) Prescott, Harley and Klein's Microbiology. 9th edition. McGraw Hill Higher Education
5. Goldsby RA, Kindt TJ, Osborne BA. (2007). Kuby's Immunology. 6th edition W.H. Freeman and Company, New York.
6. Richard C and Geiffrey S. (2009). Immunology. 6th edition. Wiley Blackwell Publication.

B.Sc. MLT- V Semester (III Year)

Course/Paper: Parasitology

Paper Code: BML -S-504

L	T	P	C
3	0	2	4

Learning Objective: This paper aims to learn about introduction, general characteristics, life cycle and laboratory diagnosis of various medically important parasites.

Unit-I
Introduction of parasites, host, zoonosis, host parasits relationship, sources of infection, mode of infection, pathogenesis, immunity in parasitic infection, lab diagnosis

Unit- II
Protozoalogy: Entamoeba histolytica, Malarial Parasites,Leishmania, Trypanosomes, their morphology, life cycle, pathogenesis, clinical features and lab diagnosis.

Unit-III
Helminthology: Introduction and classification, Taenia solium, Taenia Saginata,Fasciola, Ascaris, Wuchereria bancrofti their morphology, life cycle, pathogenesis, clinical features and lab diagnosis.

Unit-IV
Hookworm, Trichuris. Dracunculus their morphology, life cycle, pathogenesis, clinical features and lab diagnosis.

Unit-V
Diagnostic methods in Parasitology: Introduction, Examination of stool, urine, blood, Culture methods, Immunological diagnosis and serology

Learning Outcome: students would be able to understand pathogenesis and identification of various parasites by different staining and culture methods.

Suggested Readings:

1. Ananthanarayan R. and Paniker C.K.J. (2009) Textbook of Microbiology. 8th edition, University Press Publication
2. Adelberg's Medical Microbiology. 26th edition. McGraw Hill Publication
3. Goering R., Dockrell H., Zuckerman M. and Wakelin D. (2007) Mims' Medical Microbiology. 4th edition. Elsevier
4. Willey JM, Sherwood LM, and Woolverton CJ. (2013) Prescott, Harley and Klein's Microbiology. 9th edition. McGraw Hill Higher Education

B.Sc. MLT- V Semester (III Year)

Course/Paper: Diagnostic Cytology-I

Paper Code: BML -S-505

L	T	P	C
3	0	2	4

Learning Objective: The students will learn about various staining procedures for demonstration of different substances & various cytological investigations. This will include special staining procedures &handling & testing of various cytological specimens.

Unit-I

Cell: basic structure and function, cell organelles, cell cycle, Benign and Malignant tumors, Instruments used in cytology, preparation of buffers, stainsMicroscopy: Light, compound, phase contrast, fluorescence

Unit- II

Instruments and equipments used in cytology Fixation and Fixatives used in cytology, Adhesive and mounting media, Cell block and cytospin technique,

Staining such as PAP, Diff-quick, MGG, H&E, Shorr staining, significance of PAP-HPV, Destaining and restaining of slides, Cover slipping

Unit-III

Aspiration and exfoliative cytology, Patient preparation, Sample collection, Fixation, Processing and Staining FNAC, collection, processing of sample and staining, on site quick staining procedure

Unit-IV

Pap staining, Progressive & Regressive, Hormonal cytology in different age groups,Collection and processing of sputum, BAL, CSF, Pleural, peritoneal and pericardial fluid, Gynaecologic sample

Unit-V

Sex chromatin demonstration, Introduction of Immunocytochemistry, different markers and its applications, Automation in cytology, Liquid based preparation & automated screening device

Learning Outcome: Students would be able to perform collection, processing, staining and quality control in cytological diagnosis.

Suggested Readings:

1. Bibbo, (1997),Comprehensive Cytopathology,2nd edition, Saunders Publishers
2. Koss's Diagnostic Cytology,Vol.1 & 2,(2006),5th edition, Lippincott

B.Sc. MLT- V Semester (III Year)

Course/Paper: Principles of Laboratory Management

Paper Code: BML -S-506

L	T	P	C
3	0	0	3

Learning Outcome: The students will be made aware of the basic ethics, good lab practices including awareness/ safety in a clinical lab.

Unit-I

Ethical Principles and standards for a clinical laboratory professional duty to the patient, duty to colleagues and other professionals, Good Laboratory Practice (GLP) ,Introduction to Basics of GLP and Accreditation, Aims of GLP and Accreditation, Advantages of Accreditation, Brief knowledge about National and International Agencies for clinical laboratory accreditation

Unit-II

Awareness/Safety in a clinical laboratory, General safety precautions.
HIV: pre- and post-exposure guidelines, Hepatitis B & C: pre- and post-exposure guidelines, Drug Resistant Tuberculosis

Patient management for clinical samples collection, transportation and preservation, Sample accountability, Purpose of accountability, Methods of accountability

Unit-III

Sample analysis: Introduction, factors affecting sample analysis, reporting results, basic format of a test report, reported reference range, clinical alerts, abnormal results, results from referral laboratories, release of examination results, alteration in reports

Unit-IV

Quality Management system: Introduction, Quality assurance, Quality control system, Internal and External quality control, quality control chart
Biomedical
Introduction and importance of calibration and Validation of Clinical Laboratory instrument
Ethics in Medical laboratory Practice, Ethics in relation to Pre-Examination procedures, Examination procedures, reporting of results, preserving medical records
Procurement of equipment and Inventory Control,

Unit-V

Audit in a Medical Laboratory, Introduction and Importance, NABL & CAP, Responsibility, Planning, Horizontal, Vertical and Test audit, Frequency of audit, Documentation

Learning Outcome: Students would be competent enough to understand sample accountability, quality management system, biomedical waste management, calibration and validation of clinical laboratory instruments, Laboratory Information system (LIS), Hospital Information system (HIS) and financial management.

Suggested readings:

1. Teitz,(2007),Fundamentals of Clinical Chemistry,6th edition, Elsevier Publications
2. Bishop(2013),Clinical Chemistry,7th edition, Wiley Publications
3. Henry's Clinical Diagnosis and Management by Laboratory Methods,(2011),22nd edition, Elsevier

Practical Syllabus

B.Sc. MLT- V Semester (III Year)

BML-S-551 (Practical Immunohematology & Blood Banking)

1. Demonstration of apparatus and equipments used in blood banking.
2. To prepare different percent of cell suspension.
3. To perform ABO & Rh blood grouping by slide and tube method.
4. To perform forward & reverse grouping.
5. To perform Cross match.
6. To perform Coomb's test.
7. To perform Rh titre
8. To perform Transfusion transmissible marker.
9. Preparation of various blood components and their quality control

BML-S-552 (Practical Clinical Enzymology & Automation)

1. To perform enzyme estimation of LFT
2. To perform enzyme estimation of Cardiac profile
3. Determination of Troponin I
4. To perform enzyme estimation of Pancreatic disorder
5. To perform estimation of ACP.
6. Antenatal profile
7. Estimation of bicarbonate
8. Arterial blood gas analysis
9. Determination of Calcium
10. Creatinine and urea clearance test

BML-S-553(Practical Medical Microbiology-I)

1. Collection and processing of various specimens such as urine, blood for culture
2. Preparation of culture media- Nutrient agar , Mac conkey agar , Blood agar media and Chocolate agar
3. Demonstration of culture methods- Streaking method and Spreading method
4. Cultivation of anaerobic bacteria
5. Antibiotic sensitivity test
6. Processing of culture growth for biochemical tests and identification of microorganisms.
7. Biochemical tests for species identification

BML-S- 554(Practical Parasitology)

1. Leishman staining for malarial parasites
2. Demonstration of permanent slide of Trichuris, Ascaris and Hookworm
3. Saline wet mount for observing ova and eggs of parasites.
4. Iodine wet mount for observing ova and eggs of parasites.
5. Concentration of stool samples by floatation method

6. Zinc sulphate conc. Method for stool sample
7. Demonstration of various parasites by permanent slides.
8. Concentration of stool sample by sedimentation method
9. Serological diagnosis of Leishmania
10. Aldehyde Chopra test for Kala Azar
11. Malaria card test

BML-S- 555(Practical Diagnostic Cytology)

1. Preparation of various cytological fixatives
2. Preparation of various stains used in cytology
3. Preparation of smear
4. To perform PAP staining
5. To perform Giemsa staining on fluid sample
6. To prepare cell suspension
7. Processing of various fluid samples

BML-556: Hospital Posting:

Students shall be deputed to various labs of Pathology department wherein they shall undergo practical training of handling patients, collection and processing of blood, urine, sputum stool and body fluids samples. Identification of patient's particulars based on CR number, Lab Number and transfer of samples from collection centres to different labs. Process of performing various tests in different labs. Each student is required to maintain a logbook of the various posting. Student's performance shall be evaluated on continuous basis by the faculty posted in various sections. The faculty shall submit the assessment records of each student posted in his/her section on monthly basis to the HOD. Marks will be awarded out of 100.

B.Sc. MLT- VI Semester (III Year)

Course/Paper: (Clinical Endocrinology & Toxicology)

Paper Code: BML -S-601

L	T	P	C
3	0	2	4

Learning Objective: This paper is framed to provide basic knowledge of hormones & toxic substances with their determination techniques as well as related disorders.

Unit-I

Hormones, Classification of hormones, organs of endocrine system their secretion and function, regulation of hormone secretion, Mechanism of action

Unit-II

Thyroid function test: Thyroid hormones, biological function, hypothyroidism, hyperthyroidism, Determination of T_3, T_4, TSH, FT_3, FT_4, TBG, Disorder associated with thyroid dysfunction.

Unit-III

Infertility profile: LH, FSH, TSH, Estrogen, Progesterone,Total Testosterone, Free testosterone,DHEA-S, 17- Ketosteroids, Prolactin, their estimation and clinical significance, reference range, hypo and hyper secretion, Triple Test

Unit-IV

Growth hormone, ACTH, Aldosterone, Cortisol their estimation and clinical significance, reference range, hypo and hyper secretion

Unit-V

Introduction of Toxicology, Alcohol poisoning, Lead poisoning, Zinc poisoning, Mercury poisoning drugs abuse, screening procedure for drug screening, Spot tests, hair and urine test, Immunoassay for drugs.

Learning Outcome: After the exposure of the current paper students would be able to detect hormones and toxic substances in blood samples and also understand the basis of endocrine disorders.

Suggested readings:

1. Teitz,(2007),Fundamentals of Clinical Chemistry,6th edition,Elsevier Publications
2. Bishop(2013),Clinical Chemistry,7th edition, WileyPublications
3. Henry's Clinical Diagnosis and Management by Laboratory Methods,(2011),22nd edition, Elsevier
4. D M Vasudevan, (2011),Text book of Medical Biochemistry,6th edition Jaypee Publishers
5. M N Chatterjea & Rana Shinde,(2012),Text book of Medical Biochemistry,8th edition,Jayppe Publications
6. Singh & Sahni,(2008),Introductory Practical Biochemistry,2nd edition, Alpha science
7. Lehninger,(2013),Principles of Biochemistry,6th edition, W H Freeman

B.Sc. MLT- VI Semester (III Year)

Course/Paper: Advance Diagnostic Techniques

Paper Code: BML -S-602

L	T	P	C
3	0	2	4

Learning Objective: This paper imparts the required skills for the detection of diseases, operation and application of various advance techniques.

Unit-I

Chromatography, its principle, types and applications.

Paper Chromatography, Thin layer chromatography, HPLC, Gas liquid chromatography, Ion exchange chromatography and their application in diagnosis.

Unit-II

Basic Principle of electrophoresis, Paper electrophoresis, Gel electrophoresis, PAGE, SDS-PAGE, Agarose gel electrophoresis, buffer systems in electrophoresis.

Electrophoresis of proteins and nucleic acids, haemoglobin, immunoglobulin's, isoenzymes

Applications of electrophoresis in clinical diagnosis.

Unit-III

Centrifugation, fixed angle and swinging bucket rotors , RCF and sedimentation coefficient, differential centrifugation, density gradient centrifugation andUltracentrifugation.

Unit-IV

Radioisotopes, Radioactivity, instruments for radioactivity measurement, applications of radioisotopes in clinical biochemistry

Unit-V

Immunoassay: ELISA, RIA, FIA, FACS and their applications in clinical diagnosis.

Learning Outcome: After the exposure of the current paper students would find themselves equipped with a full package of skill development in order to work in an advance diagnostic setting.

Suggested Readings:

1. Teitz,(2007),Fundamentals of Clinical Chemistry,6th edition, Elsevier Publications
2. Henry's Clinical Diagnosis and Management by Laboratory Methods,(2011),22nd edition, Elsevier
3. Singh & Sahni,(2008),Introductory Practical Biochemistry,2nd edition, Alpha science
4. Lehninger,(2013),Principles of Biochemistry,6th edition, W H Freeman
5. Wilson & Walker, Practical Biochemistry,2nd edition

B.Sc. MLT- VI Semester (III Year)

Course/Paper: Diagnostic Molecular Biology

Paper Code: BML -S-603

L	T	P	C
3	0	2	4

Learning Objective: This syllabus provides a basic introduction of molecular biology and its techniques like PCR, RTPCR etc.

Unit-I

Nucleic Acids, DNA, RNA, composition, structure, types, denaturation and renaturation of DNA, chemistry of DNA synthesis, general principles of replication, enzyme involved in DNA replication – DNA polymerases, DNA ligase, primase, telomerase and other accessory proteins.

Unit II

Basic transcription apparatus, Initiation, elongation and termination of transcription, Eukaryotic Transcription of mRNA, tRNA and rRNA, types of RNA polymerases, transcription factors Introduction of translation

Unit-III

Nucleic acid amplification testing, PCR, Principle, Types, applications, Thermal cycler, RT PCR, reverse transcriptase PCR, Nested PCR

Unit-IV

Blotting techniques, southern blotting and Western blotting
Introduction to chromosomes, its structure and disorder, Karyotyping, Chromosomal studies in hematological disorders (PBLC and Bone marrow), FISH

Unit-V
Radioisotopes and its application in measurement of blood volume, determination of red cell volume and plasma volume, red cell life span, platelet life span, radiation hazards and its prevention disposal of radioactive material
Introduction and applications of Flow cytometry, Stem cell banking, Prenatal Diagnosis

Learning Outcome: Students will also be rendered to take up future molecular biology challenges and efficiently work in diagnostic molecular setup.

Suggested Readings:

1. Teitz,(2007),Fundamentals of Clinical Chemistry,6th edition,Elsevier Publications
2. Henry's Clinical Diagnosis and Management by Laboratory Methods,(2011),22nd edition, Elsevier
3. Singh & Sahni,(2008),Introductory Practical Biochemistry,2nd edition, Alpha science
4. Lehninger,(2013),Principles of Biochemistry,6th edition, W H Freeman

B.Sc. MLT- VI Semester (III Year)

L	T	P	C
3	0	2	4

Course/Paper: Medical Microbiology-II

Paper Code: BML -S-604

Learning Objective: This paper will cover the laboratory strategy in the diagnosis of various infective syndromes i.e. choice of samples, collection and transportation and processing of samples for isolation of bacterial pathogens and then to put antibiotic susceptibility testing.

Unit-I

Description, morphology, cultural characteristics, pathogenecity, cultural characteristics, clinical features and lab diagnosis of Staphylococcus, Streptococcus, Pneumococcus, Neisseria, Bordetella,

Unit- II

Description, pathogenecity, mode of infection, incubation period, cultural characteristics and toxigenecity of Haemophilus, Corynbacteria, Mycobacteria, Atypical Mycobacteria, Anthrax bacillus,

Unit-III

Description, morphology, cultural characteristics, pathogenecity, cultural characteristics, clinical features and lab diagnosis of Clostridia, Escherichia coli, Salmonella,Shigella, Proteus, Vibrio, Pseudomonas, Spirocheates, Chlamydia, Actinomyces, Rickettsia,Yersenia, Brucella,

Unit-IV

Description, morphology, cultural characteristics, pathogenecity, cultural characteristics, clinical features and lab diagnosis of Vibrio, Pseudomonas, Spirocheates, Chlamydia, Actinomyces, Rickettsia,Yersenia, Brucella,

Unit-V

Introduction of Mycology: Definition, general properties and classification
Cutaneous mycoses, Systemic mycoses, Opportunistic mycoses
Culture and laboratory test for fungus

Learning Outcome: Students would be able to identify and differentiate bacteria and fungus in biological samples.

Suggested Readings

1. Ananthanarayan R. and Paniker C.K.J. (2009) Textbook of Microbiology. 8th edition, University Press Publication
2. Adelberg's Medical Microbiology. 26th edition. McGraw Hill Publication
3. Goering R., Dockrell H., Zuckerman M. and Wakelin D. (2007) Mims' Medical Microbiology. 4th edition. Elsevier
4. Willey JM, Sherwood LM, and Woolverton CJ. (2013) Prescott, Harley and Klein's Microbiology. 9th edition. McGraw Hill Higher Education

B.Sc. MLT- VI Semester (III Year)

L	T	P	C
3	0	2	4

Course/Paper: Clinical Virology

Paper Code: BML-S- 605

Learning Objective: This course will provide introduction, general characteristics, life cycle and laboratory diagnosis of various medically important viruses.

Unit 1
Nature and Properties of Viruses
Introduction: Discovery of viruses, nature and definition of viruses, general properties, concept of viroids, virusoids, satellite viruses and Prions. Structure of Viruses: Capsid symmetry, enveloped and non-enveloped viruses

Unit-II
Isolation, purification and cultivation of viruses
Viral taxonomy: Classification and nomenclature of different groups of viruses

Unit III

Modes of viral transmission: Persistent, non-persistent, vertical and horizontal
Viral multiplication and replication strategies: Interaction of viruses with cellular receptors and entry of viruses. Assembly, maturation and release of virions

Unit- IV

Poxviruses, Herpesviruses, hepaptitis viruses, retroviruses-HIV, Picorna viruses, rhabdoviruses, orthomyxoviruses and paramyxo viruses, TORCH profile,Symptoms, mode of transmission, prophylaxis and control of Polio, Herpes, Hepatitis, Rabies, Dengue, HIV, Influenza with brief description of swine flu, Ebola, Chikungunya, Japanese Encephalitis

Unit V
Introduction to oncogenic viruses, Types of oncogenic DNA and RNA viruses, concepts of oncogenes and proto-oncogenes, prevention & control of viral diseases, antiviral compounds and their mode of action, interferon and their mode of action, General principles of viral vaccination

Learning Outcome: Students would be able to identify various viruses with latest biomedical techniques and can demonstrate the diseases associated with them.

Suggested Readings:

1. Ananthanarayan R. and Paniker C.K.J. (2009) Textbook of Microbiology. 8th edition, University Press Publication
2. Brooks G.F., Carroll K.C., Butel J.S., Morse S.A. and Mietzner, T.A. (2013)
3. Adelberg's Medical Microbiology. 26th edition. McGraw Hill Publication
4. Goering R., Dockrell H., Zuckerman M. and Wakelin D. (2007) Mims' Medical Microbiology. 4th edition. Elsevier
5. Willey JM, Sherwood LM, and Woolverton CJ. (2013) Prescott, Harley and Klein's Microbiology. 9th edition. McGraw Hill Higher Education

B.Sc. MLT- VI Semester (III Year)

Course/Paper: Biostatics & Research Methodology

Paper Code: BML -S-606

L	T	P	C
3	0	0	3

Learning Objective: The objective of this course is to acknowledge, appreciate and effectively incorporate the basic statistical concepts indispensable for carrying out and understanding biological hypothesis, experimentation as well as validations.

Unit-I

Research Methodology – Definition of research, Characteristics of research, Steps involved in research process, Types of Research methods and methodology, Terminology used in quality control such as sensitivity, specificity, accuracy, precision, positive and negative predictive value.

Unit-II

Statistics, data, population, samples, parameters; Representation of Data: Tabular, Graphical, Measures of central tendency, Arithmetic mean, mode, median; Measures of dispersion, Range, mean deviation, variation, standard deviation, Standard error, Chi-square test

Unit-III

Introduction and significance of Student's t-distribution: test for single mean, difference of means and paired t- test, F-distribution, one-way and two-way analysis of variance (ANOVA).
Small sample test based on t-test, Z- test and F test; Confidence Interval; Distribution-free test

Unit-IV

Global Perspective in the field of Clinical Laboratory Science, Development, Training, Types of Laboratory, Concept of Lab Design, Organizational Set up of NABL, CAP

Unit-V

Total Quality Management System
General Requirements for Standardization & Calibration of Clinical Laboratories: Introduction, Scope & Need of standardization,
Quality Management requirement: testing & Calibration Procedures, Total Quality Assurance, Quality Control Charts & Systems.
Quality Audit: Internal & External Audit, Accreditation & Certification NABL, ISO, CAP

Learning outcome: Students would be able to analyze data, applications of biostatistics in biological sciences as well as quality management system in diagnostic laboratory.

Suggested Readings:

1. CR Kothari, (2004),Research Methodology & Biostatistics,2nd edition,New Age India Publishers
2. Rao S,(2012),Introduction to Biostatistics and Research Methods,5th edition, PHI Publishers
3. Biostatistical Analysis (2012) 4th edition, J.H. Pearson Publication U.S.A.

Practical Syllabus

B.Sc. MLT- VI Semester (III Year)

BML-S-651(Practical Clinical Endocrinology & Toxicology)

1. To determine T_3 conc. in serum sample.
2. To determine T_4 conc. in serum sample.
3. To determine TSH conc. in serum sample.
4. To determine LH conc. in serum sample.
5. To determine FSH conc. in serum sample.
6. To determine Prolactin conc. in serum sample.
7. To determine TSH conc. in serum sample.
8. To perform TRIPLE test.
9. Demonstration of male and female infertility test.
10. Beta HCG

BML-S-652 (Practical Advance Diagnostic Techniques)

1. To perform separation of amino acids by paper chromatography
2. To perform separation of amino acids by thin layer chromatography
3. To perform separation of DNA by Agarose gel electrophoresis.
4. Separation of protein by PAGE
5. Separation of protein by paper electrophoresis
6. Separation of haemoglobin

BML-S-653(Practical Diagnostic Molecular Biology)

1. Isolation of DNA
2. Separation of DNA by Agarose gel electrophoresis
3. Demonstration of thermal cycler and PCR.
4. HIV test by Western Blotting
5. To perform karyotyping
6. Demonstration of PCR HLA B-27
7. Demonstration of PCR HIV
8. Demonstration of PCR MTB

BML-S-654(Practical Medical Microbiology-II)

1. Staining of given sample for identification of microorganisms- Gram staining, ZN staining, Indian Ink staining, Albert staining
2. Preparation of Media, nutrient agar, Mac Conkey agar, blood agar, chocolate agar, Robertson cooked meat medium, Muller Hilton agar
3. Culturing of various sample
4. AST and reporting
5. Biochemical test to differentiate between Staphylococcus and Streptococcus
6. KOH preparation
7. LPCB mount

8. Culture and laboratory test for fungus identification

BML-S-655(Practical Clinical Virology)

1. To perform HBsAg/ Australia Ag by rapid method
2. To perform HBsAg by ELISA
3. To perform HIV Tridot method.
4. To perform HIV by ELISA
5. To perform Dengue IgG/IgM
6. To perform TORCH profile
7. Demonstration of PCR HBV
8. Demonstration of PCR HIV Viral load

BML-S-656: Hospital Posting

Students shall be deputed to various labs of Pathology department wherein they shall undergo practical training of handling patients, collection and processing of blood, urine, sputum stool and body fluids samples.

Identification of patient's particulars based on CR number, Lab Number and transfer of samples from collection centres to different labs. Process of performing various tests in different labs.

Each student is required to maintain a logbook of the various posting. Student's performance shall be evaluated on continuous basis by the faculty posted in various sections. The faculty shall submit the assessment records of each student posted in his/her section on monthly basis to the HOD. Marks will be awarded out of 100.