STUDY AND EVALUATION SCHEME

BACHELOR OF SCIENCE
IN
MEDICAL LAB
TECHNOLOGY (BSC-MLT)

ABHILASHI UNIVERSITY
CHAILCHOWK, MANDI (H.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 years (06 Semesters) full time.

Medium: English

Minimum Attendance Required: 75%

Total Credits: 156

Total Marks: 3900

Assessment:

	Internal	External	Total
Theory	40	60	100
Practical	20	30	50

Internal Evaluation (Theory papers):

Mid Term-I	Mid Term-II	Attendance	Assignment / work book assignments &viva	Total
10	10	10	10	40

Evaluation Practical's/Dissertations/Project Reports:

Internal	External	Total
20	30	50

Duration of Examinations:

Internal	External
2 Hrs	03Hrs

Internal Practical Evaluation (20 marks)

The Internal evaluation done by the Internal Examiner is based on the experiment performed during the internal examination.

Experiment	Attendance	Viva+Record	Total Internal
(10 MARKS)	(05 MARKS)	(05 MARKS)	(20 MARKS)

External Practical Evaluation (30 marks)

The external evaluation done by the External Examiner is based on the experiment performed during the external examination.

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

Internal Theory Assessment: 40

MST	Attendance	Assignments	Total
20Marks	10 marks	10 Marks	40 marks

Question Paper Structure (Theory External Examination):

Max. Marks in each theory paper will be of 60 marks. The question paper shall consist of nine questions. Out of which first question shall be of short answer type/ MCQ/ Fill in the blank/ True False (not exceeding 50 words) and will be compulsory of 20 marks. Question No. 1 shall contain 10 parts representing all units of the syllabus weightage 2 marks each. Out of the remaining eight questions divided in four sections, the student will attempt any one question from each section carrying 10 marks each.

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

Internship Time Period:

For evaluation of Professional Training, out of 650 marks, 250 will be awarded by the healthcare industry/ Hospital where the candidate has taken training. After taking 3 months, training from healthcare industry the candidate shall report to parent University where he/she will submit his/her project report and will attend the institute for rest of the semester period. Then at the end of the semester, he/she will appear for the Practical examinations in the presence of Internal & external Examiners.

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.	BSCMLT- 101	Human Anatomy	4	0	0	4	40	60	100
2.	BSCMLT- 102	Human Physiology-I	4	0	0	4	40	60	100
3.	BSCMLT- 103	Basic Haematology & Clinical Pathology	4	0	0	4	40	60	100
4.	BSCMLT- 104	Fundamentals of Biochemistry-I	4	0	0	4	40	60	100
5.	BSCMLT- 105	Preventive Medicine & Community Health Care	4	0	0	4	40	60	100
6.	BSCMLT- 151	Practical: Human Anatomy	0	0	4	2	20	30	50
7.	BSCMLT- 152	Practical: Human Physiology	0	0	4	2	20	30	50
8.	BSCMLT- 153	Practical: Basic Haematology & Clinical Pathology-I	0	0	4	2	20	30	50
		Total	**20**	**00**	**12**	**26**	**260**	**390**	**650**

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

S.No.	Course Code	Subject	Period			Credit	Evaluation Scheme		
			L	T	P		Internal	External	Total
1.	BSCMLT-201	Diagnostic Molecular Biology	4	0	0	4	40	60	100
2.	BSCMLT-202	Human Physiology-II	4	0	0	4	40	60	100
3.	BSCMLT-203	Clinical Endocrinology & Toxicology	4	0	0	4	40	60	100
4.	BSCMLT-204	Fundamentals of Biochemistry-II	4	0	0	4	40	60	100
5.	BSCMLT-205	Fundamentals of Computer	4	0	0	4	40	60	100
6.	BSCMLT-251	Practical: Basic Haematology & Clinical Pathology-II	0	0	4	2	20	30	50
7.	BSCMLT-252	Practical: Fundamentals of Biochemistry	0	0	4	2	20	30	50
8.	BSCMLT-253	Practical: Fundamentals of Computer	0	0	4	2	20	30	50
		Total	**20**	**00**	**12**	**26**	**260**	**390**	**650**

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

S.No.	Course Code	Subject	Period			Credit	Evaluation Scheme		
			L	T	P		Internal	External	Total
1.	BSCMLT-301	Clinical Haematology	4	0	0	4	40	60	100
2.	BSCMLT-302	Fundamentals of Microbiology-I	4	0	0	4	40	60	100
3.	BSCMLT-303	Immunology & Serology	4	0	0	4	40	60	100
4.	BSCMLT-304	Histopathology & Histotechniques -I	4	0	0	4	40	60	100
5.	BSCMLT-305	Environmental Sciences	4	0	0	4	40	60	100
6.	BSCMLT-351	Practical: Clinical Haematology	0	0	4	2	20	30	50
7.	BSCMLT-352	Practical: Fundamentals of Microbiology-I	0	0	4	2	20	30	50
8.	BSCMLT-353	Practical: Histopathology & Histotechniques	0	0	4	2	20	30	50
		Total	**20**	**00**	**12**	**26**	**260**	**390**	**650**

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

S.No.	Course Code	Subject	Period			Credit	Evaluation Scheme		
			L	T	P		Internal	External	Total
1.	BSCMLT-401	Clinical Biochemistry	4	0	0	4	40	60	100
2.	BSCMLT-402	Fundamentals of Microbiology-II	4	0	0	4	40	60	100
3.	BSCMLT-403	Advance Diagnostic Techniques	4	0	0	4	40	60	100
4.	BSCMLT-404	Histopathology & Histotechniques -II	4	0	0	4	40	60	100
5.	BSCMLT-405	General Pathology	4	0	0	4	40	60	100
6.	BSCMLT-451	Practical: Clinical Biochemistry	0	0	4	2	20	30	50
7.	BSCMLT-452	Practical: Fundamentals of Microbiology-II	0	0	4	2	20	30	50
8.	BSCMLT-453	Practical: Immunology & Serology	0	0	4	2	20	30	50
		Total	**20**	**00**	**12**	**26**	**260**	**390**	**650**

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

S.No.	Course Code	Subject	Period			Credit	Evaluation Scheme		
			L	T	P		Internal	External	Total
1.	BSCMLT-501	Immunohematology & Blood Banking	4	0	0	4	40	60	100
2.	BSCMLT-502	Clinical Enzymology & Automation	4	0	0	4	40	60	100
3.	BSCMLT-503	Parasitology	4	0	0	4	40	60	100
4.	BSCMLT-504	Diagnostic Cytology	4	0	0	4	40	60	100
5.	BSCMLT-505	Principles of Laboratory Management	4	0	0	4	40	60	100
6.	BSCMLT-551	Practical: Immunohematology & Blood Banking	0	0	4	2	20	30	50
7.	BSCMLT-552	Practical: Clinical Enzymology	0	0	4	2	20	30	50
8.	BSCMLT-553	Practical: Parasitology	0	0	4	2	20	30	50
		Total	**20**	**00**	**12**	**26**	**260**	**390**	**650**

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

S.No.	Course Code	Subject	Period			Credit	Evaluation Scheme		
			L	T	P		Internal	External	Total
1.	BSCMLT-601	Clinical Virology	4	0	0	4	40	60	100
2.	BSCMLT-602	Biostatistics & Research Methodology	4	0	0	4	40	60	100
3.	BSCMLT-651	Practical: Advance Techniques in Clinical Diagnosis	0	0	4	2	20	30	50
4.	BSCMLT-652	Practical: Clinical Virology	0	0	4	2	20	30	50
5.	BSCMLT-653	Professional Training (Three Months)	0	0	0	10	00	250	250
6.	BSCMLT-654	Project/ Training report and Presentation	0	0	0	4	00	100	100
		Total	**20**	**00**	**12**	**26**	**120**	**530**	**650**

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

Course Name: Human Anatomy

Course Code: BSCMLT-101

L	T	P	C
4	0	0	4

Unit -I

Human body parts, Structure, Terminology and General Plan of the Body,Terms of Location and Position, Body Cavities and Their Membranes, Dorsal cavity, Ventral cavity, Planes and Sections.

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

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

Unit-II

The Integumentary System: structure and function of The Skin, Subcutaneous Tissue.
Musculoskeletal System: Basic anatomy of important muscles and bones and their functions.

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

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

Unit-III

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

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

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

Special Senses: Basic anatomy of eye, ear and nose

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

Suggested Readings:

1. Chaurasia B D, (2016), Human Anatomy, 7th edition, CBS publishers
2. Ross & Wilson,(2014),Anatomy & Physiology in health & illness,11th edition, Elsevier Publications
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 Name: Human Physiology-I

Course Code: BSCMLT-102

L	T	P	C
4	0	0	4

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.

Blood-composition, function, cellular component & their function, haemoglobin & anaemia, blood groups and coagulation.

Unit-II

Lymphatic system: Composition & function of lymph, lymphatic tissue, Immunity with the role of thymus.

Cardiovascular system: heart structure and function, arteries, veins and capillaries, cardiac cycle, heart sounds, heart rate, blood pressure, mechanism of circulation, definition of hypertension & shock.

Unit-III

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- IV

Gastrointestinal physiology: Organs of GIT, 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.

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 Name: Basic Haematology and Clinical Pathology Paper

Code: BSCMLT-103

L	T	P	C
4	0	0	4

Unit- I

Introduction to Haematology, Organization of laboratory and safety measures, 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.

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-III

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

Unit-IV

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.
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

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

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	0	4

Course Name: Fundamentals of Biochemistry-I

Course Code: BSCMLT-104

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.
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-II

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-III

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- IV

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.

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 Name: Preventive Medicine & Community Health Care

Course Code: BSCMLT-105

L	T	P	C
4	0	0	4

Unit- I

Definition and concepts of health, important public health acts, health problems of developed and developing countries, environment and health, basic emergency care and first aid.

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

Unit-II

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-III

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-IV

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.

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-I Semester (I Year)

BSCMLT-151 (Practical: Human Anatomy)

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

BSCMLT-152 (Practical: Human Physiology)

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.

BSCMLT-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

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

Course Name: Diagnostic Molecular Biology

Paper Code: BSCMLT-201

L	T	P	C
4	0	0	4

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

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

Unit-III

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-IV

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

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- II Semester (I Year)

L	T	P	C
4	0	0	4

Course Name: Human Physiology-II

Course Code: BSCMLT-202

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

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

Unit-II

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- III

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

Unit-IV

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

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)

Course Name: Clinical Endocrinology & Toxicology

Paper Code: BSCMLT-203

L	T	P	C
4	0	0	4

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

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.

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- II Semester (I Year)

Course Name: Fundamentals of Biochemistry -II

Course Code: BSCMLT-204

L	T	P	C
4	0	0	4

Unit-I

Carbohydrates: Classification, function, importance, structure, digestion & absorption.
Proteins: Classification, function, importance, structure, digestion & absorption.
Amino acids: Classification, Structure, Properties and Biological functions.

Unit-II

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-III

Lipids: Classification of lipids, Classification of fatty acids, Saturated & Unsaturated fatty acids, their biological functions, digestion and absorption, introduction of lipoproteins

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

Unit-IV

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

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
4	0	0	4

Course Name: Fundamentals of Computer

Course Code: BSCMLT-205

Unit-I

Introduction to computer: Introduction and 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.).

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.

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.

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

Practical syllabus

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

BSCMLT-251 (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.

BSCMLT-252 (Practical: Fundamentals of Biochemistry)

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 method.
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

BSCMLT-253 (Practical: Fundamentals of Computer)

1. Using basic DOS commands.
2. Using external DOS commands
3. Creating an 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.

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

L	T	P	C
4	0	0	4

Course Name: Clinical Haematology

Paper Code: BSCMLT-301

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

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-IV

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.

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- IIIrd Semester (IInd Year)

L	T	P	C
4	0	0	4

Course Name: Fundamentals of Microbiology-I

Paper Code: BSCMLT-302

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

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.

Unit-IV

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

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 Name: Immunology & Serology

Paper Code: BSCMLT-303

L	T	P	C
4	0	0	4

Unit-I

Immune system, innate and adaptive immunity; active and passive immunity; primary and secondary immune response. Cell and organs of immune system, Phagocytosis.

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, Introduction of hybridoma technology, monoclonal antibodies, polyclonal antibody

Unit-II

Mechanism of humoral and cell mediated immune response, Major Histocompatibility Complex, organization of MHC and inheritance in humans; Antigen presenting cells, antigen processing and presentation, Complement system and complement fixation test.

Laboratory tests for demonstration of antigen – antibody reaction such as agglutination, precipitation, ELISA, RIA, Immunofluorescence, Rheumatological diseases, etiology and pathogenesis and lab investigations

Unit- III

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

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

Unit –IV

Autoimmune disorders, pathogenesis, parietal cell antibody, anti sperm antibody, lupus anticoagulants, anti mitochondrial antibody, ANA, ds DNA, HLA-B27, ASMA, anti CCP

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

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

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 Name: Histopathology & Histotechniques-I

Paper Code: BSCMLT-304

L	T	P	C
4	0	0	4

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

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

Unit-IV

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

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

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)

L	T	P	C
4	0	0	4

Course Name: Environmental Sciences

Course Code: BSCMLT-305

Unit-I

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.
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.

Unit-II
Biodiversity: Hot Spots of Biodiversity in India and World, Conservation, Importance and Factors Responsible for Loss of Biodiversity, Biogeographical Classification of India
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 III

Environmental policies & practices: Climate change, Global Warming, Green house Effect, Ozone Layer, 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 IV

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; Casestudies.

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.

Suggested Readings:

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

Practical syllabus

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

BSCMLT-351 (Practical: Clinical Haematology)

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.

BSCMLT-352 (Practical: Fundamentals of Microbiology-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.

BSCMLT-353 (Practical: Histopathology & Histotechniques)

1. Demonstration of glasswares 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.

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

Course Name: Clinical Biochemistry

Paper Code: BSCMLT-401

L	T	P	C
4	0	0	4

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

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

Unit-III

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

Tumour markers: Introduction, types, applications

Unit-IV

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

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 Name: Fundamentals of Microbiology-II

Paper Code: BSCMLT-402

L	T	P	C
4	0	0	4

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.

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

Unit-II

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-III

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-IV

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

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 (II Year)

Course Name: Advance Diagnostic Techniques

Paper Code: BSCMLT-403

L	T	P	C
4	0	0	4

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

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

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- IV Semester (II Year)

L	T	P	C
4	0	0	4

Course Name: Histopathology & Histotechniques-II

Paper Code: BSCMLT-404

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, Demonstration of sex chromatin, Museum techniques

Unit-IV

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

Fluorescence Microscope: Principle and working, Immunohistochemistry: principle, types,

applications, antigen retrieval, APAAP, PAP Staining, Quality control in histopathology

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 Name: General Pathology

Paper Code: BSCMLT-405

L	T	P	C
4	0	0	4

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

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

Unit III

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

Unit IV

Infectious Diseases: pathogenesis & overview of modes of infections, prevention and control with suitable examples like Typhoid, Dengue

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.

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)

BSCMLT-451 (Practical: Clinical Biochemistry)

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.

BSCMLT-452 (Practical: 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

BSCMLT-453 (Practical: Immunology & Serology)

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

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

Course Name: Immunohematology & Blood Banking

Paper Code: BSCMLT-501

L	T	P	C
4	0	0	4

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

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.

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)

Course Name: Clinical Enzymology & Automation

Paper Code: BSCMLT-502

L	T	P	C
4	0	0	4

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

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

Unit-IV

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

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 Name: Parasitology

Paper Code: BSCMLT-503

L	T	P	C
4	0	0	4

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

Unit-IV

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

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 Name: Diagnostic Cytology

Paper Code: BSCMLT-504

L	T	P	C
4	0	0	4

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

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-IV

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

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 Name: Principles of Laboratory Management Paper

Code: BSCMLT-505

L	T	P	C
4	0	0	4

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
Awareness/Safety in a clinical laboratory, General safety precautions.

Unit-II

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

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-III

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-IV

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

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)

BSCMLT-551 (Practical: Immunohematology & Blood Banking)

1. Demonstration of apparatus and equipment's 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

BSCMLT-552 (Practical: Clinical Enzymology)

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

BSCMLT- 553 (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

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

L	T	P	C
4	0	0	4

Course Name: Clinical Virology

Paper Code: BSCMLT- 601

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

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- III

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-IV

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

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 Name: Biostatics & Research Methodology

Paper Code: BSCMLT-602

L	T	P	C
4	0	0	4

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

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-IV

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

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)

BSCMLT-651 (Practical: Advance Techniques in Clinical Diagnosis)

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

BSCMLT-652 (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