

UNIVERSITY OF MUMBAI

No. UG/ 107 of 2015-16

CIRCULAR:-

A reference is invited to the Syllabi relating to the Bachelor of Vocation program in various faculties vide this Circular No UG/33 of 2014, dated 11th November, 2014 and the Principals of the affiliated Colleges in Arts, Science & Commerce and the Heads of recognized Institutions concerned are hereby informed that the recommendation made by the Faculty of Science at its meeting held on 11th August, 2015 has been accepted by the Academic Council at its meeting held 31st August, 2015 **vide** item No.4.8 and that in accordance therewith, the revised syllabus as per the Credit Based Semester and Grading System for the Bachelor of Vocation program in faculties of Arts/Commerce/Science in the course of Medical Laboratory Technology (Sem.I to VI), which are available on the University's web site (www.mu.ac.in) and that the same has been brought into force with effect from the academic year 2015-16.

MUMBAI – 400 032
15th October, 2015

REGISTRAR

To,

The Principals of the affiliated Colleges Arts, Science & Commerce and the Heads of Recognized Institutions concerned.

A.C/4.8/31/08/2015

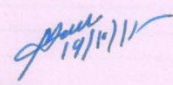
No. UG/ 107 -A of 2015

MUMBAI-400 032

15th October, 2015

Copy forwarded with Compliments for information to:-

- 1) The Deans, faculties of Arts, Science & Commerce,
- 2) The Professor-cum-Director, Institute of Distance & Open Learning (IDOL)
- 3) The Director, Board of College and University Development,
- 4) The Co-Ordinator, University Computerization Centre,
- 5) The Controller of Examinations.


REGISTRAR

Vidya Vikas Education Society's
Vikas Night College of Arts, Science and Commerce
Kannamwar Nagar-2, Vikhroli (East), Mumbai 400083

Bachelor of Vocation (Medical Laboratory Technology)

B.Voc. (MLT) Syllabus

Year 1 (Diploma)

Semester I

Course Code	Component	Unit	Topic	Credits	L / Week
BMLT101 (General & Human Anatomy , Physiology –I)	Skill	I	Basics of Human Anatomy-I	04	01
	Skill	II	Basics of Physiology-I		01
	Skill	III	Basic English		01
	Skill	IV	Human Values and Professional Ethics		01
BMLT102 (Routine Laboratory Techniques-I)	Skill	I	Human Healthcare and Safety Regulations	04	01
	Skill	II	Introduction to Haematology and Routine tests		01
	Skill	III	Specimen Collection		01
	Skill	IV	Laboratory Preparation in Hematology		01
BMLT103 (Special Laboratory Techniques-I)	Skill	I	Biochemical Test Profile -I	04	01
	Skill	II	Biochemical Test Profile – II		01
	Skill	III	Elementary Knowledge of Chemistry- I		01
	Skill	IV	Elementary Knowledge of Chemistry- II		01
BMLT104 (Cell Biology and Biodiversity–I)	General	I	Microscopy and Organization of Cell -I	03	01
	General	II	Microscopy and Organization of Cell -II		01
	General	III	Systematic study of Animals - I		01
	General	IV	Systematic study of Animals - II		01
BMLT105 (Biomolecules)	General	I	Structure, Functions and Classification of Amino Acids and Proteins	03	01
	General	II	Structure, Functions and Classification of Carbohydrates		01
	General	III	Structure, Functions and Classification of Lipids		01
	General	IV	Physical and Chemical Properties of Nucleic Acids		01
BMLT106 (Fundamentals of Microbiology)	General	I	Introductory Microbiology-1	03	01
	General	II	Morphology and Structure of Microorganisms		01
	General	III	Recombinant DNA Technology		01
	General	IV	Microbial Ecology and Biotic Interactions		01
BMLTP101			Practicals of Course BMLT101	02	06
BMLTP102			Practicals of Course BMLT102	02	06
BMLTP103			Practicals of Course BMLT103	02	06
BMLTP104			Practicals of Course BMLT104	01	06
BMLTP105			Practicals of Course BMLT105	01	06
BMLTP106			Practicals of Course BMLT106	01	06
Total Credits				30	

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**B.Voc. (MLT) Syllabus
Year 1 (Diploma)**

Semester II

Course Code	Component	Unit	Topic	Credits	L / Week
BMLT107 (General & Human Anatomy , Physiology – II)	Skill	I	Basics of Human Anatomy-II	04	01
	Skill	II	Basics of Physiology-II		01
	Skill	III	Basics of Computer Skills		01
	Skill	IV	Communication Skills		01
BMLT108 (Routine Laboratory Techniques-II)	Skill	I	Routinue Haematological Tests	04	01
	Skill	II	Urine Examination		01
	Skill	III	Stool Examination		01
	Skill	IV	Sputum and Semen Examination		01
BMLT109 (Special Laboratory Techniques-II)	Skill	I	Basic Microbiology	04	01
	Skill	II	Introduction to serology		01
	Skill	III	Serological Tests		01
	Skill	IV	Staining Techniques		01
BMLT110 (Ecology and Biodiversity-II)	General	I	Systematic study of Animals - III	03	01
	General	II	Systematic study of Animals - IV		01
	General	III	Ecosystem-I		01
	General	IV	Ecosystem-II		01
BMLT111 (Enzymology and Bioenergetics)	General	I	Enzymes	03	01
	General	II	Enzyme Purification and Chromatography Techniques		01
	General	III	Enzyme Kinetics		01
	General	IV	Bioenergetics		01
BMLT112 Microbial Physiology - Metabolism	General	I	Microbial Nutrition, Cultivation, Isolation and Preservation	03	01
	General	II	Enzyme Regulation		01
	General	III	Microbial Metabolism -I		01
	General	IV	Microbial Metabolism -II		01
BMLTP107			Practicals of Course BMLT107	02	06
BMLTP108			Practicals of Course BMLT108	02	06
BMLTP109			Practicals of Course BMLT109	02	06
BMLTP110			Practicals of Course BMLT110	01	06
BMLTP111			Practicals of Course BMLT111	01	06
BMLTP112			Practicals of Course BMLT112	01	06
Total Credits				30	
On Job Training					

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B.Voc. (MLT) Syllabus

Year 2 (Advanced Diploma)

Semester III

Course Code	Component	Unit	Topic	Credits	L / Week
BMLT201 (Hematology and Blood Banking-I)	Skill	I	Special Heamatological Tests	04	01
	Skill	II	Haemostasis & Bleeding Disorders		01
	Skill	III	Immunohaematology & Blood Transfusion		01
	Skill	IV	Routine Lab Procedures in Blood Bank		01
BMLT202 (Microbiology and Serology)	Skill	I	Laboratory Diagnosis of Mycotic and Emerging Infections	04	01
	Skill	II	Diagnostic Microbiology		01
	Skill	III	Serology		01
	Skill	IV	Bacteriology		01
BMLT203 (Clinical Pathology and Biochemistry)	Skill	I	Miscellaneous Body Fluids	04	01
	Skill	II	Biochemical Test Profile		01
	Skill	III	Analytical Techniques		01
	Skill	IV	Biochemical Processes		01
BMLT204 (Metabolism)	General	I	Carbohydrate Metabolism	04	01
	General	II	Lipid Metabolism		01
	General	III	Protein Metabolism		01
	General	IV	Nucleic Acids		01
BMLT205 (Pathogenic Microbiology)	General	I	Infectious Diseases	04	01
	General	II	Microbes of Medical Importance		01
	General	III	Mode of Microbial Infections		01
	General	IV	Antimicrobial Drugs		01
BMLTP201			Practicals of Course BMLT201	02	06
BMLTP202			Practicals of Course BMLT202	02	06
BMLTP203			Practicals of Course BMLT203	02	06
BMLTP204			Practicals of Course BMLT204	02	06
BMLTP205			Practicals of Course BMLT205	02	06
Total Credits				30	

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B.Voc. (MLT) Syllabus

Year 2 (Advanced Diploma)

Semester IV

Course Code	Component	Unit	Topic	Credits	L / Week
BMLT206 (Clinical Biochemistry and Microbiology-I)	Skill	I	Metabolic Disorders & Deficiency	04	01
	Skill	II	Clinical Endocrinology		01
	Skill	III	Body Fluid Specimen Processing		01
	Skill	IV	Blood Banking		01
BMLT207 (Histology-Cytology –I)	Skill	I	Introduction to Histology	04	01
	Skill	II	Tissue Processing		01
	Skill	III	Staining Procedures		01
	Skill	IV	Instrumentation in Histocytotechnology		01
BMLT208 (Parasitology and Blood Cell Disorders-I)	Skill	I	Medical Parasitology	04	01
	Skill	II	Common Intestinal worms		01
	Skill	III	Malarial parasites, Filarial parasites		01
	Skill	IV	Lab. diagnosis of Parasitic infections		01
BMLT209 (Biochemical Techniques)	General	I	Spectroscopic Techniques	04	01
	General	II	Electrophoretic Techniques		01
	General	III	Chromatographic Techniques		01
	General	IV	Radio Isotopic Techniques		01
BMLT210 (Immunology)	General	I	Introduction to Immunology	04	01
	General	II	Humoral Immunity		01
	General	III	Cell Mediated Immunity		01
	General	IV	Antigen-Antibody Interactions		01
BMLTP206			Practicals of Course BMLT206	02	06
BMLTP207			Practicals of Course BMLT207	02	06
BMLTP208			Practicals of Course BMLT208	02	06
BMLTP209			Practicals of Course BMLT209	02	06
BMLTP210			Practicals of Course BMLT210	02	06
Total Credits				30	
On Job Training					

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Bachelor of Vocation (Medical Laboratory Technology)

**B.Voc. (MLT) Syllabus
Year 3 (B.Voc. Degree)**

Semester V

Course Code	Component	Unit	Topic	Credits	L / Week
BMLT301 (Medical Genetics and Microbiology-II)	Skill	I	Genetics	04	01
	Skill	II	CLIA techniques		01
	Skill	III	Immunology and Virology		01
	Skill	IV	Toxicology		01
BMLT302 (Histology- Cytology –II)	Skill	I	Exfoliative Cytology-Specimen Preparation	04	01
	Skill	II	Exfoliative Cytology- Staining Techniques		01
	Skill	III	Exfoliative Cytology- Benign and Malignant Cells		01
	Skill	IV	Advanced Instrumentation		01
BMLT303 (Parasitology and Blood Cell Disorders-II)	Skill	I	Descriptive study of RBC abnormalities	04	01
	Skill	II	Disorders related to RBC		01
	Skill	III	Normal White Cell Count & Physiological variation		01
	Skill	IV	Disorders related to WBC		01
BMLT304 (Pathogenic Microbiology)	General	I	Pathogenic Microbes, Diagnosis, Prevention and Control	10	01
	General	II	Prevention and Control of Viral Diseases		01
	General	III	Human Mycotic Infections		01
	General	IV	Mechanisms and Control of Parasitic Infections		01
BMLTP301			Practicals of Course BMLT301	02	06
BMLTP302			Practicals of Course BMLT302	02	06
BMLTP303			Practicals of Course BMLT303	02	06
BMLTP304			Practicals of Course BMLT304	02	06
Total Credits				30	

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B.Voc. (MLT) Syllabus

Year 3 (B.Voc. Degree)

Semester VI

Course Code	Component	Unit	Topic	Credits	L / Week
BMLT305 (Clinical Laboratory Operations and Management)	Skill	I	Clinical Laboratory Operations and Management	04	04
BMLT306 (Professional Training)	Skill	I	Professional Training for three (3) months at reputed hospital, diagnostic centre, pathology laboratory, research institute, pharmaceutical industry, etc.	04	---
BMLT307 (Project Work)	Skill	I	Student shall carry out the project work in consultation with faculty and industrial partner organizations.	04	---
BMLT308 (Food and Industrial Microbiology)	General	I	Food Microbiology	10	01
	General	II	Contamination, Preservation and Spoilage of Food		01
	General	III	Production Strains Isolation and Screening Techniques		01
	General	IV	Fermentation Products		01
BMLTP305			Practicals of Course BMLT305	02	06
BMLTP306			Practicals of Course BMLT306	02	06
BMLTP307			Practicals of Course BMLT307	02	06
BMLTP308			Practicals of Course BMLT308	02	06
Total Credits				30	

EXAMINATION AND ASSESSMENTS FOR B.VOC. (M.L.T.):

1. General Guidelines

The Credits are defined in terms of the learner's hours which are divided into two parts such as Actual and Notional. The value of a particular course can be measured in number of Credit Points. The value of One (01) Credit is equal to 15 Hours of learners load.

The scheme of Examination shall be divided into two parts i.e. Internal Assessment includes Assignments, Seminars, Case Studies and Unit Tests which will be of 25 marks and the Semester End Examinations which will be of 75 marks. The semester wise Credit Points will be varied from program to program but the value of Credits for Under Graduate Programmes shall be of 180 Credits.

2. Credit Based Evaluation System

Scheme of Examination

For all 6 semesters, the performance of the learners shall be evaluated into two components. The first component shall carry 25% marks which will be an internal assessment while the second component shall carry 75% marks at semester end examination.

The allocation of marks for the Internal Assessment 25% and Semester End Examinations 75% are as shown below:

General Education Component Examination Pattern (Semester)

A) Internal Assessment (25%) = 25 Marks

- One periodical test on class instructions **20 Marks**
- Active participation (attentiveness/ability to answer questions) **05 Marks**

B) Theory External Examination (75%) = 75 Marks

i) **Duration:** These examinations shall be of 2^{1/2} Hours duration for each paper

ii) **Theory Question Paper Pattern:**

- There shall be five questions each of 15 marks. On each unit there will be one question and the fifth one will be based on entire syllabus.
- All questions shall be compulsory with internal choice within the questions.
(Each question will be of 20 to 23 marks with options)
- Question may be subdivided into sub questions a, b, c.... and the allocation of marks depend on the weightage of the topic.

C) Practical External Examination = 50 Marks for each paper

Skill Component Examination Pattern:-

Skill Component UGC Assessment of B.Voc. MLT will be done by Health Care Sector Skill Council under National Skill Development Corporation (NSDC), New Delhi as per UGC Guidelines.

The Certification will be jointly by NSDC and University of Mumbai.

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B.Voc. (MLT) Syllabus

Year 1 (Diploma)

Semester I

Part A: Skill Component

Course Code	Title	Credits	NOS
BMLT 101	General & Human Anatomy , Physiology -I	04	
	Basics of Human Anatomy-I		
Unit I	Introduction to: Anatomy, epithelial tissue, muscular tissue, nervous tissue. Skeletal System, Structure of bones, types of bones, Bones of cranium, face vertebral column upper and lower limbs.		HSS/N0302/N0304/N0305
	Circulation System: Structure of heart, names and position of main blood vessels.		HSS/N0302/N0304/N0305
	Lymphatic System: Lymph vessels, lymph nodes and lymphoid organs, their structure & functions.		HSS/N0302/N0304/N0305
	Digestive systems.: Parts of gastrointestinal tract and associated glands.(names)		HSS/N0302/N0304/N0305
	Respiratory System:.. Parts of Respiratory System.(diagram ,Name, function)		HSS/N0302/N0304/N0305
Unit II	Basics of Physiology- I		
	Blood. Composition and function of blood, haemopoiesis, blood coagulation. Blood groups, body fluid. Cardiovascular Systems. Circulation of blood. function of heart and blood vessels. Control of heart rate, blood volume.(Diagram of heart and Functions in details)		HSS/N0302/N0304/N0305
	Respiratory system.: Function of lungs, (theory) Respiration disorders like anoxia.dyspnea . (Theory) lung function tests.(theory)		HSS/N0302/N0304/N0305
	Digestive Systems:.. Digestion of food in mouth, stomach & small intestines. Absorption of food, function of liver. (formation of bilirubin & other functions in detail)		HSS/N0302/N0304/N0305
	Basic English		
	Grammar		
	Use of Articles and Prepositions, Tense, Transformation of		HSS/N9603/N960

Unit III	Sentences, Parts of Speech, Idioms and Phrases, Vocabulary a) Synonyms b) Antonyms c) One Word Substitution d) Homophones & Homonyms, Punctuations, Common Errors, Spelling in English		4/N9605/N9607
	Composition		
	Formal & Informal Writing, Precise, Essay Writing, Report Writing,		HSS/N9603/N9604/N9605/N9607
	Reading Comprehension		HSS/N9603/N9604/N9605/N9607
Unit IV	Human Values and Professional Ethics		
	Introduction		
	Need, basic guidelines, content and process for Value Education, Self Exploration- its content and process; ‘Natural Acceptance’ and Experiential Validation- as the mechanism for self exploration. Continuous Happiness and Prosperity- basic Human Aspirations, Right , Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority, Happiness and Prosperity .A critical appraisal of the current scenario, Method to fulfill the above human aspirations: understanding and living in harmony at various levels		
	Implications of Harmony on Professional Ethics		
	Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order , Competence in professional ethics: Ability to utilize the professional competence for augmenting universal human order, Ability to identify the scope and characteristics of people-friendly and ecofriendly production systems, Ability to identify and develop appropriate technologies and management patterns for above production systems, Case studies of typical holistic technologies, management models and production systems, Strategy for transition from the present state to Universal Human Order: at the level of individual: as socially and ecologically responsible engineers, technologists and managers, at the level of society: as mutually enriching institutions and organizations		

Course Code	Title	Credits	NOS
BMLT 102	Routine Laboratory Techniques-I	04	
Unit I	Human Healthcare and Safety Regulations		
	Basic causes of accidents, common types of laboratory accidents. First aid in laboratory		HSS/N0301/N0303/N9606
	Human health and Homeostasis, medical care in India, Medical Laboratories of developing countries, Importance of Biomedical Waste. NABL and SOP		HSS/N0301/N0303/N9606
	Organization of Laboratory		
	Functional components of clinical laboratories,(cleanliness, precautions to be taken WRT patients ,reports, analysis. Communication between physician ,patients, and the medical laboratory professional, basic needs of clinical laboratory technician, awareness of soft skills,.		HSS/N0301/N0303/N9606
	Basic Laboratory Equipments		
	Identification, use, maintenance and care of common laboratory glassware and equipments, handling of all glassware ,use, principle and care of centrifuge, colorimeter, oven, incubator, microscope, Newber's chamber, Autoclave.etc .		HSS/N0301/N0302/N0303/N0307/N9606
	Automation		
	Semiautoanalysers		HSS/N0303
Unit II	Introduction to Haematology and Routine tests		
	Components of blood and their functions, Haematopoietic systems of the body		HSS/N0302/N0304
	Haematological Diseases		
	Anaemia and various types of anemias, Thalassemias, Polycythemia, Leukemia, hemolytic disease of new born,multiple myeloma, parasitic infections of blood		HSS/N0301/N0302/N0304
Unit III	Specimen Collection		
	Specimen collection for hematological studies		HSS/N0301/N0302/N0303
Unit IV	Laboratory Preparation in Hematology		
	Cleaning of Laboratory glassware in hematology		HSS//N0303

Course Code	Title	Credits	NOS
BMLT103	Special Laboratory Techniques-I	04	
	Biochemical Test Profile - I (Quantitative determination of blood, plasma and serum)		

Unit I	Acid Phosphatase (ACP), Alkaline Phosphatase (ALP), Amino acids, Bilirubin, Cholesterol, Creatinine, Creatine Phosphokinase (CPK), SGOT, SGPT, Uric Acid, Urea, TSH		HSS/N0301/N0302/N0304
	Biochemical Test Profile (Quantitative determination of Urine)		
	Amylase, Calcium, Chlorides, Creatinine, Sodium, Potassium, Glucose, Proteins, Urea nitrogen, uric acid		HSS/N0301/N0302/N0304
Unit II	Biochemical Test Profile – II (Quantitative determination of CSF)		
	Chlorides, Glucose, Proteins		HSS/N0301/N0302/N0304
	Sterilization Techniques		
	Definition & Methods, principles, bacteriological filtration, irradiation, tyndalization		HSS/N0301/N0302/N0304
	Elementary Knowledge of Chemistry- I		
Unit III	Elementary Knowledge of Inorganic Chemistry		
	Structure of atom, atomic weight, molecular and equivalent weight. Acids, bases and salts. pH indicators (pH meter, pH paper, universal indicator). Molar solutions, normal solutions, buffer solutions, percent solutions, saturated solutions, standard solutions		HSS/N0301/N0302/N0304/ N9602
	Elementary Knowledge of Organic Chemistry		
	Organic compounds, aliphatic, aromatic, alcohol, ethers, phenols, acids, etc.		HSS/N0301/N0302/N0304/ N9602
	Elementary Knowledge of Chemistry- II		
Unit IV	Elementary Knowledge of Physical Chemistry		
	Osmosis, osmotic pressure, diffusion, hypotonic, hypertonic and isotonic solutions. Definition and classification of some colloids and crystalloids.		HSS/N0301/N0302/N0304/ N9602
	Elementary Knowledge of Analytical Chemistry		
	Principles, instrumentation, working, uses, care, maintenance : balances, - monopan, twopan, toppan, centrifuges, pH meter, colorimeter, spectrophotometer, fluorimeter, flame photometer, ion selective electrodes, urinometer, chromatograph, electrophoresis, densitometer.		HSS/N0301/N0302/N0304/ N9602

Part B: General Education Component

SUBJECT: ZOOLOGY

Course Code	Title	Credits	NOS
BMLT 104	Cell Biology and Biodiversity –I	03	
UNIT I	Microscopy and Organization of Cell -I		
	Methods in Cell Biology : Principles of light and electron microscopes, fixation & fixatives, staining techniques. Organisation of Cell : Extra nuclear and nuclear. Plasma : Structure, Osmosis, active and passive transport, endocytosis and exocytosis Endoplasmic reticulum: Structure, types and associated enzymes. Mitochondria Structure, mitochondrial enzymes and the role of mitochondria in respiration and mitochondrial DNA. Golgi complex : Structure and functions. .		
UNIT II	Microscopy and Organization of Cell -II		
	Ribosomes : Types of ribosomes, their structure and functions. Lysosomes : Polymorphism and their function Centrosome : Structure and functions. Nucleus : Structure and functions of nuclear membrane, nucleolus and chromosomes. An elementary idea of cell transformation in Cancer. An elementary idea of cellular basis of immunity.		
UNIT III	Systematic study of Animals - I		
	Detailed study of the following animal types : Protozoa : Amoeba, Paramecium and Plasmodium. Protozoa (Porifera) : Sycon, Cnidaria (Coelenterata): Obelia Classification upto orders with brief ecological note and economic importance (if any) of the following: Protozoa : Entamoeba, Trypanosoma, Giardia, Noctiluca, Eimeria, Opalina, Vorticella, Balantidium and Nyctotherus. Parazoa (Porifera) : Grantia, Euplectella, Hyalonema and Spongilla. Cnidaria (Coelenterata) : Hydra, Sertularia, Plumularia, Obelia, Tubularia, Bougainvillea, Porpita, Velella, Physalia, Rhizostoma, Millipora, Aurelia, Alcyonium, Tubipora, Zoanthus, Metridium, Madrepora, Favia, Fungia and Astrangia.		

UNIT IV	Systematic study of Animals - II		
	Detailed study of the following animal types : Platyhelminthes: Fasciola, Taenia Aschelminthes : Ascaris, Parasitic adaptations in Helminths. Annelida : Pheretima Classification upto orders with brief ecological note and economic importance (if any) of the following: Platyhelminthes : Dugesia, Schistosoma and Echinococcus. Aschelminthes: : Ascaris, Oxyuris, Wuchereria. Annelida: Nereis, Polynoe, Eunice, Arenicola, Aphrodite, Amphitrite, Chaetopterus, Tubifex and Pontobdella.		

SUBJECT: BIOCHEMISTRY

Course Code	Title	Credits	NOS
BMLT 105	Biomolecules	03	
	Structure, Functions and Classification of Amino Acids and Proteins		
UNIT I	Amino Acids & Proteins : Introduction to Bio-chemistry. Water as a biological solvent. Dissociation of water. Buffer solution. Henderson Hasselbalch equation. Amino Acids : Common structural features. Stereoisomerism and RS system of designating optical isomers. Classification based on the nature of “R” groups. Amino acids present in proteins and non-protein amino acids. Specialized role of amino acids. Physical and Chemical properties of amino acids. Titration of amino acids. Peptide Bonds : Rigid and planar nature of a peptide bond. Folding of peptide chains into regular repeating structures (helix, pleated sheets). turn in polypeptides. Chemical synthesis of polypeptides. Biologically active peptides. Proteins : Levels of protein structure. Determination of primary structure of proteins. Forces stabilising structure and shape of proteins. Native proteins and their conformations. Behaviour of proteins in solutions. Salting in & salting out of proteins. Denaturation of proteins.		

	Structural and functional diversity of proteins, fibrous proteins (keratins, collagen & elastin), globular proteins (hemoglobin, myoglobin) and conjugated proteins.		
UNIT II	Structure, Functions and Classification of Carbohydrates		
	Carbohydrates : Definition and classification of carbohydrates. Fischer and Haworth structures of carbohydrates. Stereoisomerism, and mutarotation. Anomeric forms of monosaccharides. Derivatives of monosaccharides (glycosides, deoxysugars, amino sugars and other derivatives of biological importance). Oligosaccharides (structure of maltose, lactose, sucrose, cellobiose, trehalose, raffinose). Characteristic reactions of monosaccharides : Reactions with hydrazine, hydrogen cyanide, hydroxylamine; reduction and oxidation of sugars; periodic acid oxidation; action of alkali upon sugars; acylation and methylation of sugars. Homo-and hetero-polysaccharides (structures of amylose, amylopectin, starch, inulin, pectins, dextrans, glycogen, cellulose, chitin). (GAGs) as components of connective tissue. Polysaccharides of bacterial cell wall.		
UNIT III	Structure, Functions and Classification of Lipids		
	Lipids : Definition and classification of fatty acids (saturated and unsaturated). Essential fatty acids. Important reactions of functional groups present in fatty acids. Characteristics of fatty acids and fats (saponification, iodine, acid, acetyl and peroxide values). Refractive index, m. p., b. p. and their relation to molecular size. Properties of glycerol. Fats as source of energy. Waxes. Structures, characteristics and functions of lipids : Triacylglycerols, phospholipids : lecithins (Phosphatidyl Choline), lysolecithins, cephalins (Phosphatidyl ethanolamines), Phosphatidyl serines, phosphatidyl inositol, sphingomyelins, plasmalogens), cerebroside, gangliosides, sulfatides. Lipoproteins—Composition, classification and biological		

	functions. Liposomes. Terpenes and Steroids—Terpenes of biological significance e.g. carotenes, phytol. Cholesterol and other animal sterols. Colour reactions of sterols. Sterols of yeast and fungi (Mycosterols). Phytosterols. Steroidal hormones. Bile acids. Structure and properties of Eicosanoids - Prostaglandins, Leukotrienes, Thromboxanes, Prostacyclins. Structure, sources and biochemical functions of fat soluble vitamins.		
UNIT IV	Physical and Chemical Properties of Nucleic Acids		
	Nucleic Acid and Porphyrins : Nucleic Acids : Structure and properties of purine and pyrimidine bases. Nucleosides and nucleotides. Biologically important nucleotides. Double helical model of DNA and forces responsible for it. Shorthand representation of polynucleotides. Denaturation of DNA. Physical and chemical properties of nucleic acids. Methods for isolation, purification and characterization of nucleic acids. Chemical and enzymatic hydrolysis of nucleic acids. Sequencing of polynucleotides. Porphyrins : Porphyrin nucleus and classification of porphyrins. Heme and other metalloporphyrins occurring in nature. Detection of Porphyrins spectrophotometrically and by fluorescence. Chemical nature and physiological significance of bile pigments.		

SUBJECT: MICROBIOLOGY

Course Code	Title	Credits	NOS
BMLT 106	Fundamentals of Microbiology	03	
UNIT I	Introductory Microbiology		
	History, development, scope and applications of Microbiology. Methods of Microbiology isolation of pure cultures, theory and practice of sterilization. Microscopic examination of micro-organism, bright		

	field microscopy, dark field microscopy, phase contrast microscopy, electron microscopy. Staining of microbes, theory of Gram staining. Nature of Microbial World : Prokaryotes and eucaryotes, growth pattern in microbes		
	Morphology and Structure of Microorganisms		
UNIT II	Morphology & fine structure of bacteria, fungi, actinomycete and algae. Organization of cell wall, cell membrane, flagella and capsules in bacteria. Morphogenesis in bacteria, formation of spores and cysts. Animal Viruses : Morphology, cultivation and viral disease cycle. Bacteriophages : Morphology, multiplication, detection and enumeration. Biotransformation of (a) D-Sorbitol to L-Sorbose. (b) Antibiotics. (c) Steroids.		
	Recombinant DNA Technology		
UNIT III	Recombinant DNA technology, genetic engineering and gene cloning in micro-organisms. Strategies of genetic engineering. Restriction enzymes, vectors, plasmids. Genetic engineering for human welfare : (a) Production of pharmaceuticals. (b) Insect pest control. (c) Use of Genetically Engineered Micro-organisms (GEMs) for control of pollution		
	Microbial Ecology and Biotic Interactions		
UNIT IV	Rhizosphere & Rhizoplane micro-organisms, reasons for increased microbial activity in rhizosphere. Biogeochemical Cycling—Carbon cycle, Nitrogen cycle, Phosphorus & Sulphur cycle. Symbiotic & non-symbiotic Nitrogen fixation biofertilisers & biopesticides. Sewage (waste-water) treatment, chemical characteristics, microbiological characteristics, waste water treatment processes.		

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Bachelor of Vocation (Medical Laboratory Technology)

B.Voc. (MLT) Syllabus

Year 1 (Diploma)

Practicals for Semester I

Part A: Skill Component

Sr. No	Experiment	Credits	NOS
	BMLTP101 (General –I & Anatomy, Physiology -I)	02	
1	Study of Epithelial, Muscle, Nerve and mammalian blood cells through permanent or temporary cells		HSS/ N0302/N0304/N0305
2	Study of the skeletal system of human beings		HSS/ N0302/N0304/N0305
3	To study human respiratory system		HSS/ N0302/N0304/N0305
4	To study human circulatory system		HSS/ N0302/N0304/N0305
5	To study human digestive system		HSS/ N0302/N0304/N0305
6	To study the compound microscope and parts.		HSS/ N0302/N0304/N0305
7	To separate the plasma and serum from given blood sample		HSS/ N0301/N0302/N0304
8	To visit the following places, meet people visiting/living/working in that environment, understand their life style, understand value of human life in each environment and share with them the aspects of their joys and sorrows: 1. Charitable and Government Hospitals		

	BMLTP102 (Routine Laboratory Technology-I)	02	
9	To identify and to study applications of the different laboratory instruments. (A) Hot air oven. (B) centrifuge. (C) autoclave (D) burettes & pipettes (E) colorimeter (F) Neubauer's Chamber		HSS/ N0301/N0303/N0307
10	Determination of haemoglobin concentration by Sahli's method		HSS/ N0301/N0302/N0304
11	Determination of haemoglobin concentration by cyanmeth method		HSS/ N0301/N0302/N0304
12	Determination of total erythrocyte (RBC) count		HSS/ N0301/N0302/N0304
13	Determination of leukocyte (WBC) count		HSS/ N0301/N0302/N0304
14	Determination of packed cell volume (PCV)		HSS/ N0301/N0302/N0304
15	Determination of erythrocyte sedimentation rate (ESR)		HSS/ N0301/N0302/N0304
16	Determination and calculation of red blood indices MCH, MCHC, MCHC		HSS/ N0301/N0302/N0304
17	Study of differential leukocyte count		HSS/ N0301/N0302/N0304
18	Determination of absolute Eosinophil count		HSS/ N0301/N0302/N0304
19	Determination of platelet count		HSS/ N0301/N0302/N0304
	BMLTP 103 (Special Laboratory Technology-I)	02	
20	Principles and working of laboratory instruments		HSS/ N0301/N0303/N0307
21	Importance and methods of cleaning of glass apparatus		HSS/ N0303
22	Calibration of apparatus and glasswares		HSS/ N0303
23	Preparation and standardization of volumetric solutions		HSS/N9602
24	Basic titration such as acid vs alkali, silver nitrate vs sodium chloride		HSS/ N0301/N0302/N0304
25	Preparation of buffer solution and measurement of their pH		HSS/N9602
26	Verification of Beer Lambert's Law		HSS/ N0301/N0302/N0304
27	Determination of blood sugar level of plasma (or serum) (a) Orthotoluidine method, (b) Glucose oxidase method		HSS/ N0301/N0302/N0304
28	Determination of the serum urea nitrogen (a) Diacetyl monoxime method		HSS/ N0301/N0302/N0304
29	Determination of serum creatinine : Alkaline picrate method		HSS/ N0301/N0302/N0304
27	Determination of serum total cholesterol		HSS/

			N0301/N0302/N0304
28	Determination of serum bilirubin (a) Malloy and Evelyn (b) DMSO method		HSS/ N0301/N0302/N0304
29	Determination of serum glutamate pyruvate transaminase (SGPT) and serum glutamate Oxaloacetate transaminase (SGOT) End point reaction		HSS/ N0301/N0302/N0304
30	Sterilization Techniques		HSS/ N0301/N0302/N0304

Part B: General Education Component

Course Code	Title	Credits	NOS
BMLTP 104	Cell Biology and Biodiversity –I	01	
1	Classification upto orders with ecological notes and economic importance, if any, of the following animals : Protozoa : (a)Examination of cultures of Euglena and Paramecium. (b)Slides : Amoeba, Euglena, Trypanosoma, Monocystis, Paramoecium (Binary fission and cjtin , Parazoa (Porifera) : Specimens : Sycon, Grantia, Euplectella, Hyalonema, Spongilla, Euspongia. Cnidaria (Coelenterata) : (a) Specimens : Porpita, Velella, Physalia, Aurelia, Rhizostoma Metridium, Millipora, Alcyonium, (b) Slides : Hydra (W.M.) Hydra with buds. Obelia (colony and medusa). Sertularia, Plumularia. Platyhelminthes : (a) Specimens : Dugesia, Fasciola, Taenia, (b) Slides : Miracidium, Sporocyst, Redia, Cercaria of Fasio , Scolex nottio ,Tamate Alm n s:Ac is ma e nd fe le ric ll , An ylo t . Ali : :Ph etima e is, Hete one i , olynno , Eun ce, Arthropoda : Peripatus, Prawn, Lobster, Cancer (Crab), Sacculina, Eupagurus (Hermit crab), Lepas, Balanus, Apis, Lepisma (Silver Fish), Schistocerca (Locust), Poecilocus, (Ak Grasshopper), Gryllus		

	(Cricket), Mantis (Preying Mantis) Cicada, Forficula (Earwig) Cimex, Scarabaeus (Dung beetle), Agrian (Dragon fly), Odontotermes Mollusca: Anodonta, Mytilus, Ostrea, Cardium, Pholas, Solen (Razorfish) Pecten, Haliotis, Patella, Aplysia, Doris, Ehindermta : seschiu , Ohrxa Aneon , Hehordata alanossus		
2.	CELL BIOLOGY Paper chromatography. Gel electrophoresis through photographs or through research laboratories. Familiarity with TEM & SEM. Study of different ultrastructures of cell organelles through photographs.		

Course Code	Title	Credits	NOS
BMLTP 105	Biomolecules	01	
1.	Qualitative tests for : (a) Carbohydrates. (b) Amino acids and proteins , (c) Cholesterol and lipids		
2.	Determination of saponification value of fats		
3.	Determination of Iodine value of fats		
4.	Estimation of ascorbic acid by dye method		
5.	Titration curve for amino acids and determination of pKa value		
6.	Verification of Beer-Lambert Law for nitrophenol or cobalt chloride		
7.	Estimation of Amino acids by ninhydrin method		
8.	Estimation of Protein by biuret method		
9.	Estimation of Carbohydrate by anthrone method.		

Course Code	Title	Credits	NOS
BMLTP 106	Fundamentals of Microbiology	01	
1.	Use of microscope in examination of unstained bacteria, fungi, algae, parasites and stained cell preparations including simple staining, Gram's staining, acid fast staining, capsule staining, spore staining using prokaryotic and eukaryotic cells, hanging drop preparation.		
2.	Preparation of culture media, spread plates, pour plates, selective media, differential media.		
3.	Separation of pure cultures and study the effect of selective nutrients on prokaryotes.		
4.	Isolation of Soil Bacteria, Soil Fungi, Soil Actinomycetes		
5.	Selective media for Soil microflora and use of growth factors, Study of Rhizosphere interactions, Quantitative measurements of Soil nutrients and Rhizosphere microflora and preparation of starter cultures of Rhizobia, Azotobacter.		

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B.Voc. (MLT) Syllabus

Year 1 (Diploma)

Semester II

Part A: Skill Component

Course Code	Title	Credits	NOS
BMLT107	General & Human Anatomy, Physiology -II	04	
	Basics of Human Anatomy-II		
	Urinary System.: Parts of Urinary System.(name, Function)		HSS/N0302/N0304/N0305
Unit I	Endocrine System: Various endocrine glands. Thyroid. Parathyroid. Adrenal glands pituitary pancreas. Thymus and sex glands.(detail function of each gland & clinical significance)		HSS/N0302/N0304/N0305
	Reproductive System. Male & female Reproductive organs.(name & function)		HSS/N0302/N0304/N0305
	Nervous System.: Parts of brain, spinal cord, peripheral nerves.(function)		HSS/N0302/N0304/N0305
	Basics of Human Physiology-II		
Unit II	Excretory Systems:.. Structure & function of kidney and urinary bladder. Mechanism of urine formation. disorders of kidney.		HSS/N0302/N0304/N0305
	Reproductive Systems: Physiology of reproductive organs.		HSS/N0302/N0304/N0305
	Nervous System: Neurone & its function,.		HSS/N0302/N0304/N0305
Unit III	Basics of Computer Skills		
	Data, information,properties , Types of information. computing files,internet,server. Introduction to computer: Introduction to associated terms like CPU,storage devices, peripherals output & input devices etc.		HSS/N9603/N9604/N 9605

	MS WORD: Basic. Making new document, editing, formatting the text (text: border, color, spacing, copying the text, undo, Redo, repeat) Formatting: Paragraph alignment, (line spacing, paragraph spacing, paragraph indents) Borders paragraph border, shading. Spelling and grammar,		HSS/N9603/N9604/N 9605
	COLUMNS: typing text by defining columns, converting text to column & columns to text		HSS/N9603/N9604/N 9605
	TABLES: selecting the table, insertion of row, columns text, merging the cell converting table to text and text to table insert date, time, foot notes header footer, end notes. MS WINDOW: making new file, folders. saving data		HSS/N9603/N9604/N 9605
Unit IV	Communication Skills		
	The Types of Business Communication		
	Introduction, Business Communication, The Classification, Functions & Scope of Business Communication, Internal Communication, External Communication,		HSS/N9603/N9604/N9605/N9607
	The Communication Process		
	Elements of Communication, The Communication Cycle, The Barriers To Communication		HSS/N9603/N9604/N9605/N9607
	The Principles of Communication		
	Introduction, The Medium of Communication, Accuracy, Brevity, Clarity, Courtesy, Conclusion		HSS/N9603/N9604/N9605/N9607
	The Modes of Communication		
	Oral, written, messenger service, postal service, FAX, Electronic mail		HSS/N9603/N9604/N9605/N9607
	The Essentials of Written Communication		
	Office stationery and forms, telephone and FAX equipments, Computers with internet connection		HSS/N9603/N9604/N9605/N9607

Course Code	Title	Credits	NOS
BMLT 108	Routine Laboratory Technology-II	04	
Unit I	Routinue Haematological Tests		HSS/N0301/N0302/ N0304
	Determination of hemoglobin concentration ,determination of haematocrit , enumeration of formed elements ,calculations of red blood cell indices - MCV, MCH,and MCHC, Automated systems in haematology ,study of blood smear , Reticulocyte count, Erythrocyte sendimantation rate (ESR) Eosinophil count , platelet count		
Unit II	Urine Examination		
	Urine analysis, routine examination of urine, rapid chemical tests of Urine		HSS/N0301/N0302/ N0304
	Clinical significance, specimen collection, laboratory investigation, Clinical significance, specimen collection, laboratory investigation		HSS/N0301/N0302/ N0304
Unit III	Stool Examination		
	Gross examination, physical examination of stool, determination of pH, chemical examination of feces, microscopic examination of stool specimen		HSS/N0301/N0302/ N0304
	Clinical significance, specimen collection, laboratory investigation, Clinical significance, specimen collection, laboratory investigation		HSS/N0301/N0302/ N0304
Unit IV	Semen Examination		HSS/N0301/N0302/ N0304
	Semen analysis, routine examination of semen, quantitative determination of semen fructose, interpretative semen analysis, examination for the presence of sperms		
	Sputum Examination		HSS/N0301/N0302/ N0304
	Indication, collection, container, transport, preservation for different types of sputum analysis. Physical examination and its significance, chemical examination and its significance. Microscopic examination and its significance.		

Course Code	Title	Credits	NOS
BML T 109	Special Laboratory Technology-II	04	
Unit I	Basic Microbiology		
	Classification , morphology and physiology of bacteria, anatomy of bacterial cell, growth requirement of bacteria- growth curve, nutrients required. Gram positive & Gram negative Bacteria. Normal flora of human body.		HSS/N0301/N0302/ N0304
Unit II	Introduction to serology		
	Antigens, antibodies, structure and classes of antibodies, monoclonal antibodies and its uses. Collection and preparation of specimen,		HSS/N0301/N0302/ N0304
Unit III	Serological Tests		
	Serological test for syphilis (STS), Agglutination- 4 tests ,C-reactive protein test (CRP) ,Rheumatoid arthritis test (RA) ,Serodignosis of streptococcal infection .HBsAg, HIV-1(Rapid TriDot test) Widal test, Tuberculine test		HSS/N0301/N0302/ N0304
Unit IV	Staining Techniques		
	Gram positive & Gram negative Bacteria. Difference between cocci & bacteria, virus(definition ,properties & example) Sputum test for AFB		HSS/N0301/N0302/ N0304

Part B: General Education Component

SUBJECT: ZOOLOGY

Course Code	Title	Credits	NOS
BMLT 110	Ecology and Biodiversity-II	03	
	Systematic study of Animals - III		
UNIT I	Detailed study of the following animal types Arthropoda : Periplanata, Prawn, Social organizations in insects (honey bee and termite), life cycle of Anopheles and Culex. Classification up to orders with ecological notes and economic importance (if any) Arthropoda : Peripatus, Prawn, Lobster, Cancer, (Crab) Sacculina, Eupagurus (Hermit crab), Lepas, Balanus, Apis, Lepisma (Silver Fish), Schistocerca (Locust), Poecilocus, (AkGrasshopper), Gryllus (Cricket), Mantis (Preying Mantis) Cicada, Forficula (Earwig) Scarabaeus (Dung beetle), Agrian (Dragon fly), Odontotermes, (Termite queen), Cimex (Bed bug), Cicindela (Tiger beetle), Polistes (Wasp), Bombyx (Silk moth), Julus (Millipede), Scolopendra (Centipede) Palamnaeus (Scorpion) Aranea (Spider) and Limulus (King crab).		
	Systematic study of Animals – IV		
UNIT II	Mollusca : Pila Echinodermata : Asterias, Echinoderm larvae. Hemichordata : Balanoglossus, External characters and affinities. Classification up to orders with ecological notes and economic importance (if any) Mollusca : Chiton, Anodonta, Mytilus, Ostrea, Cardium, Pholas, Solen (Razor Fish), Pecten, Haliotis, Patella, Aplysia, Doris, Limax, Loligo, Sepia, Octopus, Nautilus shell and Dentalium. Echinodermata : Echinus, Cucumaria, Ophiothrix and Antedon. Hemichordata : Balanoglossus.		
	Ecosystem –I		
UNIT III	Ecology - Scope of ecology and subdivisions. Ecosystem - Components, ecological energetics, food web, introduction to major ecosystems of the world. Ecological factors - Temperature, light and soil as ecological factors.		

	Nutrients : Biogeochemical cycles & concept of limiting factors. Ecological : Morphological, physiological and behavioural adaptations in animals in different habitats. Population : Characteristics and regulation of population.		
UNIT IV	Ecosystem-II		
	Inter and intra - Competition, predation, parasitism, commensalisms & specific relationships & mutualism. Biotic community - Characteristics, ecological succession, ecological niche. Natural resources - Renewable and nonrenewable natural resources and their conservations. Environmental Degradation. - Causes, impact and control of environmental pollution.		

SUBJECT: BIOCHEMISTRY

Course Code	Title	Credits	NOS
BMLT 111	Enzymology and Bioenergetics	03	
UNIT I	Enzymes		
	General Characteristics : Introduction to enzymes. General characteristics of enzymes. Prosthetic group. Holoenzymes, apoenzyme and cofactors. Coenzymes and their biochemical functions, assay of enzyme activity, units of enzyme activity. Active sites(s) of enzymes. IUB system of nomenclature and classification of enzymes. Enzymes as catalysts. Theories of enzymes catalysis : Proximity and orientation effects, acid base catalysis, covalent catalysis. Role of metals in enzyme catalysis.		
UNIT II	Enzyme Purification and Chromatography Techniques		
	Enzyme Purification : Need for purification. Preliminary fractionation procedures and precipitation techniques, Chromatography methods : Gel filtration—, adsorption—, ion exchange—and affinity chromatography. Types of support materials. Selection of appropriate conditions and elution procedures. Criteria of enzyme purity.		
	Enzyme Kinetics		
	Enzyme Kinetics : Factors affecting velocity of enzyme catalysed reactions : Enzyme concentration, pH and		

UNIT III	temperature. Michaelis –Menten equation. Determination of K_m and its significance. Enzyme inhibition. Various types of enzyme inhibitions. Determination of K_i value. Enzyme inhibitors and their importance. Introduction to multisubstrate enzymes. Allosteric enzymes and enzyme regulation. Isoenzymes and their clinical significance. Bioenergetics :		
UNIT IV	Bioenergetics Biological systems and concept of free energy, Endergonic processes and role of ATP & other high energy compounds. Biological oxidations. Redox potential. Enzymes and co-enzymes involved in oxidations and reductions. Mitochondrial electron transport chain and oxidative phosphorylation. Mechanism of oxidative phosphorylation.		

SUBJECT: MICROBIOLOGY

Course Code	Title	Credits	NOS
BMLT 112	Microbial Physiology —Metabolism	03	
	Microbial Nutrition, Cultivation, Isolation and Preservation		
UNIT I	Microbial Nutrition: Requirements for Growth. Physical requirement (Temperature, pH, osmotic pressure), chemical requirements (C, N, S, P, O). Culture Media : Chemically defined media, complex media, anaerobic growth media, selective & differential media, and enrichment culture. Cultivation of Aerobes and Anaerobes. Microbial Growth : Growth in population, bacterial growth curve, mathematical nature and expression, measurement of growth in bacteria, Factors affecting growth in microorganisms, continuous cultures and synchronous cultures.		
	Enzyme Regulation		
UNIT	Enzymes and their Regulation: Chemical and physical properties of enzymes. Nomenclature of Enzymes.		

II	Mechanism of enzymes action. Inhibition of enzyme action. Regulation of enzymes.		
	Microbial Metabolism –I		
UNIT III	Microbial Metabolism : Respiration and fermentation. Glycolysis, Pentose Phosphate pathway, The Entner Doudoroff pathway, Fermentation. Tricarboxylic acid cycle. Catabolism of lipid, proteins. Glyoxylate cycle. Beta oxidation.		
	Microbial Metabolism –II		
UNIT IV	Microbial Utilization of Energy & Biosynthesis : Transport of nutrient by bacteria. Biochemical mechanisms of generation of ATP. Synthesis of Amino Acids : Glutamate, lysine, glutamine, serine, arginine family. Structures and biosynthesis of cell wall peptidoglycan. Biosynthesis of Carbohydrates (gluconeogenesis) & Phospholipids. Replication of DNA molecules, Transcription & Translation (process of protein synthesis). Bacterial Genetics : Conjugation, Transformation, Transduction (generalized transduction, specialized transduction), The Regulation of Gene Expression : Lac operon, tryptophan operon.		

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Bachelor of Vocation (Medical Laboratory Technology)

B.Voc. (MLT) Syllabus

Year 1 (Diploma)

Practicals for Semester II

Part A: Skill Component

Sr. No	Experiment	Credits	NOS
	BMLPT107 (General –I & Anatomy, Physiology -I)	02	
1	To study human urinary system		HSS/ N0302/N0304/N0305
2	To study human reproductive system		HSS/ N0302/N0304/N0305
3	To study human nervous system		HSS/ N0302/N0304/N0305
4	To measure the blood pressure of human being		HSS/ N0302/N0304/N0305
5	To measure the body weight and height and calculate BMI of a human (body mass index)		HSS/ N0302/N0304/N0305
6	Introduction to the word		HSS/N9603/N9604/N9605
7	Introduction to the excel		HSS/N9603/N9604/N9605
8	Introduction to the internet		HSS/N9603/N9604/N9605
	BMLTP108 (Routine Laboratory Technology-II)	02	
10	To prepare of the 1/10 N HCL		HSS/N9602
11	To prepare the different concentration of solutions.		HSS/N9602
12	To prepare different bulbs required in the laboratory		HSS/N0301/N0302/N0304/
13	To determine the nature of the given solution		HSS/N0301/N0302/N0304/ N9602
14	To find out the normality of given solution		HSS/N0301/N0302/N0304/ N9602
15	Routine examination of urine (physical examination of urine)		HSS/N0301/N0302/N0304/ N9602
16	Determination of specific gravity of urine by urinometer and refractormeter		HSS/N0301/N0302/N0304/ N9602

17	Chemical examination of urine.		HSS/ N0301/N0302/N0304
18	Microscopic examination of urine		HSS/ N0301/N0302/N0304
19	Physical and chemical examination of semen		HSS/ N0301/N0302/N0304
20	Microscopic examination of semen		HSS/ N0301/N0302/N0304
21	Physical examination of stool		HSS/ N0301/N0302/N0304
22	Chemical examination of stool		HSS/ N0301/N0302/N0304
23	Microscopic examination of stool		HSS/ N0301/N0302/N0304
24	Determination of reducing substances in stool		HSS/ N0301/N0302/N0304
25	Routine examination of sputum		HSS/ N0301/N0302/N0304
	BMLTP109 (Special Laboratory Technology-II)	02	
26	Preparation of smear		HSS/ N0301/N0302/N0304
27	Monochrome staining (simple staining)		HSS/ N0301/N0302/N0304
28	Gram's staining		HSS/ N0301/N0302/N0304
29	Study of motility of capsule		HSS/ N0301/N0302/N0304
30	Study of bacterial capsule		HSS/ N0301/N0302/N0304
31	Study of acid fast bacilli		HSS/ N0301/N0302/N0304
32	Study of malarial parasite		HSS/ N0301/N0302/N0304
33	Isolation of bacteria by streak plate techniques		HSS/ N0301/N0302/N0304
34	To perform qualitative widal test		HSS/ N0301/N0302/N0304
	BMLTP107 (On Job Training)		

Part B: General Education Component
SUBJECT: ZOOLOGY

Course Code	Title	Credits	NOS
BMLTP 110	Ecology and Biodiversity-II	01	
1.	Study of the following permanent stained preparations : L.S. and T.S. Sycon, gemmules, spicules and spongin fibres of a sponge. T.S. Hydra (Testis and ovary region). T.S. Fasciola (Different regions). T.S. Ascaris (Male & female). T.S. Pheretima (Pharyngeal and typhlosolar regions); setae, septal nephridia, spermathecae and ovary of Pheretima, Trachea, mouth parts of Periplaneta Radula and osphradium of Pila. T.S. Star fish (Arm).		
2.	Preparation of the following slides : Temporary preparation of Paramecium, mouth parts of Periplaneta (cockroach), radula of Pila & appendages of Prawn. Preparation of permanent whole mount stained in borax carmine of Hydra, Obelia. Sertularia, Plumularia and Bougainvillea.		
3.	Dissections of the following animals : Pheretima : Digestive, reproductive and nervous systems. Periplaneta : Digestive and nervous systems; mouth parts and trachea. Pila : Pallial complex, digestive and nervous systems		
4.	ECOLOGY :Study of animal adaptations with the help of specimens, charts and models. Study of Zoogeographical regions and their fauna. Study of biotic components of an ecosystem. Study of different types of nests in birds. Study & preparation of zoogeographical charts.		

Course Code	Title	Credits	NOS
BMLTP 111	Enzymology and Bioenergetics	01	
1.	Assay of serum alkaline phosphatase activity		
2.	Effect of pH on enzyme activity		
3.	Effect of Temperature on enzyme activity		
4.	Effect of substrate concentration on enzyme activity		
5.	Inhibition of alkaline phosphatase by EDTA		

Course Code	Title	Credits	NOS
BMLT 112	Microbial Physiology —Metabolism	01	
1.	Measurement of Soil Enzymes.		
2.	Use of ultraviolet light for its germicidal effect.		
3.	The replica plating technique.		
4.	Presumptive, confirmed and completed tests for safety of water supplies.		
5.	Effect of temperature, Osmotic pressure, energy source etc. on growth of prokaryotes		
6.	Relation of free oxygen to microbial growth, monitoring of dissolved oxygen in various effluents		
7.	Determination of COD in Industrial effluents.		
8.	Effects of antimetabolites on Microbial culture (Inhibition by Sulfanilamide).		
9.	Determination of Water Activity of various substrates and assay of surface active agents.		
10.	Turbidimetric/spectrophotometric monitoring of growth using liquid cultures. Efficiency of photosynthesis in photoautotrophs.		

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Kannamwar Nagar-2, Vikhroli (East), Mumbai 400083**

Bachelor of Vocation (Medical Laboratory Technology)

B.Voc. (MLT) Syllabus

Year 2 (Advanced Diploma)

Semester III

Part A: Skill Component

Course Code	Title	Credits	NOS
BMLT 201	Hematology and Blood Banking-I	04	
Unit I	Special Hematological Tests		
	Special Hematological tests & factors in Haemoglobin synthesis & automation		
	Screening of sickle cell anaemia, Estimation of foetal haemoglobin, Haemoglobin electrophoresis, Osmotic fragility test, Heinz body preparation, Laboratory diagnosis of protozoan blood parasites, Lupus erythematosus (LE) cell preparation, Preparation of bone marrow smear for microscopic examination, Cytochemical tests.		HSS/N0301/N0302/ N0304
	Autoanalysis- Electrolyte acid base balance		
	Acid base balance		HSS/N0301/N0302/ N0304
	Interpretation of lab findings in Haematology		
	Anaemias, Leukaemias, Miscellaneous disorders.		HSS/N0301/N0302/ N0304
Unit II	Haemostasis & Bleeding Disorders		
	Introduction to Haemostasis & coagulation		
	Haemostasis, Mechanism of blood coagulation, Fibrinolysis.		HSS/N0301/N0302/ N0304
	Laboratory Investigation & Bleeding Disorders		
	Laboratory preparation for coagulation tests, Routine coagulation tests, (prothrombin time, plasma recalcification time, partial thromboplastin time, activated partial thromboplastin time, thrombin time, Laboratory diagnosis of bleeding disorders).		HSS/N0301/N0302/ N0304

Unit III	Immunohaematology & Blood Transfusion		
	Principles of Immunohaematology & Clinical of Blood Transfusion		
	Principles of immunohaematology, Human blood group systems, (basic ABO blood group systems, Clinical significance of blood transfusion.		HSS/N0301/N0302/N0304
	Collection & Processing of blood for transfusion		
	Preparation for blood collection, Blood collection, Transportation of blood after collection, storage of blood, Preparation and use of blood components.		HSS/N0301/N0302/N0304
Unit IV	Routine Lab Procedures in Blood Bank		
	Routine Lab procedures in Blood Bank		
	Specimen collection for blood bank, General laboratory reagents in blood bank. Preparation of laboratory reagents in blood bank, Reporting of haemagglutination reaction, ABO blood grouping Rh blood typing Antihuman globulin (AHG) or crossmatching		HSS/N0301/N0302/N0304
	Transfusion reactions & Haemolytic Disease of a new born		
	Blood transfusion process, Transfusion reaction, Haemolytic disease of the newborn.		HSS/N0301/N0302/N0304

Course Code	Title	Credits	NOS
BMLT 202	Microbiology and Serology	04	
Unit I	Laboratory Diagnosis of Mycotic and Emerging Infections		
	Introduction to Microbiology		
	Disease oriented microbiology, culture & sensitivity test, aerobic, anaerobic techniques		HSS/N0301/N0302/N0304
	Laboratory Diagnosis of Mycotic infections		
	Introduction to Fungi and parasitic fungi, specimen collection, Laboratory diagnosis of mycotic infections, Diagnostic mycology		HSS/N0301/N0302/N0304
	Emerging / New infections in human being		HSS/N0301/N0302/N0304
Unit II	Diagnostic Microbiology		
	Diagnostic Microbiology & Micro Techniques		
	Role of microbiology laboratory, specimen handling, laboratory records, safety Regulations, Basic procedures of Diagnostic Rapid and automation methods in Diagnostic Microbiology, Culture environments of microbes, Quality control in microbiology, Quick reference of media and biochemical tests		HSS/N0301/N0302/N0304
	Lab Diagnosis of parasitic infections		

	Collection and handling of faecal specimen, Laboratory techniques in parasitological investigation of stool, Processing of specimens other than stool, Lab identification of human parasites		HSS/N0301/N0302/N0304
	Serology		
Unit III	Serology : Introduction & Serological Lab Procedures		
	Principles of immunologic reactions, serodiagnosis. Collection and preparation of specimen, Serological test for syphilis (STS), Agglutination tests, C-reactive protein test (CRP), Rheumatoid arthritis test (RA), Serodiagnosis of streptococcal infection, Serodiagnostic tests for miscellaneous disorders, Immunologic test for pregnancy RIA, ELISA		HSS/N0301/N0302/N0304
	Parasitology		
	Introduction, Protozoa, Helminths, Medical Entomology		HSS/N0301/N0302/N0304
	Bacteriology		
Unit IV	Bacteriology		
	Gram positive - streptococcus, staphylococcus, bacillus, mycobacterium, corynebacterium, Gram negative - E-coli, Klebsiella, Salmonella, shingela, Vibrio, Pseudomonas		HSS/N0301/N0302/N0304
	Diagnostic & Systemic Bacteriology		
	Staphylococcus, Streptococcus, spirochaetes, mycoplasma, rickettsiae etc, Systematic grouping of pathogenic bacteria, Laboratory identification of infectious agents, Diagnosis of anaerobic infections, identifying characteristics of common pathogenic bacteria, Antimicrobial susceptibility test. IMViC, Urease, catalase, gelatin liquefaction, coagulase, oxidase, sugar fermentation, antibiotic sensitivity test.		HSS/N0301/N0302/N0304

Course Code	Title	Credits	NOS
BMLT 203	Clinical Pathology and Biochemistry	04	
Unit I	Miscellaneous Body Fluids		
	Lab Examination of Miscellaneous Body Fluids		
	Cerebrospinal fluid, Laboratory investigation, Serous fluids, Synovial fluid.		HSS/N0301/N0302/N0304
	Routine Biochemical Tests		
	Phosphatases, transaminases, lactic dehydrogenase, Creatine kinase, Electrolytes, Blood gases and bicarbonate, Determination of serum / plasma bicarbonate		HSS/N0301/N0302/N0304

Unit II	Biochemical Test Profile		
	Normal & Abnormal Biochemical processes of the body (Basic physiology and biochemistry of the body)		
	Basic physiology and biochemistry of the body , interrelated metabolic processes of the body.		HSS/N0301/N0302/N0304
	Biochemical Test Profile		
	Liver tests ,Renal tests, Endocrine function tests, Lipid profile, Transaminase, LDH, CPK, CPK-MB, SGPT/SGOT/ Amylase.GTT		HSS/N0301/N0302/N0304
Unit III	Analytical Techniques		
	Basic Steps of Analytic Techniques		
	Basic steps in analytical chemistry, titrimetry photometry, Electrochemistry, Immuno - chemistry, Separation and analysis of organic compounds		HSS/N0301/N0302/N0304
	Principles of Analytic Techniques		
	Principles of analytical chemistry, titrimetry, photometry, Electrochemistry, Immunochemistry.		HSS/N0301/N0302/N0304
Unit IV	Biochemical Processes		
	Normal & Abnormal Biochemical processes of the body (Biochemical changes in the body under pathological conditions)		
	Biochemical changes in the body under pathological conditions.		HSS/N0301/N0302/N0304
	Normal & Abnormal Biochemical processes of the body (Functions of various organs and their clinical assessment)		
	Functions of various organs and their clinical assessment		HSS/N0301/N0302/N0304

Part B: General Education Component

SUBJECT: BIOCHEMISTRY

Course Code	Title	Credits	NOS
BMLT 204	Metabolism	03	
UNIT I	Carbohydrate Metabolism		
	Digestion & Absorption of Carbohydrates : Metabolic Pathways of Carbohydrates, Glycolysis and alcoholic fermentation, The Pentose Phosphate Pathway, Glucuronate and glyoxylate pathway, TCA cycle, Glycogenolysis & Glycogenesis, Gluconeogenesis, Biosynthesis of starch, Biosynthesis of Ascorbic acid.		
UNIT II	Lipid Metabolism		
	Digestion & Transport of Lipids : -Oxidation of fatty acids including odd chain fatty acids. α -and ω - oxidation of fatty acids Degradation of triglycerides and phospholipids. Formation and utilization of ketone bodies. Biosynthesis of saturated and unsaturated fatty acids. Biosynthesis of triglycerides and phospholipids, biosynthesis of cerebrosides; sulfatides and gangliosides. Biosynthesis of Cholesterol. Biosynthesis of Prostaglandins, Thromboxanes, Leukotrienes, Lipoxins and Prostacyclins.		
UNIT III	Protein Metabolism		
	Digestion of Proteins : General Reactions of Amino Acids : Deamination, transamination and decarboxylation. Urea cycle. Catabolism of Carbon Skeletons of Amino Acids : Glycine and Alanine, Serine and threonine, Phenylalanine and Tyrosine, Tryptophan, Histidine, Leucine, Valine and Isoleucine, Cysteine and Methionine, Lysine, Glutamic acid and Glutamine, Aspartic acid and Asparagine. Biosynthesis of Nutritionally Non-Essential Amino Acids : Glutamate and Glutamine, Aspartate and Asparagine, Proline, Alanine, Cysteine & Selenocysteine, Tyrosine, Serine, Glycine.		
UNIT IV	Nucleic Acids		
	Nucleic Acids : Degradation of purines and pyrimidines. Biosynthesis of purines, pyrimidines and nucleotides. Catabolism of Heme & Formation of Bile pigments. Biosynthesis of porphyrins and heme. Conjugation of bilirubin and its clinical significance.		

SUBJECT: MICROBIOLOGY

Course Code	Title	Credits	NOS
BMLT 205	Pathogenic Microbiology	03	
UNIT I	Infectious Diseases		
	Brief introduction to terminology of Infections diseases, Frequency of disease, Recognition of Infectious disease, Infections, Disease cycle, Virulence and mode of transmission, Emerging and reemerging Infectious diseases, Global travel & Health considerations, Nosocomial Infections.		
UNIT II	Microbes of Medical Importance		
	Nomenclature and classification of microbes of medical importance. Origin of the Normal Flora, Germfree and Gnotobiotic Life, Distribution and occurrence of Normal Flora of Skin, Eye, Respiratory Tract, Mouth, Intestinal Tract & Genitourinary Tract.		
UNIT III	Mode of Microbial Infections		
	Microbial adherence, Passive Penetration into body, Active Penetration into body, Events in Infection following penetration, Microbial virulence factors.		
UNIT IV	Antimicrobial Drugs		
	Development of chemotherapy, General characteristics of antimicrobial drugs, Determining level of antimicrobial activity, Mechanism of action of antimicrobial agents, factors influencing the effectiveness of antimicrobial drugs, Antibacterial drugs viz. sulfonamides, Quinolones, Penicillins, Cephalosporins, Tetracyclines, Erythromycin, Chloramphenicol, Drug Resistance, Antifungal and Antiviral drugs.		

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Year 2 (Advanced Diploma)**

Practicals for Semester III

Part A: Skill Component

Sr. No	Experiment	Credits	NOS
	BMLTP201(Hematology and Blood Banking-I)	02	
1	To study sickling test using 2% sodium metabisulphite		HSS/ N0301/N0302/N0304
2	Determination of reticulocyte count.		HSS/ N0301/N0302/N0304
3	Determination of prothrombin time		HSS/ N0301/N0302/N0304
4	Determination of glucose-6-phosphate dehydrogenase(G-6-PD)		HSS/ N0301/N0302/N0304
5	Determination of serum sodium and potassium using flame photometer/commercial kit		HSS/ N0301/N0302/N0304
6	Determination of serum chloride		HSS/ N0301/N0302/N0304
7	Determination of bleeding time		HSS/ N0301/N0302/N0304
8	Determination of blood clotting time 1.capillary method 2.tube method		HSS/ N0301/N0302/N0304
9	Qualitative test for ABO grouping with antisera by slide method		HSS/ N0301/N0302/N0304
10	Qualitative test for ABO grouping with antisera by tube method		HSS/ N0301/N0302/N0304
11	Qualitative test for Determination of D(Rho) antigen on human red blood cells. 1.tube method 2.slide method		HSS/ N0301/N0302/N0304
12	Determination of D by tube method.		HSS/ N0301/N0302/N0304
13	To perform cross matching test by saline-tube method		HSS/ N0301/N0302/N0304
14	To perform direct coomb's test		HSS/ N0301/N0302/N0304
15	To perform indirect coomb's test		HSS/

			N0301/N0302/N0304
16	Determination of the anti-D antibody titer		HSS/ N0301/N0302/N0304
17	Determination of the foetal haemoglobin		HSS/ N0301/N0302/N0304
	BMLTP202 (Microbiology and Serology)	02	
18	Study of gram's staining		HSS/ N0301/N0302/N0304
19	Study of acid fast bacilli by ZNCF(hot stain)staining		HSS/ N0301/N0302/N0304
20	Demonstration of bacterial capsule by negative staining. (india ink method)		HSS/ N0301/N0302/N0304
21	Demonstration of bacterial motility by hanging drop preparation		HSS/ N0301/N0302/N0304
22	Isolation of microorganism by streak method		HSS/ N0301/N0302/N0304
23	To perform biochemical test 1.IMVic test 2.Catalase test 3.Coagulase test 4.Oxidase test 5.Gelatin liquefaction test 6.Urease test		HSS/ N0301/N0302/N0304
24	Identification of organism from urine sample.		HSS/ N0301/N0302/N0304
25	Identification of organism from pus sample.		HSS/ N0301/N0302/N0304
26	Antibiotic sensitivity test from stalk culture or biological specimen using commercial plates and discs		HSS/ N0301/N0302/N0304
27	Identification of ova/cyst from given stool sample. 1.iodine preparation 2.saline preparation		HSS/ N0301/N0302/N0304
28	Identification of malarial parasite by using blood smear.		HSS/ N0301/N0302/N0304
29	To perform widal test-by tube method or slide method		HSS/ N0301/N0302/N0304
30	To perform VDRL test/RPR		HSS/ N0301/N0302/N0304
31	To perform RA test by latex agglutination		HSS/ N0301/N0302/N0304
	BMLTP203 (Clinical Pathology and Biochemistry)	02	
13	Estimation of blood sugar level of plasma (or serum) (a) orthotoluidine method (b)glucose-oxidase method		HSS/ N0301/N0302/N0304
14	To perform pregnancy test by dipstick method		HSS/ N0301/N0302/N0304
15	Estimation of the serum urea nitrogen.		HSS/

	(a)diacetyl monoxime method.		N0301/N0302/N0304
16	Estimation of serum creatinine. (a)alkaline-picrate method.		HSS/ N0301/N0302/N0304
17	Determination of protein in blood Albumin, globulin		HSS/ N0301/N0302/N0304
18	Determination of serum bilirubin. (a)malloy and evelyn. (b)DMSO method.		HSS/ N0301/N0302/N0304
19	Estimation of serum total cholesterol.		HSS/ N0301/N0302/N0304
20	Determination of serum glutamate pyruvate transaminase(SGPT) and serum glutamate oxaloacette transaminase(SGOT) (a)end point reaction		HSS/ N0301/N0302/N0304
21	Determination of serum alkaline phosphatase		HSS/ N0301/N0302/N0304
22	To perform glucose tolerance test		HSS/ N0301/N0302/N0304

Part B: General Education Component

Course Code	Title	Credits	NOS
BMLTP 204	Metabolism	01	
1.	Estimation of blood glucose by the methods of (i) Folin Wu (ii) Nelson Somogyi.		
2.	Isolation and assay of glycogen from rat liver.		
3.	Estimation of Ca ⁺ in serum		
4.	Estimation of total and free cholesterol in serum.		
5.	Estimation of total lipids in serum by Vanillin method.		
6.	Estimation of proteins by Lowry's method.		
7.	Estimation of Lipoproteins in plasma		
8.	Colorimetric estimation of inorganic phosphate.		

Course Code	Title	Credits	NOS
BMLTP 205	Pathogenic Microbiology	01	
1.	Stainings – Gram's, Alberts, ZNCF.		
2.	Isolation and Maintenance of Pure Cultures.		
3.	Physiological characteristics of bacteria and its use for their identification.		
4.	Assay of antimicrobials.		
5.	Preparation of serum/plasma.		
6.	Sterilization – Introduction to autoclave, hot air oven, filter sterilization.		

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B.Voc. (MLT) Syllabus

Year 2 (Advanced Diploma)

Semester IV

Part A: Skill Component

Course Code	Title	Credits	NOS
BMLT 206	Clinical Biochemistry and Microbiology-I	04	
Unit I	Metabolic Disorders & Deficiency		
	Diagnostic Test profile		
	Other than biochemical tests profiles i.e. ANC, Arthritis, Cardiac, Hypertension, Anaemia.		HSS/N0301/N0302/N0304
Unit II	Clinical Endocrinology		
	Hormonal studies & Clinical Endocrinology		
	Thyroid, Pancreas, Adrenal & Sexual glands, hormones & it's diagnostic significance.		HSS/N0301/N0302/N0304
Unit III	Body Fluid Specimen Processing		
	Specimen processing for biochemical analysis		
	Blood, Urine, Cerebrospinal fluid, Body fluids		HSS/N0301/N0302/N0304
	Automation in Clinical Biochemistry Laboratory		
	Classification of automated systems , steps of automation in biochemical analysis, some commonly used automated analysers of biochemical laboratories		HSS/N0301/N0302/N0304
Unit IV	Blood Banking		
	Blood Banking		
	Organization, operation, administration of bank and maintenance of records, government regulation (FDA)		HSS/N0301/N0302/N0304

Course Code	Title	Credits	NOS
BMLT 207	Histology-Cytology -I	04	
Unit I	Introduction to Histology		
	Introduction to Histology & Cytotechnology		
	Basic terminology , Laboratory equipment for histology and cytology , Use and care of frequently used equipment , Preparation of reagent solutions		HSS/N0301/N0302/ N0304 / N409
Unit II	Tissue Processing		
	Lab techniques in histology: Tissue Processing		
	Logging of specimen, preparation of tissues , processing of tissues , Frozen section technique , Handling and embedding of small tissue fragments.		HSS/N0301/N0302/ N0304 / N409
Unit III	Staining Procedures		
	Lab techniques in histology: Staining Procedures		
	Routine staining procedure in histotechnology , special stains and staining techniques , stains for particular substances		HSS/N0301/N0302/ N0304 / N409
Unit IV	Instrumentation in Histocytotechnology		
	Instrumentation in Histocytotechnology		
	Autoanalyser, Tissue Processor, Microtome		HSS/N0301/N0302/ N0304 / N409

Course Code	Title	Credits	NOS
BMLT 208	Parasitology and Blood Cell Disorders-I	04	
Unit I	Medical Parasitology		HSS/N0301/N0302/ N0304
Unit II	Common Intestinal worms		HSS/N0301/N0302/N0304
Unit III	Malarial parasites, Filarial parasites		HSS/N0301/N0302/N0304
Unit IV	Lab. diagnosis of Parasitic infections		HSS/N0301/N0302/N0304

Part B: General Education Component
SUBJECT: BIOCHEMISTRY

Course Code	Title	Credits	NOS
BMLT 209	Biochemical Techniques	03	
UNIT I	Spectroscopic Techniques		
	Spectroscopic Techniques: Beer-Lambert's Law. Light absorption and its transmittance. Determination and application of extinction coefficient. Applications of following spectroscopic techniques in elucidating structure of Biomolecules- Visible, U.V., infra-red and fluorescence spectroscopy. ORD, C.D. and N.M.R.		
UNIT II	Electrophoretic Techniques		
	Electrophoretic Techniques : Principles and applications of the following electrophoresis techniques. Paper and gel electrophoresis, high voltage electrophoresis, SDS-PAGE : Discontinuous electrophoresis, isotachopheresis, isoelectric focussing and immunoelectrophoresis. Centrifugation Techniques : Various centrifugation techniques and their applications in Biochemistry. Preparative and analytical ultra- centrifugation procedures. Application of partial specific volume, diffusion coefficient and viscosity measurements in the study of macromolecules of biochemical importance.		
UNIT III	Chromatographic Techniques		
	Chromatographic Techniques : General principles of chromatography and the application of following chromatographic procedures in isolation and purification of biomolecules : Absorption, partition, paper and thin layer chromatography. Gas liquid chromatography. High performance liquid chromatography (HPLC), Ion exchange and Exclusion chromatography. Affinity chromatography		
UNIT IV	Radio Isotopic Techniques		
	Radio Isotopic Techniques : Nature of isotopes and radioisotopes. Radioactive decay. Properties of radioactive emissions. Units of radioactivity. Techniques used to measure radioactivity; GM counter and liquid scintillation counting and gamma counter. Labelling of Biochemical compounds and autoradiography. Use of radioactive tracers in the study of		

	enzyme reaction mechanisms and metabolic pathways. Radioimmuno assay. Biological hazards of radiation and safety measures in handling radioisotopes		
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SUBJECT: MICROBIOLOGY

Course Code	Title	Credits	NOS
BMLT 210	Immunology	03	
UNIT I	Introduction to Immunology		
	Introduction and history of Immunology, Non-specific Defense; Physical Barriers, Chemical Barriers, Phagocytosis, Inflammation, Fever, Types of Immunity, Active & Passive Immunity, Immunological memory, Primary & Secondary Lymphoid organs, Mucosa Associated Lymphoid tissue (MALT), Cutaneous Associated Lymphoid Tissue (CALT), Lymphocyte Traffic, Cells of immune system, Antigens; factors affecting Immunogenicity, epitopes, haptens.		
UNIT II	Humoral Immunity		
	Humoral Immune Response, Antibodies / Immunoglobulins, Structure, function and type of antibodies, Antigenic-combining regions of antibodies, factors influencing antibody production, Genetic model, Multigene Organisation, generation of antibody diversity.		
UNIT III	Cell Mediated Immunity		
	Cell Mediated Immune System, Mechanism of CMI, Types of effector T Cells, Helper T-cells, Suppressor, T-cells, cytotoxic T cells, Killer T cells, Cytokines, Lymphokines, Colony Stimulating factors, Tumour Necrosis factor, Interferons, Accessory cells (Macrophages), the Complement System, Classical and Alternate pathway, HLA, Monoclonal antibody technology and its applications, Interactions between B and T lymphocytes.		
UNIT IV	Antigen-Antibody Interactions		
	Antigen-Antibody Interactions : Precipitation reaction, Immuno-diffusion test, counter current Immuno electrophoresis, complement fixation tests, Widal test, Wasserman's test, Weil Felix reaction, Western Blotting, Types of vaccines.		

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B.Voc. (MLT) Syllabus

Year 2 (Advanced Diploma)

Practicals for Semester IV

Part A: Skill Component

Sr. No	Experiment	Credits	NOS
	BMLT P206 (Clinical Biochemistry and Microbiology-I)	02	
1	Puncture fluid		HSS/ N0301/N0302/N0304
2	Routine examination of peritoneal (ascitic) fluid		HSS/ N0301/N0302/N0304
3	Routine examination of pleural fluid		HSS/ N0301/N0302/N0304
4	Routine examination of synovial fluid		HSS/ N0301/N0302/N0304
5	Routine examination of CSF		HSS/ N0301/N0302/N0304
6	Chemical examination of CSF		HSS/ N0301/N0302/N0304
7	To determine uric acid in serum.		HSS/ N0301/N0302/N0304
8	To determine uric acid concentration of urine.		HSS/ N0301/N0302/N0304
9	To estimate serum calcium and phosphorus		HSS/ N0301/N0302/N0304
10	To estimate the concentration of serum amylase		HSS/ N0301/N0302/N0304
11	To estimate the concentration of CPK total and LDH		HSS/ N0301/N0302/N0304
12	To determine serum acid phosphatase		HSS/ N0301/N0302/N0304
13	Determination of antistreptolysin O (ASO)		HSS/ N0301/N0302/N0304
14	To perform C-reactive protein test (CRP)		HSS/ N0301/N0302/N0304
	BMLTP207 (Histology and Cytology-I)	02	

15	To study autoanalysers		HSS/N0301/N0302/N0304/N0409
16	Introduction to chromatography		HSS/N0301/N0302/N0304/ N0409
	BMLT P208 (Parasitology and Blood Cell Disorders-I)	02	
17	Routine examination of feces.		HSS/ N0301/N0302/N0304
18	Gross examination and physical examination of stool.		HSS/ N0301/N0302/N0304
19	Concentration method of microscopic stool examination		HSS/ N0301/N0302/N0304
20	Microscopic examination of stool specimen.		HSS/ N0301/N0302/N0304
21	Detection of malarial parasite		HSS/ N0301/N0302/N0304
22	Detection of trypanosomes(the casual agent of sleeping sickness)		HSS/ N0301/N0302/N0304
23	Laboratory diagnosis of kala azar		HSS/ N0301/N0302/N0304
24	Laboratory diagnosis of microfilaria(wuchereia bancrofti)		HSS/ N0301/N0302/N0304
25	Quantitative determination of serum (or plasma) igG class antibodies to toxoplasma gondii by ELISA		HSS/ N0301/N0302/N0304
26	Determination of IgM class antibodies to toxoplasma gondii by ELISA		HSS/ N0301/N0302/N0304

Part B: General Education Component

Course Code	Title	Credits	NOS
BMLTP 209	Biochemical Techniques	01	
1.	Separation and identification of amino acids by (i) Paper chromatography (ii) Thin layer chromatography.		
2.	Separation of phospholipids by thin layer chromatography		
3.	Estimation of lactic acid in blood before and after exercise.		
4.	Preparation of starch from potato and its hydrolysis by salivary amylase.		

Course Code	Title	Credits	NOS
BMLTP 210	Immunology	01	
1.	Demonstration of Immune organs in dissected animal.		
2.	Demonstration of Immune cells in the smears prepared from Immune organs.		
3.	Complement fixation.		
4.	Antigen-antibody interactions – Agglutination – Precipitation – Blood grouping – Immunodiffusion		

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B.Voc. (MLT) Syllabus

Year 3 (B,Voc. Degree)

Part A: Skill Component

Semester V

Course Code	Title	Credits	NOS
BMLT 301	Medical Genetics and Microbiology-II	04	
Unit I	Genetics		
	Genetics: Genetics disorders, Karyotyping, Electrophoresis and Hybridization techniques		
	Introduction to Medical Genetics (Structures of DNA RNA). Genetic of common diseases.		HSS/N0301/N0302/N0304
Unit II	CLIA techniques		
	CLIA techniques		HSS/N0301/N0302/N0304
	Care and handling of laboratory animals		
	Introduction , general care and handling, ethics and legality in use of laboratory animals		HSS/N0301/N0302/N0304
Unit III	Immunology and Virology		
	Immunology		
	Immunity/Immune system, innate immunity, adaptive immunity, cells and organs involved in immune system		HSS/N0301/N0302/N0304
	Virology		
	General characteristics of Viruses, Chemotherapy of Viral diseases, classification of viruses, Oncogenic Viruses, RNA/DNA Viruses, AIDS, Miscellaneous viruses, Structure of viruses, lysogenic cycle, lytic cycle, smallpox, polio, HIV, Hepatitis B		HSS/N0301/N0302/N0304
Unit IV	Toxicology		
	Toxicological investigation & Therapeutic drug monitoring		
	Analytical Techniques, drug screening, heavy metals		HSS/N0301/N0302/N0303 / N0304/N0305/N0306/ N0307/N9602/N9606

Course Code	Title	Credits	NOS
BMLT 302	Histology-Cytology -II	04	
Unit I	Exfoliative Cytology-Specimen Preparation		
	Diagnostics Exfoliative cytology: Preparation of specimen		
	Preparation of specimens for cytological evaluation ,		HSS/N0301/N0302/ N0304 /N0409
Unit II	Exfoliative Cytology- Staining Techniques		
	Diagnostics Exfoliative cytology: Cytological Stains and Staining Techniques		
	Cytological stains and staining techniques ,		HSS/N0301/N0302/N0304 /N0409
Unit III	Exfoliative Cytology- Benign and Malignant Cells		
	Diagnostics Exfoliative cytology: Characteristics of Benign and malignant cells		
	Charecteristics of benign and malignan cells		HSS/N0301/N0302/N0304 /N0409
Unit IV	Advanced Instrumentation in Laboratory Technology		HSS/N0301/N0307

Course Code	Title	Credits	NOS
BMLT 303	Parasitology and Blood Cell Disorders-II	04	
Unit I	Descriptive study of RBC abnormalities		
	Descriptive study of RBC abnormalities		HSS/N0301/N0302/ N0304
Unit II	Disorders related to RBC		
	Disorders related to RBC		HSS/N0301/N0302/ N0304
Unit III	Normal white cell count & physiological variation		
	Normal white cell count & physiological variation		HSS/N0301/N0302/ N0304
Unit IV	Disorders related to WBC		
	Disorders related to WBC		HSS/N0301/N0302/ N0304

Part B: General Education Component

SUBJECT: MICROBIOLOGY

Course Code	Title	Credits	NOS
BMLT 304	Pathogenic Microbiology	03	
	Pathogenic Microbes, Diagnosis, Prevention and Control		
UNIT I	Introduction to important diseases caused by Streptococcus, Pneumococcus, Neisseria, Corynebacterium, Bacillus, Clostridium, enterobacteriaceae (Proteus, Shigella, Salmonella), Vibrio, Yersinia, Hemophilus, Mycobacterium, The operative pathogenic mechanisms, laboratory diagnosis, prevention and control of these diseases.		
	Prevention and Control of Viral Diseases		
UNIT II	Morphology, pathogenesis, life cycle, laboratory diagnosis, prevention and control of viral diseases viz. Rabies, Polio, Small pox, Herpes, Measles, Influenza and AIDS.		
	Human Mycotic Infections		
UNIT III	Introduction to Human mycotic infections viz Cryptococcosis, Dermatophytosis, Blastomycosis, Opportunistic Mycosis; Candidiasis and Aspergillosis.		
	Mechanisms and Control of Parasitic Infections		
UNIT IV	Life cycle, pathogenic, mechanisms and control of parasitic infections viz. amoebiasis, Kala-azar, toxoplasmosis, ascariasis, filariasis, hook worm infections.		

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Bachelor of Vocation (Medical Laboratory Technology)

B.Voc. (MLT) Syllabus

Year 3 (B.Voc.Degree)

Practicals for Semester V

Part A: Skill Component

Sr. No	Experiment	Credits	NOS
	BMLT P301 (Clinical Biochemistry and Microbiology-II)	02	
1	To detect hepatitis-B surface antigen(HBsAg)		HSS/ N0301/N0302/N0304
2	To detect HIV antibodies		HSS/ N0301/N0302/N0304
3	To perform haemoglobin electrophoresis		HSS/ N0301/N0302/N0304
4	To perform electrophoresis		HSS/ N0301/N0302/N0304
5	To determine T4 by RIA/ELISA method		HSS/ N0301/N0302/N0304
6	Visit to animal house and demonstration about care of laboratory animals		HSS/ N0301/N0302/N0304
	BMLTP302 (Histology and Cytology-II)	02	
7	Tissue processing by using tissue processor		HSS/ N0301/N0302/N0304
8	Sharpening of the microtome knife		HSS/ N0301/N0302/N0304
9	Gross examination and fixation of the specimen		HSS/ N0301/N0302/N0304
10	Decalcification of calcified tissue		HSS/ N0301/N0302/N0304
11	Processing of the tissue by manual method		HSS/ N0301/N0302/N0304
12	Section cutting of paraffin wax embedded tissue		HSS/ N0301/N0302/N0304
13	To fix the section on the slide		HSS/ N0301/N0302/N0304
14	Staining of the tissue section by using hematoxylin and eosin staining method		HSS/ N0301/N0302/N0304

	BMLTP 303 (Parasitology and Blood Cell Disorders-II)	02	
15	Preparation of staining of blood smear		HSS/ N0301/N0302/N0304
16	Study of morphology of blood cells		HSS/ N0301/N0302/N0304
17	Blood cells disorder in leukemia		HSS/ N0301/N0302/N0304
18	Screening for sickle cell anemia		HSS/ N0301/N0302/N0304
19	Determination of osmotic fragility of red blood cells		HSS/ N0301/N0302/N0304
20	Determination of fetal hemoglobin.		HSS/ N0301/N0302/N0304
21	Preparation of lupus erythromatosus(LE) cell		HSS/ N0301/N0302/N0304
22	Preparation of Heinz bodies		HSS/ N0301/N0302/N0304
23	Microscopic examination of bone marrow smear		HSS/ N0301/N0302/N0304
24	Detection of presence of iron in bone marrow smear		HSS/ N0301/N0302/N0304
25	Laboratory tests for diagnosis of aplastic anemia		HSS/ N0301/N0302/N0304
26	Investigations of megaloblastic anemia		HSS/ N0301/N0302/N0304
27	Laboratory tests in iron deficiency anemia		HSS/ N0301/N0302/N0304
28	Laboratory test for diagnosis of hemolytic disorders.		HSS/ N0301/N0302/N0304

Part B: General Education Component

Course Code	Title	Credits	NOS
BMLTP 304	Pathogenic Microbiology	01	
1.	Identification of both gram positive and gram negative microorganisms on the basis of : (i) Morphology. (ii) Bio-chemical characteristics. (iii) Serological reactions.		
2.	Demonstration of pathogens (Viruses, fungi, parasites) in permanent mounted slides.		
3.	Demonstration of cysts/ovas of protozoa/Helminths.		
4.	Demonstration of Laboratory grown fungi on sabauraud's agar.		
5.	Germ tube test for candida albicans.		
6.	Demonstration of fungi through normal saline/KOH preparation.		

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B.Voc. (MLT) Syllabus

Year 3 (B.Voc. Degree)

Semester VI

Part A: Skill Component

Course Code	Title	Credits	NOS
BMLT 305	Clinical Laboratory Operations and Management	04	
Unit I	Reagent preparation: The metric system, preparation of molar, normal, percent solutions Buffers, Acid, Base, pH (Definition and examples) Lab calculations and graphs.	200 Marks (Theory = 100 Marks Practical = 100 Marks)	HSS/N9602
	Clinical sample collection e.g. Blood, Urine, Stool examination, Saliva sample, Sputum sample, Semen analysis etc.		HSS/N0301/N0302
	Preparing and maintaining Lab records: Labeling of sample, ;.(making, entries storage, annexes), management of histopathology records.		HSS/N0304/N0305/N9603 / N9604/N9605
	Reporting results : a. Basic format of a test report, b. Release of examination results c. Alteration in reports		HSS/N0304/N0305
	Quality Management system : Internal and External quality control		HSS/N0306/N0307/ N9606
	Biomedical waste management in a clinical laboratory : Disposal of used samples, reagents and other biomedical waste		HSS/N9609
	Calibration and Validation of Clinical Laboratory instruments		HSS/N0303
	Ethics in Medical laboratory Practice : Pre-Examination procedures, Examination procedures, Reporting of results, Preserving medical records, Access to Medical laboratory Records		HSS/N0304/N0305/ N9603 / N9604 /N9605
	Audit in a Medical Laboratory		HSS/N0304/N0305
	Documentation		HSS/N0304/N0305

	Professional Training	04	
BMLT 306	Professional Training for three (3) months at reputed hospital, diagnostic centre, pathology laboratory, research institute, pharmaceutical industry, etc. (Student shall submit the valid certificate of completion of training issued by the concern organization to the college for the award of B.Voc. degree) (Professional Training completed / obtained by the student for 3 months will be included in this semester for 200 marks)	200 Marks	HSS/N0307/N0308
	Project Work	04	
BMLT 307	Student shall carry out the project work in consultation with faculty and industrial partner organizations. (Project work done by the student will be included in this semester for 200 marks)	200 Marks	HSS/N0307/N0308

Part B: General Education Component

SUBJECT: MICROBIOLOGY

Course Code	Title	Credits	NOS
BMLT 308	Food and Industrial Microbiology	03	
	Food Microbiology		
UNIT I	Food as a substrate for microorganisms, Nutritive value of food stuffs, effect of Hydrogen ion concentration (pH), moisture requirement on food, Important food borne diseases viz. Staphyococcal intoxication, Botulism. Salmonellosis, Shigillosis, Qualitative and Quantitative analysis of food components (proteins, fats, lipids, carbohydrates), Microbiological examination of food products including dairy products, food poisoning caused by bacteria and fungi.		
UNIT II	Contamination, Preservation and Spoilage of Food Contamination, preservation and spoilage in various foods viz. cereals & cereal products (cereal grains, flour, bread, pasta, macroni), sugars & sugars products (Maple, Syrup, Honey, Candy), Vegetables & Fruits, Meat (Fresh meat, fresh beef, hamburger, fish), Milk and Milk products (cheese, butter).		
UNIT III	Production Strains Isolation and Screening Techniques Production strains Isolation & screening techniques, preservation and genetic modification of Industrial Microorganisms, Fermentation Media, characteristics of ideal production media, common substrates used in ideal fermentations, Batch and continuous fermentations.		
UNIT IV	Fermentation Products Yeasts (Baker's) and its uses, fermentation of Beer, Wine and Alcohol, Production of organic acids viz. acetic acid, lactic acid, propionic and butyric acid and mixed acids. Mass transfer in aerobic fermentation.		

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Bachelor of Vocation (Medical Laboratory Technology)

B.Voc. (MLT) Syllabus

Year 3 (B.Voc. Degree)

Practicals for Semester VI

Part A: No Practicals for Skill Component

Part B: General Education Component

Course Code	Title	Credits	NOS
BMLTP 308	Food and Industrial Microbiology	01	
1.	Quantitative examination of microbial types in raw processed preserved food stuffs.		
2.	Direct microscopic determination of bacteria in raw, pasteurized milk and reductase test.		
3.	Various biochemical tests and their importance in Food Microbiology.		

Examination Pattern (Semester)

D) Internal Assessment (25%) = 25 Marks

- One periodical test on class instructions 20 Marks
- Active participation (attentiveness/ability to answer questions) 05 Marks

E) Theory External Examination (75%)= 75 Marks

- iii) **Duration:** These examinations shall be of 2^{1/2} Hours duration for each paper
- iv) **Theory Question Paper Pattern:**
 - There shall be five questions each of 15 marks. On each unit there will be one question and the fifth one will be based on entire syllabus.
 - All questions shall be compulsory with internal choice within the questions.
(Each question will be of 20 to 23 marks with options)
 - Question may be subdivided into sub questions a, b, c.... and the allocation of marks depend on the weightage of the topic.

F) Practical External Examination = 50 Marks for each paper

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B.Voc. (MLT) List Reference Books

Sr. No.	Title of the Book	Author
01	A guidebook to Biochemistry	Michael Yudkin
02	A Manual of Laboratory & Diagnostic Tests (6/ e)	Frances Fischbach
03	Anatomy & Physiology	Ross and Wilson
04	Anatomy and Physiology	N Murgesh
05	Anatomy and Physiology for nurses	Evelyn Pearce
06	Anatomy and Physiology for nurses	Sears
07	Anatomy and Physiology for nurses	Pearson
08	Anatomy and Physiology: Understanding the Human Body	Clark
09	At the Bench : A Laboratory Navigator	Kathe Barker
10	At the Helm : A Laboratory Navigator	Kathe Barker
11	Atlas of haematology (5/e)	G.A. McDonald
12	Bacterial Metabolism	Gerhard
13	Basic Medical Laboratory techniques	Barbara H. Estridge <i>et al</i>
14	Biochemistry	Voet and Voet
15	Biochemistry	Stryer
16	Biochemistry	U. Satyanarayan. & U. Chakrapani
17	Biology in the Laboratory	Doris Helms
18	Biometrics Identity	Sameer Nanawati
19	Biopharmaceutical and Pharmacokinetics	Chatwal, G.R.
20	Biostatistics : A Foundation for Analysis in Health Sciences	Wayne W. Daniel
21	Biotechnological Innovations in Health Care	Butterworth – Heinmann
22	Calculations for Molecular Biology	Stephenson
23	Cell Molecular Biology	Gerald Karp
24	Churchill's Medical Dictionary	Churchill Livingstone
25	Churchill's Medical Dictionary	Churchill Livingstone

26	Clinical Biochemistry	Richard Luxton
27	Clinical Diagnosis & Management by Laboratory method0 (20/e)	John Bernard Henary
28	Clinical Haematology	Christopher A. Ludlam
29	Clinical Laboratory Management	Lynne Shore
30	Clinical Pediatric Neurology	Gerals Fenichel
31	Color Atlas and Synopsis of Clinical Dermatology	Thomas Fitzpatrick
32	Color atlas of basic Histopathology	---
33	Companion to Microbiology	Alan Bull and Paulin Meadow
34	Current topics in AIDS (Volume I)	M.S. Gotlib
35	Di Fiore's Atlas of Histology	Di Fiore
36	Drugs for the heart	Lionrl H. Opie
37	Endocrinology	Headley
38	Fundamental Principles of Bacteriology	Salle, S.J.
39	Gel Electrophoresis of Nucleic Acids	D. RickWood and B.D. Hames
40	Gene VII	Benjamin Lewin
41	Gene VIII	Benjamin Lewin
42	General Microbiology	Stanier
43	Haematology (International edition)	Emmanuel C.Besa
44	Haematology (Pathophysiological basis for clinical practice (3/e)	Stephen M. Robinson
45	Haematology for students Practitioners	Ramnik Sood
46	Hand book of Medical Laboratory Technology (2/e)	V.H. Talib
47	Hospital Acquired Infections	Dr. V. Muralidhar
48	Human Physiology	Andrew Davis
49	Immunology	Riott
50	Immunology	Rao, C.V.
51	Immunology	Kuby
52	Immunology	Roitt, Jonathaan Brostoff and David Male
53	Immunology and Serology	Joshi
54	Instrumental Analysis	Chatwal Anand
55	Laboratory Reference	Jane Roskams
56	Manual of Endocrinology and Metabolism	Norman Levin
57	Medical Bacteriology	Peter Hawkey
58	Medical Bacteriology	Peter Hawkey
59	Medical Dictionary	Oxford
60	Medical Informatics	Mohan Bansal
61	Medical Laboratory Management	Sangeeta Sharma <i>et al</i>

62	Medical Laboratory Sciences, Theory & Practical	A. Kolhatkar
63	Medical Laboratory Technology – Volume I	Kanai Mukherjee
64	Medical Laboratory Technology – Volume II	Kanai Mukherjee
65	Medical Laboratory Technology – Volume II	Kanai Mukherjee
66	Medical Laboratory Technology Methods & Interpretation (5/e)	Ramnik Sood
67	Medical Microbiology	Paniker & Satish Gupte
68	Medical Microbiology	Paniker & Satish Gupte
69	Medical Mycology	Dr. Jagdish Chander
70	Medical Parasitology	R.L. Ichhpujani and Rajesh Bhatia
71	Medicinal Chemistry	Ashutosh Kar
72	Microbiology	Pelczar
73	Microbiology	Prescott
74	Molecular and antibody Probes in Diagnosis	Mathew R. Walker
75	Molecular and Antibody Probes in Diagnosis	Mathew R. Walker
76	Molecular Biology in Medicine	Timothy M. Cox
77	Molecular Biology in Medicine	M. Cox
78	Molecular Biotechnology	Glick
79	Neurodegenerative Diseases	Donald B. Calne
80	Outline of Biochemistry	Conn Stumpf
81	Pharmaceutical Microbiology	Hugo
82	Pharmacology	H.P. Rang
83	Physicians' Desk Reference	Edward Barnhart
84	Practical Clinical Biochemistry	Harold Varley
85	Practical Haematology	J.B. Dacie
86	Practical Haematology (8/e)	Sir John
87	Practical Medical Microbiology - (Volume I and II)	Mackie & MacCartney
88	Practical Medical Microbiology - (Volume I and II)	Mackie & MacCartney
89	Principal of Biochemistry	M. A. Siddiqi
90	Principles of Biochemistry	David L. Nelson
91	Principles of Biochemistry	Lehninger
92	Principles of Clinical Toxicology	Gosses
93	Principles of Clinical Toxicology	Thomas

94	Principles of Genetics	Gardner
95	Principles of Internal Medicine	Isselbacher
96	Proteins and Proteomics : Laboratory Manual	Richard J. Simpson
97	Purifying Proteins for Proteomics: Laboratory Manual	Richard J. Simpson
98	Research Methodology in Medical Sciences	Chandorkar
99	Text book of Medical Biochemistry	Chaterjee & Shinde
100	Text book of Microbiology	Ananthanereyan
101	Text book of Parasitology	N.C. Dey
102	Text book of Parasitology	Chaterjee
103	Textbook of Biochemistry and Human Biology	G.P. Talwar
104	Textbook of Medical Laboratory Technology	Godkar and Godkar
105	Textbook of Medical Physiology	Guyton and Hall
106	Zinsser Microbiology	Joklik and Willett
107	Oxford Practical Grammar	Eastwood, John
108	Essential English Grammar	Murphy, Raymond
109	Practical Communication Skills	Chrissie Wright
110	Business Communication	Sinha, K. K.
111	Business English	Taylor, Ken.
112	English Vocabulary in Use	Mccarthy, Micheal.
113	Business Letters, Emails	Shirley Taylor
114	The Craft of Business Letter Writing	Monipally, M. Matthew.
115	Presentations Laws	Anne
116	Telephoning and Teleconferencing Skills	Ken Taylor
117	Business and Administrative Communication	Locker, o. Kitty
118	Presentation Skills in English	Bob Dignen
119	Public Speaking	Osbrn, Micheal
120	Communication in Organisation	Dalmer Fisher
121	Keep Talking : Communicative Fluency Activities for Language Teaching	Friederike Klippel
122	A Handbook for English Language Laboratories	E. Sureshkumar
123	Cambridge Idioms Dictionary	Cambridge
124	Write to the Point : How to Communicate in business with style and purpose	Salvatore J. Iacone
125	Commercial Correspondence and Office Management	R. S.N. Pillai
126	Comdex Computer Course Kit	Gupta, V.
128	Computer Fundamentals	P.K. Sinha

129	Excel 2010 Inside Out	Dodge, Mark
130	Information Technology for Management	Lucas, Henry C.
131	A Foundation Course in Value Education	R R Gaur, R Sangal, G P Bagaria, 2009
132	Fundamentals of Ethics for Scientists & Engineers	E G Seebauer & Robert L. Berry, 2000
133	Human Values, New Age International Publishers	A.N. Tripathy, 2003
134	Environment Biology	Agarwal, K. C. 2001
135	Environment Protection and Laws	Jadhav, H & Bhosale, V.M. 1995
136	Waste Water Treatment	Rao M. N. & Datta A.K. 1987
137	Environment Science (1 st Indian Edition)	Daniel D. Chiras 2010
138	Essentials of Environment Science	Joseph
139	Environment Pollution Control Engineering	Rao, C.S.
140	Perspectives in Environmental Studies	Kaushik, A.
141	Clinical Biochemistry	G. Guru
142	Handbook of Biochemistry	M.A. Siddique
143	Textbook of Medical Biochemistry	S. Ramkrishnan
144	Biochemical Techniques	K. Choudhary
145	Blood Banking Operations	G. Gurur
146	Blood Banking Training Manual	Indian Society for Blood Banking
147	Practical Medical Microbiology	Mackie and MacCartney
148	Textbook of Medical Microbiology	R. Ananthnarayan and C.K. J. Paniker
149	Invertebrate Zoology	E.L. Jordan / V.S. Verma
150	Concepts of Ecology	N. Arunumugam
151	Essentials of Cytology	C.B. Powar
152	Cell Biology , Genetics and Evolution	N. Arunumugam
153	Zoology of F.Y.B.Sc. Volume I and II	S.S. Bhattacharya
154	Zoology of S.Y.B.Sc. Volume I , II and III	S.S. Bhattacharya & S.G. Yeragi
155	Molecular Biology	V.S. Verma & V.V. Agrawal
156	Embryology, Ecology and Physiology	N. Arunumugam
157	Manual of Zoology	Ekumarnath Ayyer
158	Fundamentals of Cytogenetics & Genetics	Mahabali Ram
159	Human Anatomy, Physiology & Health Education	Harie R. Berasari , Gandhi & Goel