



Shri Vaishnav Vidyapeeth Vishwavidyalaya Indore

Shri Vaishnav Institute of Paramedical Sciences

BACHELOR IN MEDICAL LABORATORY TECHNOLOGY (BMLT)

Syllabus BMLT I SEMESTER

Session 2022-2023

Subject Code	Category	Subject Name	Teaching and Evaluation Scheme								
			Theory			Practical		L	T	P	CREDITS
			End Sem University Exam (60%)	Two Term Exam (20%)	Teacher Assessment (20%)	End Sem University Exam (60%)	Teacher Assessment (40%)				
BMLT101	CC	Basic Histology I (Anatomy & Physiology)	60	20	20	0	0	3	0	0	3

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P - Practical; C - Credit;

*Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in class, given that no component shall exceed more than 10 marks.

Course Educational Objectives (CEOs): The students will

CEO1: rationalize the basic knowledge of human anatomy.

CEO2: develop understanding about human system histology.

CEO3: gain knowledge about functioning systems in the body.

Course Outcomes (COs): Student should be able to

CO1: understand the human system with emphasis on general anatomy, general histology and various glands.

CO2: acquainted with the regulation of blood, lymphatic system and Immune system.

CO3: understand the regulation of homeostasis in the blood, Identification of blood groups and function of Lymph.

CO4: Recognize and memorize important body systems anatomy and histology.

Unit-I

Introduction: Human Body as a Whole:

- General Anatomy: Definition of anatomy, and its divisions, Terms of positions, planes relationship and movements, Body regions. Body cavities, Membranes – Cutaneous, Serous, Mucous and Synovial membranes and some clinical terms used in anatomy.
- General histology: definition, Electron microscopic structure of Human cell; Tissues-Classification, functions and Microscopic Structures of Primary tissues –Epithelial tissue, connective, tissue, muscular tissue & Nervous tissues
- Glands: Classification, microanatomy of serous & mucous glands with examples.

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Unit-II

Blood, Lymphatic System & Immunity-I:

- Blood volume: Determination of blood volume, Properties of blood.
- The Plasma: Composition character & Functions, The Erythrocytes: Erythropoiesis, Functions, Fragility of RBCs, Fate of RBCs and Erythrocyte sedimentation rate (ESR).
- Hemoglobin: structure, types, compounds of hemoglobin and abnormal hemoglobin,
- Anemia: Types with examples; Polycythemia; Leukocytes – Types, functions, morphology, and formation of WBCs. Structure and functions of platelet with reference of Clotting and anti-clotting mechanisms, anticoagulants.

Unit-III

Blood, Lymphatic System & Immunity-II:

- **Haemostasias:** Bleeding disorders: Purpura, Hemophilia, Vitamin K deficiency and tests for bleeding disorders.
- **Blood group and blood transfusion-** Blood group: different systems, Blood grouping & cross matching and clinical importance. Blood transfusion: Hazards of blood transfusion, storage of blood; Homeostatic imbalances: Sickle-Cell disease, Leukemia; Clinical Connection - Withdrawing Blood, Complete Blood Count. Anticoagulants - Aspirin and Thrombolytic Agents, Hemolytic Disease of the Newborn.
- **The Lymphatic System:** General consideration of Lymphatic system; Gross anatomy of - Cisterna Chyli & Thoracic Duct; Brief discussion over names of regional lymphatics, axillary and inguinal lymph nodes; Histology of – Lymph Node, Spleen, Tonsil & Thymus.

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- **Lymph:** lymphoid tissue formation, composition and function of lymph. Microbial evasion of phagocytosis, Abscesses and Ulcers, Cytokine therapy; Homeostatic imbalances – AIDS, Autoimmune diseases.

Unit-IV

The Cardiovascular System:

- General considerations about basics of Cardiovascular System; Gross anatomy & related applied aspects of Heart – Location, Mediastinum, Shape and Size, Pericardium, Chambers, Exterior & Interior, Blood supply of heart, Systemic & pulmonary circulation.
- Conduction system of heart; Major arteries - Branches of aorta, common carotid artery, subclavian artery, axillary artery, brachial artery, superficial palmar arch, femoral artery, internal iliac artery, Peripheral pulse;
- Major veins - Inferior vena cava, portal vein, portosystemic anastomosis, cephalic vein, Great saphenous vein; Histology of – Elastic Artery, Muscular Artery & Vein.
- Cardiac cycle, Cardiac Output, Cardiac Index and Normal ECG waves.

Unit-V

- **Gastro-intestinal system (with relevant applied anatomy and Physiology):** Parts of the gastrointestinal tract, Stomach, Small and large intestine, Gall bladder, Gross anatomy of tongue and liver.
- **Respiratory system (with relevant applied Anatomy and Physiology):** Lungs, Breathing mechanism, Lung Volumes and capacities, O₂ and CO₂ transportations.

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- **Renal system(with relevant applied anatomy and Physiology):** Basic Anatomy of Kidneys, Structure of Nephron, Normal and abnormal urine constituents, Urine formation, Micturition.
- **Endocrine and Reproductive system(with relevant applied anatomy and Physiology):** Pituitary, Thyroid, Parathyroid, Pancreas, Adrenal gland and male and female gonads.
- **Nervous system(with relevant applied anatomy and Physiology):** Parts of Brain and spinal cord.

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Course Educational Objectives (CEOs): The students will

CEO1: identify various systems present in the human body.

CEO2: develop understanding about how human systems work in coordination with other systems.

CEO3: understand, analyze and interpret various histological tests for blood.

Course Outcomes (COs): Student should be able to

CO1: understand and identify the human system with emphasis on general anatomy, general histology, and various glands.

CO2: distinguish various human systems based on their respective functions.

CO3: memorize and perform various histological tests.

CO4: analyze and interpret the results of various blood test.

List of Practical's

- Identification of epithelium and tissue with examples.
- Identification of bones of axial & appendicular skeleton with important bony landmarks.
- Identification of heart & its chambers with great vessels
- Surface anatomy of main arteries, veins and nerves.
- Marking of quadrants of abdomen and Identification of abdominal and pelvic organs.

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- Estimation of Hemoglobin by – Sahli's method.
- Perform test for White Blood Cell count.
- Perform test for Red Blood Cell count.
- Determination of Blood groups (ABO and Rh system) Landsteiner Law.

Suggested readings:

1. G.K. Pal (2021). *Textbook of Medical Physiology, 4th edition*. Elsevier.
2. Gyton A.C and Hall J.E. (2020). *Textbook of medical physiology*, Prism Books(Pvt) ltd. Bangalore.
3. C.C. Chatterjee . *Human Physiology* Vol.1 and Vol.2, CBS Publishers & Distributors.
4. Graaff et al, (2013). *Schaum's Outline of Human Anatomy and Physiology*. McGraw Hill Education. New York City.
5. C. Shier David et al, (2012), *Hole's Human Anatomy and Physiology*, McGraw-Hill Education. New York.
6. Seema Tripathi, *Human Anatomical and Physiological Systems*, Viva Books Pvt. Ltd.

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Course Educational Objectives (CEOs): The students will -

CEO1: ingrain the understanding regarding general chemistry, analytical chemistry and micronutrition.

CEO2: understand and comprehend the theories and techniques behind specimen collections.

Course Outcomes (COs): Student should be able to -

CO1: develop profound knowledge about general biochemistry.

CO2: comprehend with principles behind analytical Instrumentation.

CO3: acquainted with carbohydrate metabolism and clinical manifestation.

CO4: acquainted with proteins and nucleic acids metabolism and related disorders.

CO5: differentiate between micronutrient and electrolyte, memorize enzymes and hormones.

Unit-I

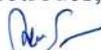
General Biochemistry:

- Elementary knowledge of inorganic chemistry; Structure of atom, atomic weight, molecular weight and equivalent weight: Acids, bases and salts. pH indicators: pH meter and pH measurement.
- Molar solutions, Normal solutions, Buffer solutions; Percent solution; Saturated solution; Standard solutions; Elementary knowledge of organic chemistry (Organic compounds, aliphatic, aromatic, alcohol, ethers, phenols, acids etc.)
- Elementary knowledge of Physical Chemistry; Osmosis, osmotic pressure, diffusion, hypotonic, hypertonic and isotonic solutions; Definition and classification of some Colloids and crystalloids.

Unit- II

Elementary Knowledge of Analytical Chemistry

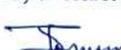
- Principles, Instrumentation, working, uses, care, Maintenance; Balances - mono-pan, two-pan, top-pan; Centrifuges; pH meter; Colorimeter; Spectrophotometer; Fluorimeter; Flame-photometer; Ion selective electrodes; Urinometer; Chromatograph; Electrophoresis; Densitometer.

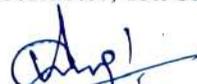

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BMLT102	CC	Biochemistry I	60	20	20	0	0	3	0	0	3

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Unit- III

Carbohydrates:

- Dietary Sources; digestion; absorption; basic metabolism; regulation of blood glucose & its importance; glucose tolerance test; glycosylated Hb; other parameters and related disorders
- Lipids: Dietary sources digestion; absorption; basic metabolism; lipid profile (cholesterol, triglyceride, lipoproteins, phospholipids) and its significance in various disorders

Unit-IV

Proteins & Nucleic Acid:

- Dietary sources; digestion; absorption; fate of amino Acids; nitrogen equilibrium; formation and detoxification of ammonia; formation of urea; formation of non protein nitrogenous products e.g. uric acid, creatinine;
- Disorders related to protein and nitrogen metabolism; Definition of DNA, Nucleic acids- structure of DNA Watson & Crick model of DNA- Types of RNA.

Unit-V

Specimen Collection:

- Vitamins, Minerals and Electrolytes: Fat soluble and water soluble vitamins; vitamin deficiency; Na; K; Cl; Ca; Mg; I₂; P; Fe and iron binding capacity.
- Enzymes: Classification; properties; factors affecting enzyme Activity; isoenzymes and coenzymes; Clinical enzymology - Therapeutic, diagnostic and analytical uses of enzymes with normal values of serum enzymes.
- Hormones-Chemical nature and biochemical functions.

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Course Educational Objectives (CEOs): The students will-

CEO1: understand, analyze and interpret test for macronutrients, blood and Urine.

Course Outcomes (COs): Student should be able to -

CO1: memorize and perform various tests.

CO2: analyze and interpret the results of various tests.

List of Practical's:

General tests of biomolecules

- General tests of carbohydrates
- General test of proteins

Urine analysis

- Normal urine.
- Abnormal constituents of urine.

Blood analysis

- Separation of serum from blood.
- Separation of plasma from blood

Suggested readings:

1. U. Satyanarayana and Chakrapani. (2020). *Outlines of Biochemistry*. ELSEVIER
2. Victor W. Rodwell, David A. Bender. (2015). *Harper's Illustrated Biochemistry*. A Lange Medical book.

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3. Drew Provan, Andrew Krentz. (2006). *Oxford Handbook of Clinical and Laboratory*. Oxford University Press.
4. Henry and John Bernard. (2011). *Clinical Diagnosis and Management by Laboratory Methods* Philadelphia.
5. B. Rose S. and Mileusnic, R. (1999). *The Chemistry of Life*. Penguin Press Science.
6. C. Lane, and Oxygen N. (2004). *The Molecule that Made the World*. Oxford University Press. USA.

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Course Educational Objectives (CEOs): The students will –

COE1: able to understand the basic characteristics of microorganisms, their growth requirement and describe sources of microorganisms in foods.

COE2: Able to classify and describe food borne diseases and use this information while reporting and investigating an outbreak in the region.

Course Outcomes (COs): Student should be able to -

CO1: develop profound knowledge regarding microorganisms, their action on food and human body.

CO2: comprehend about differentiate between pathogenic and non-pathogenic microorganisms.

CO3: enhance knowledge about microorganisms' growth.

CO4: learn about food hazards and contaminants protein metabolism.

CO5: understand food borne diseases.

Unit-I

Introduction to Microbiology and Microbial Genetics:

- Introduction & brief history of microbiology; Scope & relevance of microbiology.
- The microbial role in disease; The discovery of microbial effects; Introduction & concept of genetics.
- Definition of terminology- genetics, genome, gene, chromosome, base pairs, genetic code, genomics, genotype and phenotype. Types of bacterial variation- genotypic & phenotypic

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Unit II

The Bacteria-Bacterial Taxonomy

- Introduction to bacterial taxonomy; Taxonomic classification of organisms; Meaning and definition of taxonomy & classification. Meaning and definition of eukaryotic cell & prokaryotic cell; General property of bacterial cell.
- Morphology and Physiology of Bacteria - Introduction of bacteria, Classification of bacteria, Morphology based on size, shape, arrangement, motility, flagella, spores, capsules, mesosomes and ribosomes.

Unit III

Growth & Multiplication of Bacteria:

- Meaning of growth of bacteria; Types of bacterial growth with definition of generation time; Growth form in laboratory; Definition of growth curve including its phases; Multiplication of bacteria.
- Factors that affect growth-energy requirement, oxygen; requirement & metabolism, carbon dioxide requirement, temperature, pH, light & osmotic effect; Definition of Psychrophilic & thermophiles bacteria.

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Unit-IV

Stains used in Microbiology:

- Introduction of stain; Importance of stain in microbiology; Types of stain in detailed giving example- Simple stain, differential stain, negative stain, impregnation method
- Special staining for certain bacteria result interpretation of Gram staining & Ziehl Neelsen staining.

Unit-V

Bacteriological Media & Culture Techniques

- Introduction of culture media; Basic requirements & uses of culture media.
- Based on constituents/ingredients (simple, complex, synthetic or defined, special), Based on Oxygen requirement (aerobic & anaerobic media), Indication of culture media.
- Types of culture methods (streak culture, stab culture, pour plate method, broth culture) and Anaerobic culture methods.

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BACHELOR IN MEDICAL LABORATORY TECHNOLOGY (BMLT)

Syllabus BMLT I SEMESTER

Session 2022-2023

Subject Code	Category	Subject Name	Teaching and Evaluation Scheme								
			Theory			Practical		L	T	P	CREDITS
			End Sem University Exam (60%)	Two Term Exam (20%)	Teacher Assessment (20%)	End Sem University Exam (60%)	Teacher Assessment (40%)				
BMLT103(P)	CC	Microbiology -I (Practical)	00	00	00	30	20	0	0	2	1

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P - Practical; C - Credit;

*Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in class, given that no component shall exceed more than 10 marks.

Course Educational Objectives (CEOs): The students will-

CEO1: understand and create culture media and methods of culture growth.

CEO2: Develop profound understanding for antibiotic susceptibility.

Course Outcomes (COs): Student should be able to -

CO1: memorize and perform various tests.

CO2: analyze and interpret the results of various tests.

List of Practical's:

1. **Microscope**
 - a. Light Microscope
2. **Staining**
 - a. Grams staining
 - b. ZN staining
3. **Preparation of commonly used culture media**
 - a. Nutrient Agar
 - b. Chocolate agar
 - c. Mac Conkey agar
 - d. Muller Hinton agar
4. **Culture methods**
 - a. Streak method
 - b. Stab method
 - c. Pour Plate method

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Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P - Practical; C - Credit;

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5. Antibiotic susceptibility test

- Diffusion methods
- Dilution Methods/ Serial dilution method

➤ Practical's will be modified as per the feasibility.

Suggested readings:

- Pelczar Mj, Chan ECS and Kleig NR. (1993). **Microbiology**. Tata McGraw Hill. New York.
- LM Prescott. (2002). **Microbiology**. McGraw Hill. New York.
- Stuart Hoggy, (2005) **Essential Microbiology**, Wiley and Sons. New York.
- Copal E Hopier . 2011). **Manual of Clinical Laboratory methods**. Medical Laboratory.

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BMLT104	CC	Pathology-I	60	20	20	0	0	3	0	0	3

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P - Practical; C - Credit;

*Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in class, given that no component shall exceed more than 10 marks.

Course Educational Objectives (CEOs): The students will-

CEO1: Interpret morphological changes of the disease in correlation to clinical manifestations, lab investigations and radiological findings of the disease

CEO2: Acquire the ability to identify and find appropriate solutions to medical problems

Course Outcomes (COs): Student should be able to -

CO1: develop competency in techniques of pathology branches like hematology, clinical pathology, blood bank, histopathology, and cytology.

CO2: acquire knowledge and understand the formation of blood cells, structure, functions, and methods of estimating different parameters.

CO3: understand the detailed aspects of inflammation and healing inflammation.

CO4: understand the principles of hemodynamic disorder.

CO5: acquire knowledge and understand Nutritional & Infectious Diseases in detail..

Unit-I

Introduction to Pathology:

- Introduction and scope of Pathology; Brief resume of Historical Aspects; Subdivisions of Pathology.
- Ethical aspects of Pathology practice, Laboratory organization, safety and Instrumentations.
- Techniques for Studying Pathology: Basic concepts of Microscope, cryostat, Flow cytometry & PCR.

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BMLT104	CC	Pathology- I	60	20	20	0	0	4	0	0	4

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P - Practical; C - Credit;

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Unit II

Basics of Haematology:

- Introduction to Haematology. Brief description of composition and functions of blood.
- Collection and prevention of blood for various haematological investigations. Normal and absolute values of haematology, quality assurance in haematology.
- Haemoglobinometry, various methods of estimation of Hb, Physiological variations in Hb, PCV, and Platelet.

Unit-III

Haematological investigations –

- Haemocytometry, procedures for cell counts (RBCs, WBCs and Platelets), an errors involves and means to minimized such errors.
- Preparation and staining procedures of blood smears, study of morphology of blood cells.
- Determination of haematocrit values.

Unit-IV

Investigations of other biological fluids:

- Composition of urine, Routine examination of urine, abnormal constituents of urine.
- Compositions of different biological fluids (CSF, BAL, Synovial fluid etc.), examination of different biological fluids.
- Composition of Semen. Semen analysis.

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BMLT104	CC	Pathology- I	60	20	20	0	0	4	0	0	4

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit;

*Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in class, given that no component shall exceed more than 10 marks.

Unit-V

Blood and lymphatic Diseases:

- Anemia: types, causes and Cell morphology. Thalassemia, Sickle Cell anemia. Polycythemia.
- Haematoma, Leukemia, Leukocytopenia, Thrombocytopenia, Purpura.
- Lymphoma, Myeloma, Myelodysplastic syndrome (MDS).

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BMLT104(P)	CC	Pathology-I (Practical)	00	00	00	30	20	0	0	2	1

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P - Practical; C - Credit;

*Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in class, given that no component shall exceed more than 10 marks.

Course Educational Objectives (CEOs): The students will-

CEO1: understand, analyze and interpret test for hematology.

Course Outcomes (COs): Student should be able to -

CO1: memorize and perform various tests.

CO2: analyze and interpret the results of various tests.

List of Practical's:

- Hemoglobin estimation – Sahli's method and Cyanmethemoglobin method
- Peripheral blood film (PFB), Preparation, staining by leishman stain & examination.
- Cell counts by Neubauer chamber – RBCs, WBC, Platelets.
- ESR & PCV estimation
- Determination of Blood Groups with Direct and Indirect Coombs Test.
- Understand Leishman's staining and calculate Differential WBC count.
- Determination of packed cell Volume.
- Understand Erythrocytes Sedimentation Rate [ESR]
- Calculation of Blood indices.
- Determination of Clotting Time and Bleeding Time

Suggested readings:

- Porter R. (1997) *The greatest benefit to mankind: a medical history of humanity from antiquity to the present*. HarperCollins, London.
- B. Rosai J (1997). *Pathology: a historical opportunity*. Americal Journal of Patholog. Muir's Textbook of Pathology.
- M.I. Filipe et.al. (202). *Histochemistry in Pathology*. Churchill Livingstone. London.

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