**B.Voc. Degree Programme Medical Lab Technology**

**(Three Year Degree Programme)**

**Semester - 1**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Paper Code**  | **Nomenclature**  | **Duration of Exam** | **External** | **Internal** | **Max Marks** | **Type** | **Hours per Semester**  | **Credits**  |
| BVMLT -101 | Biochemistry-I | 3 Hours | 80 | 20 | 100 | General | 60 | 3 |
| BVMLT -102 | Microbiology-I | 3 Hours | 80 | 20 | 100 | General | 60 | 3 |
| BVMLT -103 | Pathology-I | 3 Hours | 80 | 20 | 100 | General | 60 | 3 |
| BVMLT -104 | Haematology-I | 3 Hours | 80 | 20 | 100 | General | 60 | 3 |
| BVMLT -105 | Practicals based on 101, 104 | 3 Hours | - | - | - | Skill | 75 | 5 |
| BVMLT -106 | Practicals based on 103, 102 | 3 Hours | - | - | - | Skill | 75 | 5 |
| BVMLT -107 | Compulsory Computer | 3 Hours | 100 | - | 100\*\* | Skill | 30 | 5 |
| BVMLT -108 | English | 3 Hours  | 40 | 10 | 50 | Skill | 30 | 3 |
| **Total** |  |  |  |  | **450** |  |  |  |

**Semester - 2**

|  |  |  |  |  |  |  |  |  |
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| **Paper Code**  | **Nomenclature**  | **Duration of Exam** | **External** | **Internal** | **Max Marks** | **Type** | **Hours per Semester**  | **Credits**  |
| BVMLT -201 | Biochemistry-II | 3 Hours | 80 | 20 | 100 | General | 60 | 3 |
| BVMLT -202 | Microbiology-II | 3 Hours | 80 | 20 | 100 | General | 60 | 3 |
| BVMLT -203 | Pathology-II | 3 Hours | 80 | 20 | 100 | General | 60 | 3 |
| BVMLT -204 | Haematology-II | 3 Hours | 80 | 20 | 100 | General | 60 | 3 |
| BVMLT -205 | Practicals based on 101, 104, 201, 204 | 3 Hours | 80 | 20 | 100 | Skill | 75 | 5 |
| BVMLT -206 | Practicals based on 102, 103, 203, 202 | 3 Hours | 80 | 20 | 100 | Skill | 75 | 5 |
| BVMLT -207 | Compulsory Computer | 3 Hours | 100 | - | 100\*\* | Skill | 30 | 3 |
| BVMLT -208 | English | 3 Hours | 40 | 10 | 50 | Skill | 60 | 5 |
| EVS |  | 3 Hours | 80 | 20 | 100\*\* | Skill | 30 | 3 |
| **Total** |  |  |  |  | **650** |  |  |  |
| **Total (I + II)** | **1100** |  |  |  |

**Semester - 3**

|  |  |  |  |  |  |  |  |  |
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| **Paper Code**  | **Nomenclature**  | **Duration of Exam** | **External** | **Internal** | **Max Marks** | **Type** | **Hours per Semester**  | **Credits**  |
| BVMLT -301 | Biochemistry-III | 3 Hours | 80 | 20 | 100 | General | 60 | 3 |
| BVMLT -302 | Microbiology-III | 3 Hours | 80 | 20 | 100 | General | 60 | 3 |
| BVMLT -303 | Pathology-III | 3 Hours | 80 | 20 | 100 | General | 60 | 3 |
| BVMLT -304 | Haematology-III | 3 Hours | 80 | 20 | 100 | General | 60 | 3 |
| BVMLT -305 | Practicals based on 301, 304 | 3 Hours | - | - | - | Skill | 75 | 5 |
| BVMLT -306 | Practicals based on 303, 302 | 3 Hours | - | - | - | Skill | 75 | 5 |
| BVMLT -307 | Hindi/Sanskrit  | 3 Hours  | 40 | 10 | 50 | Skill | 30 | 3 |
| **Total** | **450** |  |  |  |
| **Total (Sem. I + II + III)** | **1550** |  |  |  |

**Semester - 4**

|  |  |  |  |  |  |  |  |  |
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| **Paper Code**  | **Nomenclature**  | **Duration of Exam** | **External** | **Internal** | **Max Marks** | **Type** | **Hours per Semester**  | **Credits**  |
| BVMLT -401 | Biochemistry-IV | 3 Hours | 80 | 20 | 100 | General | 60 | 3 |
| BVMLT -402 | Microbiology-IV | 3 Hours | 80 | 20 | 100 | General | 60 | 3 |
| BVMLT -403 | Pathology-IV | 3 Hours | 80 | 20 | 100 | General | 60 | 3 |
| BVMLT -404 | Haematology-IV | 3 Hours | 80 | 20 | 100 | General | 60 | 3 |
| BVMLT -405 | Practicals based on 301, 304, 401, 404 | 3 Hours | 80 | 20 | 100 | Skill | 75 | 5 |
| BVMLT -406 | Practicals based on 302, 303, 403, 402 | 3 Hours | 80 | 20 | 100 | Skill | 75 | 5 |
| BVMLT -407 | Hindi/Sanskrit  | 3 Hours  | 40 | 10 | 50 | Skill | 30 | 3 |
| BVMLT -408 | Hospital Training |  | 100 | - | 100 | Skill | 60 | 5 |
| **Total** | **750** |  |  |  |
| **Total (Sem. I + II + III + IV)** | **2300** |  |  |  |

**Semester - 5**

|  |  |  |  |  |  |  |  |  |
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| **Paper Code**  | **Nomenclature**  | **Duration of Exam** | **External** | **Internal** | **Max Marks** | **Type** | **Hours per Semester**  | **Credits**  |
| BVMLT -501 | Biochemistry-V | 3 Hours | 80 | 20 | 100 | General | 60 | 3 |
| BVMLT -502 | Microbiology-V | 3 Hours | 80 | 20 | 100 | General | 60 | 3 |
| BVMLT -503 | Pathology-V | 3 Hours | 80 | 20 | 100 | General | 60 | 3 |
| BVMLT -504 | Haematology-V | 3 Hours | 80 | 20 | 100 | General | 60 | 3 |
| BVMLT -505 | Practicals based on 501, 504 | 3 Hours | - | - | - | Skill | 75 | 5 |
| BVMLT -506 | Practicals based on 503, 502 | 3 Hours | - | - | - | Skill | 75 | 5 |
| BVMLT -507 | Project Work |  | 50 | - | 50 | Skill | 30 | 3 |
| **Total** | **450** |  |  |  |
| **Total (Sem. I + II + III + IV + V)** | **2750** |  |  |  |

**Semester - 6**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Paper Code**  | **Nomenclature**  | **Duration of Exam** | **External** | **Internal** | **Max Marks** | **Type** | **Hours per Semester**  | **Credits**  |
| BVMLT -601 | Biochemistry-VI | 3 Hours | 80 | 20 | 100 | General | 60 | 3 |
| BVMLT -602 | Microbiology-VI | 3 Hours | 80 | 20 | 100 | General | 60 | 3 |
| BVMLT -603 | Pathology-VI | 3 Hours | 80 | 20 | 100 | General | 60 | 3 |
| BVMLT -604 | Haematology-VI | 3 Hours | 80 | 20 | 100 | General | 60 | 3 |
| BVMLT -605 | Practicals based on 501, 504, 601, 604 | 3 Hours | 80 | 20 | 100 | Skill | 75 | 5 |
| BVMLT -606 | Practicals based on 502, 503, 603, 602 | 3 Hours | 80 | 20 | 100 | Skill | 75 | 5 |
| BVMLT -607 | Project Work |  | 50 | - | 50 | Skill | 30 | 3 |
| BVMLT -608 | Hospital Training  |  | 100 | - | 100 | Skill | 60 | 5 |
| **Total** | **750** |  |  |  |
| **Total (Sem. I + II + III + IV + V + VI)** | **3500** |  |  |  |

1. Syllabus of B.Voc-I (English) and B.Voc.-II (Hindi/Sanskrit) is same is as that of B.Sc.-I & B.Sc.-II.
2. Environmental Studies paper will be studied as a qualifying paper. Syllabus is same as that of T.D.C.
3. Theory exams will be held semester wise.
4. Practical exams will be annual ( in even semester).

**B.VOC-I (SEMESTER-I)**

**PAPER-I**

**BIOCHEMISTRY - I**

**Time : 3 Hrs. University Assessment : 80%**

**Subject Code : BVMLT-101 Internal Assessment : 20%**

 **Total Marks : 100**

 **Minimum Pass Marks : 40%**

**Note : Attempt five questions in all, selecting two questions from each section. Question No. 1 is compulsory (short answer type). Nine questions are to be spread over the entire syllabus. All questions carry equal marks.**

**Section-A**

Introduction to Medical Lab Technology, Role of Medical Laboratory technologists-ethics, responsibility, safety measures and hazards in clinical biochemistry, first aid (accidents).

 Units of measurements, S.I. Units, measurement of volume, various volumetric apparatus (cylinders, flasks, pipettes), calibration of volumetric apparatus.

Cleaning and caring of general laboratory glassware and equipment, preparation and storage of distilled water, preparation of reagents and standard solutions, storage of chemicals and reagents, use of analytical balance, dry and moist heat radiation, filtration, autoclaving and chemical disinfection for sterilization.

**Section-B**

Introduction, aim and scope of Biochemistry. Elementary knowledge of inorganic chemistry :- atomic weight, molecular weight, equivalent weight, acid, bases. Elementary knowledge of organic chemistry :

(a) Organic compounds

(b) Aliphatic and aromatic compounds

(c) Alcohols, Aldehydes, Ketones, Amines, Esters, Phenol etc.

Viscosity - principles and applications; sedimentation - principles and applications; Radio-isotopes and their use in Biochemistry, mole, molar, molal and normal solutions, pH measurement, buffer solutions, percent solutions, osmosis, dialysis, surface tension.

**B.VOC-I (SEMESTER-I)**

**PAPER-II**

**MICROBIOLOGY - I**

**Time : 3 Hrs. University Assessment : 80%**

**Subject Code : BVMLT-102 Internal Assessment : 20%**

 **Total Marks : 100**

 **Minimum Pass Marks : 40%**

**Note : Attempt five questions in all, selecting two questions from each section. Question No. 1 is compulsory (short answer type). Nine questions are to be spread over the entire syllabus. All questions carry equal marks.**

**Section-A**

**Basic principles and usage of Instruments:**

General Instruments : Distillation plant, Centrifuge machine, Analytical Balance, Hotplate, Magnetic Stirrer, Water Bath, Automatic dispenser and diluters, Deionizer.

Microbiological Instruments : pH-meter, Autoclave, Incubator, Hot air oven, Laminar Air flow, Colony counter, Muffle furnace, Refrigerator, Inoculator, Mc Intosh and Flides anaerobic jar.

**Microscopy and Micrometery:**

Microscopy : Study of compound microscope-magnification, numerical aperture, resolution and components of microscope. Dark ground illumination, care of microscope and common difficulties. Study of phase contrast, interference, fluorescent, polarising and electron microscope. Calibration of ocular micrometer and measurement of microorganisms.

**Section-B**

**Microbiology & Medicine :** Introduction to Medical Microbiology, Discovery of microorganisms. Countribution of Robert Koch, Antonie Van Leeuwenhoek, Louis Pasteur, Bordet, Paul Ehrlich, Alexander Flemming, Elie Metchnikoff, Needham, Tyndall Janssen, Joseph Lister, Karl Landsteiner etc. Scope & relevance and safety measurers of Medical Microbiology. Role of medical microbiology in identification and management of various infectious diseases.

**Sterilization and Disinfection :** Definition, mode of action and uses of various physical methods of sterilization - heat, UV radiation, ionizing radiation, character affecting sterilization, autoclave control and sterilization indicators. Chemical disinfectants - phenol and its compounds, alcohol, halogen, heavy metals and quaternary ammonium compounds, aldehyde, gaseous compounds. Use and abuse of disinfectants. Disinfectants, antiseptics, chemotherapeutic agents, chemotherapeutic index, development of chemotherapy, antibiotics and effect of antibiotics on protein and nucleic acid synthesis and cytoplasmic membrane. Future development of chemo-therapy.

**B.VOC-I (SEMESTER-I)**

**PAPER-III**

**PATHOLOGY - I**

**Time : 3 Hrs. University Assessment : 80%**

**Subject Code : BVMLT-103 Internal Assessment : 20%**

 **Total Marks : 100**

 **Minimum Pass Marks : 40%**

**Note : Attempt five questions in all, selecting two questions from each section. Question No. 1 is compulsory (short answer type). Nine questions are to be spread over the entire syllabus. All questions carry equal marks.**

**Section-A**

Introduction to histopathology and laboratory organization, Introduction to anatomical terms and organization of human body. Tissues - Definitions, types, classification, location and functions.

 Management and planning, receiving and recording of specimens, indexing, maintaining records, knowledge of maintenance and use of various equipments.

**Study of :**

Skeletal system, bones, joints and muscles.

Respiratory system.

Cardiovascular system.

Alimentary system mechanism and physiology of digestion and absorption.

**Section-B**

**Study of :**

Liver structure and function.

Urinary system.

Male genital system.

Female genital system.

**Study of :**

Nervous system.

Spleen, lymph node and R.E. system.

Endocrine glands and their functions.

**B.VOC-I (SEMESTER-I)**

**PAPER-IV**

**HAEMATOLOGY - I**

**Time : 3 Hrs. University Assessment : 80%**

**Subject Code : BVMLT-104 Internal Assessment : 20%**

 **Total Marks : 100**

 **Minimum Pass Marks : 40%**

**Note : Attempt five questions in all, selecting two questions from each section. Question No. 1 is compulsory (short answer type). Nine questions are to be spread over the entire syllabus. All questions carry equal marks.**

**Section-A**

Introduction to haematology and laboratory organization, Lab safety and instrumentation, Transportation of different clinical materials to distant laboratories, Formation of blood, blood morphology, Chemistry and functions. Composition and functions of blood, Physiology of coagulation of blood.

Various anticoagulants, their uses, composition, amount, mode of action and their merits and demerits. Collection and preservation of blood for various haematological investigations. Changes in blood on storage, Morphology of normal and abnormal blood cells and their identifications; Methods of preparation of different types of vials.

**Section-B**

Normal and absolute values in haematology, Quality assurance in haematology. Haemoglobinometery, variouos methods of estimation of Hb, errors involved and standardization of instruments for Hb estimation. Physiological variations in haemoglobin.

Haemoglobin, its synthesis, functions and degradation, haemoglobin pigments and their measurement, abnormal haemoglobin and means of identification. Calculation of different red cell indices (Haemogram).

**B.VOC-I (SEMESTER-I)**

**PAPER-I**

**BIOCHEMISTRY - I**

**Subject Code : BVMLT-101**

**PRACTICAL**

1. Organization of clinical laboratories

(a) Organizational Structure

(b) Functional Components

1. Study of laboratory ethics and responsibility of its workers.
2. Biohazards and Safety precautions.
3. First aid-knowledge of first aid procedures.
4. The calibration of volumetric apparatus
5. Study of cleaning and sterilization of glassware & equipments.
6. Preparation of normal, molar, molal and percent solutions.
7. Preparation of buffer solutions and determination of their pH.
8. The determination of pH using indicators.
9. The detection of changes in the confirmation of bovine serum albumin by viscosity measurements.
10. The effect of pH on the conformation of bovine serum albumin.
11. To study the phenomenon of osmosis.
12. To study the phenomenon of dialysis.

**B.VOC-I (SEMESTER-I)**

**PAPER-II**

**MICROBIOLOGY - I**

**Subject Code : BVMLT-102**

**PRACTICAL**

1. Role of Microbiology Laboratory
2. Basic rules for specimen collection and handling, transportation of specimen and safety regulations.
3. Laboratory Procedures in Microbiology :

(a) Disinfection and sterilization

(b) Laboratory culture

1. Study of Principle and Working of :

(a) Microscopes (all types)

(b) Distillation apparatus

(c) Centrifuge

(d) Balance

(e) De-ionizer

(f) pH meter

(g) Autoclave

(h) Incubator

(i) Oven

(j) Colony Counter

(k) Muffle Furnace

(l) Refrigerator

**B.VOC-I (SEMESTER-I)**

**PAPER-III**

**PATHOLOGY - I**

**Subject Code : BVMLT-103**

**PRACTICALS**

1. Study of laboratory organization related to histology and cytology - basic terminologies and specimen handling.
2. Use and care of equipments, laboratory supplies and management.
3. Study of tissues.
4. Study of all the systems with the help of model/charts.
5. Study of bones.

**B.VOC-I (SEMESTER-I)**

**PAPER-IV**

**HAEMATOLOGY - I**

**Subject Code : BVMLT-104**

**PRACTICALS**

1. Methods of collection of blood.
2. Study of appliances for haematology practical
3. Making blood smear, staining and use of microscope for identifying components of blood.
4. Preparation of anticoagulant fluids.
5. Preparation of reagents for coagulant studies.
6. Study of various methods of estimation of Haemoglobin.
7. Study of basic laboratory procedures in Haematology.
8. Collection and processing of blood specimen -
	1. Plasma
	2. Serum
	3. Preparation of blood films
9. Cleaning of laboratory glassware in Haematology.

**B.VOC-I (SEMESTER-II)**

**PAPER-I**

**BIOCHEMISTRY - II**

**Time : 3 Hrs. University Assessment : 80%**

**Subject Code : BVMLT-201 Internal Assessment : 20%**

 **Total Marks : 100**

 **Minimum Pass Marks : 40%**

**Note : Attempt five questions in all, selecting two questions from each section. Question No. 1 is compulsory (short answer type). Nine questions are to be spread over the entire syllabus. All questions carry equal marks.**

**Section-A**

**Water :** Structure of water, solvents, properties of water, importance of water :

**Carbohydrates :** Structure, classification and their functions in biological system.

**Lipids :** General structure of fatty acids and classification of lipids.

**Amino acids :** Common structural features, physical and chemical properties, separation of amino acids and essential amino acids.

**Proteins :** Classification, structural organization and functions of proteins.

**Section-B**

**Enzymes :** Definition, classification of enzymes, concept of active sites, general mode of action of enzymes, mechanism of enzyme activity, Coenzymes, a brief account of Vitamins.

**Nucleic acids** : Structure, function and types of deoxyribonucleic acid (DNA) and ribonucleic acid (RNA), Nucleotides, Nucleosides, Nitrogen bases and role of Nucleic acids.

**Porphyrins :** A brief account of Porphyrins.

**B.VOC-I (SEMESTER-II)**

**PAPER-II**

**MICROBIOLOGY - II**

**Time : 3 Hrs. University Assessment : 80%**

**Subject Code : BVMLT-202 Internal Assessment : 20%**

 **Total Marks : 100**

 **Minimum Pass Marks : 40%**

**Note : Attempt five questions in all, selecting two questions from each section. Question No. 1 is compulsory (short answer type). Nine questions are to be spread over the entire syllabus. All questions carry equal marks.**

**Section-A**

**Cultural Media:** Liquid and solid media, container for media distribution of media in tubes, bottles and petridishes. Common ingredients of cultural media, synthetic media, peptone water, nutrient agar and broth, chocolate and blood agar, malt extract and broth, milk agar etc. Special media for *Neisseria*, *Corynebacterium*, *Mycobacterium* & *Enterobacteriaceae* group.

**Cultivation of bacteria:** Instruments used, inoculation hood, laminar flow, culture procedure, incubation (aerobic and anaerobic). Isolation of pure culture and its preservation. Blood culture. Introduction and uses of culture, classification of cultures, antimicrobial sensitivity, anaerobic cultivation techniques.

**Pure culture:** Maintenance and preservation of pure cultures. Collection, transport processing and storage of clinical sample for microbiological analysis.

**Section-B**

Anatomy of bacterial cell, intercellular components and their functions, bacterial reproduction, morphological study of bacteria and its appendages - flagella, fimbriae, pili, capsule, spore and cysts.

**Classification and identification of bacteria:** Biological groups, morphological and biological classification, deoxyribonucleic acid (DNA) composition as a basis of classification system of identification - morphology, staining reactions, cultural characters, biochemical reactions, antigenic characters and Medical importance.

Typical growth curve, various phases of growth physiology of bacteria-catabolism and anabolism. Nutrition of microbes and physical conditions required for growth. Effect of carbon, nitrogen, growth factors, vitamins, temperature, pH, osmotic pressure, oxygen and carbon dioxide on microbial growth.

**B.VOC-I (SEMESTER-II)**

**PAPER-III**

**PATHOLOGY - II**

**Time : 3 Hrs. University Assessment : 80%**

**Subject Code : BVMLT-203 Internal Assessment : 20%**

 **Total Marks : 100**

 **Minimum Pass Marks : 40%**

**Note : Attempt five questions in all, selecting two questions from each section. Question No. 1 is compulsory (short answer type). Nine questions are to be spread over the entire syllabus. All questions carry equal marks.**

**Section-A**

**Introduction to Histopathology:**

General Principle, Reception, recording and labelling of histology specimens; Fixation and various fixatives - Mode of action and indication preparation; Processing of histological tissues for paraffin-embedding, Embedding and embedding media,Vacuum embedding.

**Equipment used in Histopathology :** Tissue Processor; Microtome - various types, their working principle and maintenance;Microtome knives and knife-sharpening; Automatic slide strainer; Freezing microtome**;** Cryostat; Section cutting, cutting faults and remedies; Decalcification - Methods, advantages and disadvantages, various types - their mechanisms of action.

**Section-B**

**Major techniques used in Histopathology :**

Routine staining procedures, mounting and mounting media; Dye chemistry, theory and practice of staining; Solvent mordents, accelerators and accentuators; Use of controls in various staining procedures.

Preparation of Haematoxylin and Eosine, Methods of preparation, staining technique for rapid diagnosis, Histo-chemical staining, Cyto-chemical staining, Collection of Museum specimens, Preparation and storage, methods of mounting

**B.VOC-I (SEMESTER-II)**

**PAPER-IV**

**HAEMATOLOGY - II**

**Time : 3 Hrs. University Assessment : 80%**

**Subject Code : BVMLT-204 Internal Assessment : 20%**

 **Total Marks : 100**

 **Minimum Pass Marks : 40%**

**Note : Attempt five questions in all, selecting two questions from each section. Question No. 1 is compulsory (short answer type). Nine questions are to be spread over the entire syllabus. All questions carry equal marks.**

**Section-A**

Fundamentals of Haematology: History and discovery of blood group system, Principles used in blood grouping. ABO system and the methods used. Factors influencing the results of blood grouping. Rhesus blood group system (Rh-system), Rh-antigen, Source of antigens and types of antibodies.

Compatibility tests in blood transfusion (Direct & indirect), Cross-matching, Coomb's test - Principles involved and the methods used. Blood transfusion and it's hazards. Laboratory investigations of transfusion reactions and mismatched transfusion.

**Section-B**

Selection and screening of donor and collection of blood. Solution and apparatus used. Storage of blood, Preparation and storage of plasma; preparation of red cell suspension and how to serve a requisition. Detection of time when to discard blood in Blood bank.

Bone marrow aspiration methods, staining, preparation of bone marrow smears and preparation of histological sections. Preparation and staining procedures of blood smears - thin smears, thick smear, buffy coat smear and wet preparation.

**B.VOC-I (SEMESTER-II)**

**PAPER-I**

**BIOCHEMISTRY - II**

**Subject Code: BVMLT-201**

**PRACTICALS**

1. To study the phenomenon of imbibition of water.
2. To study the phenomenon of diffusion of water.
3. To study the phenomenon of plasmolysis and deplasmolysis.
4. To determine the osmotic pressure of cell sap by plasmolytic method.
5. To study the qualitative analysis of carbohydrates.
6. To study the qualitative analysis of proteins.
7. To study the qualitative analysis of fats & oils.
8. To study the structure of DNA and RNA from model/charts.
9. To study the effects of temperature, pH and substrate concentration on enzyme activity.

**B.VOC-I (SEMESTER-II)**

**PAPER-II**

**MICROBIOLOGY - II**

**Subject Code : BVMLT-202**

**PRACTICALS**

1. Principle, construction and working of : Microscope, Laminar Air Flow
2. Study of bacterial cell morphology
3. Isolation of pure cultures and preservation.
4. Demonstration of staining procedures for Gram staining, endospore and capsules.
5. Classification and identification of bacteria with respect to Gram Staining.
6. Study of growth curve in Bacteria and yeast
7. Preparation of culture media and technique of aseptic transfers.
8. Study of composition and preparation of stains.

**B.VOC-I (SEMESTER-II)**

**PAPER-III**

**PATHOLOGY - II**

**Subject Code : BVMLT-203**

**PRACTICALS**

1. Histological study of all the systems.
2. Preparation of stains.
3. Microtomy.

**B.VOC-I (SEMESTER-II)**

**PAPER-IV**

**HAEMATOLOGY - II**

**Subject Code : BVMLT-204**

**PRACTICALS**

1. Study of Human blood groups :
	1. Basic blood group system : ABO
	2. Sub groups of ABO
	3. Other variants in the ABO blood group system
2. Study of Rhesus (Rh) blood group system and immune antibodies.
	1. Rh antigen
	2. Rh antibody
3. Study of pre-transfusion testing
	1. Antibody screen
	2. Major cross-match
4. Study of compatible blood groups.
5. Screening of donors
6. Cross-matching of blood-samples-Coomb's test
7. Preparation and storage of plasma
8. Methods of storage of blood.
9. Preparation of bone-marrow smears.

**B.VOC-II (SEMESTER-III)**

**PAPER-I**

**BIOCHEMISTRY - III**

**Time : 3 Hrs. University Assessment : 80%**

**Subject Code : BVMLT-301 Internal Assessment : 20%**

 **Total Marks : 100**

 **Minimum Pass Marks : 40%**

**Note : Attempt five questions in all, selecting two questions from each section. Question No. 1 is compulsory (short answer type). Nine questions are to be spread over the entire syllabus. All questions carry equal marks.**

**Section-A**

Analytical Biochemistry-I : Titrimetry, Colorimetry, Spectrophotometry, Flame photometry, Atomic absorption spectroscopy, Automatic washer.

Analytical Biochemistry-II : Electrometric determination of Na+ and K+, Chromatography (Thin-layer and liquid chromatography), Electrophoresis (Paper and Gel electrophoresis) for haemoglobin.

**Section-B**

Principle procedures and applications of :

(a) Semi auto-analyzer, diluters and dry chemistry analyzer.

(b) Osmometry

(d) ELISA (Enzyme Linked Immunosorbent Assay)

Principle procedures and applications of :

(a) Coulter-counters

(b) RIA (Radio-Immunoassay)

(c) PCR (Polymerase Chain Reaction)

**B.VOC-II (SEMESTER-III)**

**PAPER-II**

**MICROBIOLOGY - III**

**Time : 3 Hrs. University Assessment : 80%**

**Subject Code : BVMLT-302 Internal Assessment : 20%**

 **Total Marks : 100**

 **Minimum Pass Marks : 40%**

**Note : Attempt five questions in all, selecting two questions from each section. Question No. 1 is compulsory (short answer type). Nine questions are to be spread over the entire syllabus. All questions carry equal marks.**

**Section-A**

**Identification of Bacteria :** *Micrococci, Staphylococci, Streptococci, Pneumococci, Corynebacteria, Escherichia, Klebsiella, Enterobacter, Salmonella, Shigella, Citrobacter, Yersinia, Pseudomonas, Vibrio, Haemophilus, Mycoplasma, Rickettsia.*

**Pathogenic and Non-Pathogenic Fungi:** *Candida, Cryptococci, Dermatophytes, Sporothrix, Histoplasma, Blastomyces, Coccidioides, Para-coccidioides,* Dematiaceous fungi, *Mycetoma,* Actinomyces, *Nocardia.*

**Section-B**

**Principles of staining techniques, composition & preparation of stains:** Making of films, staining methods, mounting media. Gram stain - preparation of stain and staining methods, speical stains for acid fast bacilli (AFB), Diptheria, intracytoplamic lipids, polysaccharides, nuclear materials, stain for amoeba, fungi, rickettsia. Ziehl - Neelsen stain, Albert stain and negative stain.

Morphology, life cycle and laboratory diagnosis of haemoflagellates (*Leishmania, Trypanosomes*); Morphology and life cycle of tissue and blood nematodes (*Trichinella*; *Filaria; Dracunculus*), Lab. Diagnosis of tissue & blood nematode infection; Morphology and life cycle of intestinal cestodes ( *Taenia, Echinococcus*); Culture techniques for protozoa (*Amoeba, Giardia, Leishmania*) ; Culture methods for Helminths, Hookworm, Round worm; Egg counting techniques; Preparation of stains and staining procedures of malaria; Identification of different plasmodium species; Preparation of media and maintenance of cultures (*E. histolytica*; *Giardia*; *Leishmania*)

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**B.VOC-II (SEMESTER-III)**

**PAPER-III**

**PATHOLOGY -III**

**Time : 3 Hrs. University Assessment : 80%**

**Subject Code : BVMLT-303 Internal Assessment : 20%**

 **Total Marks : 100**

 **Minimum Pass Marks : 40%**

**Note : Attempt five questions in all, selecting two questions from each section. Question No. 1 is compulsory (short answer type). Nine questions are to be spread over the entire syllabus. All questions carry equal marks.**

**Section-A**

General properties of living organisms; chemistry of the cells; cellular membranes; cytoskeleton; endoplasmic reticulum; golgi body; lysosomes; nuclear envelope; chromatin and chromosomes; mitosis; meiosis; Gametogenesis; reproductive cycle; fertilisation; cleavage; a model of gastrulation; Epithelial tissue; connective tissues (blood connective, cartilage, bone); muscular tissue; nervous tissue.

Introduction, evaluation and reporting of cytopathology specimens; Clinical residents in the following, keeping in view the special requirements of each case (Cytohormonal status, malignancy, infection, etc.); Types of smears (morning specimen, evening specimen, pre-menstrual specimen, etc.).

**Section-B**

Method of obtaining various specimens : urine sample, gastric smear, colonic lavage etc. Principles and preparation of solutions of stains. Techniques for concentration of specimens : various filters and cytocentrifuge.

Normal anatomy, histology and cytology of the cervix and endometrium, Sampling methods for the cervix, Microbiology of the female genital tract and the cytological preparations of common infections of the cervix.

Introduction to routine screening and reporting of non-gynaecological cytology specimens including those from : Respiratory system, Urinary system.

**B.VOC-II (SEMESTER-III)**

**PAPER-IV**

**HAEMATOLOGY - III**

**Time : 3 Hrs. University Assessment : 80%**

**Subject Code : BVMLT-304 Internal Assessment : 20%**

 **Total Marks : 100**

 **Minimum Pass Marks : 40%**

**Note : Attempt five questions in all, selecting two questions from each section. Question No. 1 is compulsory (short answer type). Nine questions are to be spread over the entire syllabus. All questions carry equal marks.**

**Section-A**

Erythrocyte sedimentation rate, factors influencing ESR and various procedures for its estimation with significance; Haematocrit value by macro and micro methods, their merits and demerits; Immunochemical, Immunoprecipitation, Immuno fixation and radial immunodiffusion tests; Methods of determination of Packed Cell Volume (PCV).

Determinations of innate immunity and its mechanism, phagocytosis of the compliment system, gross structure and development of cells concerned with antibody production, cellular processes involved in antibody formation.

**Section-B**

White blood corpuscles - introduction, development of WBC, diluting fluids, errors in sampling, mixing, diluting and counting and means to minimize such errors.

Haemocytometry, procedures for cell counting, advantages and disadvantages, uses and mechanism (visual as well as electronic) of cell counting; quality controls in cell counts; WBC and platelet counts; Basic principles of semi or automated blood cell counters; Some special tests – red blood corpuscles (RBC) osmotic fragility and foetal haemoglobin percentage; Haematopoietic systems of the body; Calculations of red blood cell indices - **mean corpuscular volume (MCV), mean corpuscular hemoglobin concentration (MCHC)**, mean corpuscular hemoglobin (MCH)

**B.VOC-II (SEMESTER-III)**

**PAPER-I**

**BIOCHEMISTRY - III**

**Subject Code : BVMLT-301**

**PRACTICALS**

1. Demonstration of principle and working of : Colorimeter, spectrophotometer, flame photometer, PCR (Polymerase Chain Reaction), coulter-counters.
2. Demonstration of osmometry.
3. Demonstration of RIA(Radio-Immunoassay)
4. Demonstration of DOT ELISA (Enzyme Linked Immunosorbent Assay)
5. Demonstration of polyacrylamide Gel Electrophoresis of a biological sample.

**B.VOC-II (SEMESTER-III)**

**PAPER-II**

**MICROBIOLOGY - III**

**Subject Code : BVMLT-302**

**PRACTICALS**

1. Identification of Pathogenic and non-pathogenic fungi from class-work materials/diseased tissues.
2. Collection, handling and storage of samples for viral diagnosis.
3. Isolation of Lactobacilli and Streptococci from curd.
4. Morphology and Life cycle of haemoflagellates *Leishmania, Trypanosomes*
5. Laboratory diagnosis of *Leishmania, Trypanosomes*.
6. Morphology and life cycle of tissue and blood nematodes *Filaria*, *Trichinella*, *Dracunculus*
7. Lab. diagnosis of tissue & blood nematode infection.
8. Morphology and life cycle of intestinal cestodes *Taenia,* *Echinococcus*
9. Culture techniques for protozoa *Amoeba, Giardia, Leishmania*
10. Culture methods for Helminths, Hookworm, Round worm.
11. Egg counting techniques.
12. Preparation of stains and staining procedures of malaria.
13. Identification of different plasmodium species.
14. Preparation of media and maintenance of cultures of *E. histolytica*, *Giardia*, *Leishmania*

**B.VOC-II (SEMESTER-III)**

**PAPER-III**

**PATHOLOGY - III**

**Subject Code: BVMLT-303**

**PRACTICAL**

1. To study collection of specimens and their clinical significance.
2. Preparation of specimens for cytological evaluation.
3. Concentrating specimens by centrifugation
	1. Thick specimen
	2. Watery specimen
4. To study preparation of smear, procedure of its fixation and mailing of smears
5. To study cell division from prepared slides of mitosis and meiosis.
6. Temporary squash preparations of onion root tip for the study of mitosis using acetocarmine stain.
7. Gynaecological and non-gynaecological cytology preparations and their studies.

**B.VOC-II (SEMESTER-III)**

**PAPER-IV**

**HAEMATOLOGY - III**

**Subject Code : BVMLT-304**

**PRACTICALS**

1. Determination of Haematocrit / Packed Cell volume (PCV)
2. Determination of Erythrocyte sedimentation rate (ESR)
3. Preparation of diluting fluids for Red Blood Corpuscles (RBC) and White Blood Corpuscles (WBC) counts.
4. Principles of haemocytometry, RBC, WBC, platelet counts, absolute eosinophil count, bleeding Time (BT), clotting time (CT), ESR and haemoglobin
5. To study osmotic fragility of RBC
6. Calculations of red blood cell indices - **mean corpuscular volume (MCV), mean corpuscular hemoglobin concentration (MCHC)**, mean corpuscular hemoglobin (MCH)

**B.VOC-II (SEMESTER-IV)**

**PAPER-I**

**BIOCHEMISTRY - IV**

**Time : 3 Hrs. University Assessment : 80%**

**Subject Code : BVMLT-401 Internal Assessment : 20%**

 **Total Marks : 100**

 **Minimum Pass Marks : 40%**

**Note : Attempt five questions in all, selecting two questions from each section. Question No. 1 is compulsory (short answer type). Nine questions are to be spread over the entire syllabus. All questions carry equal marks.**

**Section-A**

Carbohydrae metabolism, glycolysis, Kreb cycle (Tricarboxylic acid cycle) and their clinical importance, glucose tolerance test (GTT). Protein metabolism-urea cycle and its biomedical significance, Lipid metabolism, Beta-oxidation of fatty acids, ketonebodies, metabolic changes in liver and adipose tissues during starvation, lipid profile.

Principle, assay procedures and clinical significance of following; Glucose, total proteins, A/G ratio, Albumin, globulin, urea, Blood Urea Nitrogen level (BUN), uric acid, creatinin, cholesterol, Billirubin (Direct and Indirect).

Essential Electrolytes : Quantitative estimation of Sodium, potassium, calcium, chloride, lithium, phosphorus, magnesium inorganic phosphate, Protein Bound iodine (PBI) 17 Ketosteroids, Barbiturates and their clinical significance.

**Section-B**

Principle techniques and clinical significance of acid base balance test, D-Xylose absorption test, Inulin clearance test, urea and creatinin clearance tests, renal function tests, glycosylated haemoglobin & Liver function tests.

Collection and preservation of biological fluids (blood, serum, plasma, urine and cerebrospinal fluid (CSF),Quality control of clinical investigation, normal ranges of various bio-metabolites and their confidence limits, automation in clinical biochemistry laboratory, laboratory organization management and maintenance of records.

**B.VOC-II (SEMESTER-IV)**

**PAPER-II**

**MICROBIOLOGY-IV**

**Time : 3 Hrs. University Assessment : 80%**

**Subject Code : BVMLT-402 Internal Assessment : 20%**

 **Total Marks : 100**

 **Minimum Pass Marks : 40%**

**Note : Attempt five questions in all, selecting two questions from each section. Question No. 1 is compulsory (short answer type). Nine questions are to be spread over the entire syllabus. All questions carry equal marks.**

**Section-A**

**Safety measure in Microbiology Laboratory :** Occurence of Lab infections, route of infection in laboratory, safety measure precaution in use of pathogens in teaching. Lab organization managment, recording of results and quality control in Medical Microbiology Lab.

Preservation of microbes and lyophilisation methods; Total viable count of microorganisms (bacteria, yeast & moulds); Testing of disinfectants : Rideal - Walker, Chick - Martin and In-use tests; Preparation and standardization of vaccines and immunization schedule; Sterilization - Definition, methods, principles, bacteriological filtration, irradiation, tyndalization.

**Section-B**

**Virology:** Definition, General introduction of Virus, physico-chemical characteristics of viruses, diseases caused by different viruses and mode of infection, mode of transmission of viral agents, different staining techniques used in virology, use of embryonated eggs in clinical virology, principles of animal cell culture and their use in virology, use of common laboratory animals in viral diagnosis, prevention of viral diseases, immunity in viral infection.

**Care and management of experimental animals:** General directions for the care of animals, common diseases and experimental procedures. Various experimental animals - rabbits, guineapigs, mice, rats, fowls, and monkeys - their data, cages, feeding and handling.

**B.VOC-II (SEMESTER-IV)**

**PAPER-III**

**PATHOLOGY - IV**

**Time : 3 Hrs. University Assessment : 80%**

**Subject Code : BVMLT-403 Internal Assessment : 20%**

 **Total Marks : 100**

 **Minimum Pass Marks : 40%**

**Note : Attempt five questions in all, selecting two questions from each section. Question No. 1 is compulsory (short answer type). Nine questions are to be spread over the entire syllabus. All questions carry equal marks.**

**Section-A**

**Cytopathology :** General functions of the cells, cellular membranes, cytoskeleton**,** golgi body, lysosomes**,** nuclear envelope**,** chromatin & chromosomes**,** mitosis

**Cyto-chemistry :** Carbohydrates and amyloid - special stains and procedures; Connective tissues, trichrome staining and other special stains for muscle fibres, elastic, reticulin fibres and collagen fibres; Staining technique for Glycogen; Staining technique for fat; Staining technique for mucin.

**Section-B**

Principles of metal impregnation techniques; Demonstration and identification of minerals and pigments; Metachromasia and metachromatic dyes

**Cytology :** Stains and cytologic preparation with special emphasis on May-Grünwald Giemsa stain MGG, and Papanicolaqu stains (PAP) method; Special stains like periodic acid Schiff (PAS), Mucicarmine, Alcian blue, Schmorl's, Perl's stain and Congo Red; Cytologic screening and quality control in cytology laboratory.

**B.VOC-II (SEMESTER-IV)**

**PAPER-IV**

**HAEMATOLOGY - IV**

**Time : 3 Hrs. University Assessment : 80%**

**Subject Code : BVMLT-404 Internal Assessment : 20%**

 **Total Marks : 100**

 **Minimum Pass Marks : 40%**

**Note : Attempt five questions in all, selecting two questions from each section. Question No. 1 is compulsory (short answer type). Nine questions are to be spread over the entire syllabus. All questions carry equal marks.**

**Section-A**

Haemostatic mechanism and theoris of blood coagulation, disorders of hemostasis, physicochemical properties of coagulation factors, screening coagulation procedures, Quantitative assay of coagulation factors.

Principles and methods of assessment of coagulation bleeding time (BT), clotting time (CT), Prothrombin time, recalcification time, activated partial thromboplastin time, thromboplastin regeneration time, Hypercoagulable states, coagulation disorders.

**Section-B**

Thrombocytopenia, thrombocythemia, platelet function test, clot retraction test, platelet factor 3 test (PF3), Heinz body preparation.

[Lupus erythematosus (LE) cell](https://www.google.co.in/url?sa=t&rct=j&q=&esrc=s&source=web&cd=7&cad=rja&uact=8&ved=0ahUKEwi_tpKjqbrUAhXKLo8KHbWvD64QFghGMAY&url=http%3A%2F%2Fwww.labpedia.net%2Ftest%2F100&usg=AFQjCNFrZRP6VYa0yRLcEaQUh5u-mmcBjw)- definition, morphology, causes. Various methods of demonstrating LE cells, Blood parasites, Malaria, *Leishmania donovani* (L-D) bodies, microfilaria and methods of demonstration.

**B.VOC-II (SEMESTER-IV)**

**PAPER-I**

**BIOCHEMISTRY - IV**

**Subject Code : BVMLT-401**

**PRACTICALS**

1. Separation of sugars by Paper Chromatography.
2. Separation of lipids by thin-layer chromatography.
3. Determination of total soluble sugars by ferricyanide method (Colorimetric method).
4. Quantitative estimation of glucose in blood plasma using glucose oxidase by enzymatic method.
5. Determination of glycogen in liver.
6. Estimation of protein by Lowry's method.
7. Determination of protein by Bradford method.
8. Determination of sodium and potassium content in blood serum samples by flame photometer.
9. Quantitative estimation of calcium by volumetric procedure.
10. Quantitative analysis of lipids :
	1. The determination of the acid value of a fat.
	2. The saponification value of a fat.
	3. The iodine number of a fat.
	4. The estimation of blood cholesterol.
11. Estimation of blood sugar, urea, uric acid, creatinin, bilirubin etc.
12. **B.VOC-II (SEMESTER-IV)**

**PAPER-II**

**MICROBIOLOGY - IV**

**Subject Code: BVMLT-402**

**PRACTICALS**

1. Handling and care of laboratory animals.
2. Recording of laboratory data and use of computers.
3. Safety measures in Microbiology laboratory
4. Methods of preservation of microbes.
5. Isolation of bacteria from curd.
6. Indole, Methyl red, Voges-Proskauer, Citrate utilization (IMViC) test from coliform bacteria.
7. Study of sterilization techniques.

**B.VOC-II (SEMESTER-IV)**

**PAPER-III**

**PATHOLOGY - IV**

**Subject Code : BVMLT-403**

**PRACTICALS**

1. Study of cytological stains and staining techniques :
	1. Papanicolaou staining (PAP) method
	2. May-Grünwald Giemsa stain (MGG) method
2. Staining techniques for :
	1. Glycogen
	2. Fat
	3. Mucin
3. Preparation of special cytological stains like :
	1. periodic acid Schiff (PAS)
	2. Mucicarmine
	3. Alcian blue
	4. Schmorl
	5. Perl's stain
	6. Congo red
4. To study staining procedures for :
	1. Muscle fibres
	2. Elastin fibres
	3. Reticulin fibres
	4. Collagen fibres
	5. Trichome staining

 **B.VOC-II (SEMESTER-IV)**

**PAPER-IV**

**HAEMATOLOGY - IV**

**Subject Code : BVMLT-404**

**PRACTICALS**

1. Study of determination of bleeding time.
2. Study of coagulation tests :
	1. Determination of prothrombin time
	2. Determination of activated partial thromboplastin time.
3. Study of screening test :
	1. bleeding time
	2. clotting time
4. Study of clot retraction and lysis time.
5. Preparation of Lupus erythematosus (LE) smears
6. Preparation of haemolysate
7. Study of blood parasites

**B.VOC-III (SEMESTER-V)**

**PAPER-I**

**BIOCHEMISTRY - V**

**Time : 3 Hrs. University Assessment : 80%**

**Subject Code : BVMLT-501 Internal Assessment : 20%**

 **Total Marks : 100**

 **Minimum Pass Marks : 40%**

**Note : Attempt five questions in all, selecting two questions from each section. Question No. 1 is compulsory (short answer type). Nine questions are to be spread over the entire syllabus. All questions carry equal marks.**

**Section-A**

Qualitative analysis of urine for physical and chemical constitutents i.e. sugar, proteins, bile salts, bile pigments, ketone bodies, porphobilinogen, faecal occult blood.

Chemical analysis of body fluids i.e. Cerebrospinal fluid (CSF), pleural fluid, Ascitic fluid. Collection and recording of biological specimens, separation of serum plasma, preservation and disposal of biological samples material. Volumetric analysis - Preparation of standard acid and base solutions.

**Section-B**

Qualitative tests of inorganic urinary ingredients : Chlorides, Phosphates, sulphur compounds, sodium (Na), Potassium (K), Calcium (Ca) and Magnesium (Mg) and their clinical significance.

Pathological changes in composition of body fluids and their clinical co-relation. Nosocomial infections and sterility testing of I/V fluids and processing of various samples for hospital infections. Basic statistics (mean, median, mode, standard deviation (SD), coefficient of variation (CV), normal distribution, probability, t-test, chi-square test), normal and reference range.

**B.VOC-III (SEMESTER-V)**

**PAPER-II**

**MICROBIOLOGY - V**

**Time : 3 Hrs. University Assessment : 80%**

**Subject Code : BVMLT-502 Internal Assessment : 20%**

 **Total Marks : 100**

 **Minimum Pass Marks : 40%**

**Note : Attempt five questions in all, selecting two questions from each section. Question No. 1 is compulsory (short answer type). Nine questions are to be spread over the entire syllabus. All questions carry equal marks.**

**Section-A**

Bacteriological examination of water, milk, food and air; Toxin-antitoxin assays and pathogenicity tests; Epidemiological markers of microorganisms - serotyping Bacteriophage and Bacteriocin typing methods

Food poisoning (food intoxication and food infection) Bacterial food poisoning (Botulism, *Staphylococcus* and *Escherichia coli*), fungal food poisoning (*Aspergillus*, *Penicillium* and *Claviceps*)

**Section-B**

Lab diagnosis of common bacterial infection viz : Pyogenic infections, Respiratory tract infections: Meningitis, Diphtheria, Whooping cough, Gas gangrene, Food-poisoning, Enteric fever, Acute diarrhoeal diseases, Cholera Urinary tract infection, Tuberculosis, Leprosy, Plague, Anthrax, Typhus fever, Syphilis, Gonorrhoea.

Lab diagnosis of fungal infections viz: superficial dermatophyte fungal infections, cadidiasis, cryptococcosis pulmonary infections, mycetoma, other deep mycotic infections and subcutaneous fungal infections. Sporotrichosis, Chromoblastomycosis, Eye and Ear fungi infections.

**B.VOC-III (SEMESTER-V)**

**PAPER-III**

**PATHOLOGY - V**

**Time : 3 Hrs. University Assessment : 80%**

**Subject Code : BVMLT-503 Internal Assessment : 20%**

 **Total Marks : 100**

 **Minimum Pass Marks : 40%**

**Note : Attempt five questions in all, selecting two questions from each section. Question No. 1 is compulsory (short answer type). Nine questions are to be spread over the entire syllabus. All questions carry equal marks.**

**Section-A**

Micro-organisms in the tissues-various staining techniques for their demonstration and identification; Examination of body fluids - peritoneal and pericardial fluid, bronchoalveolar lavage fluid, hydatid cyst fluid and Joint fluid.

Nucleic acids, DNA and RNA special stains and procedures; Tissues requiring special treatment i.e. eye ball, Endometrial biopsy, under calcified bone; Examination of semen - physical characters, count, motility, viability and morphology.

**Section-B**

Autopsy Techniques; Neuropathological Techniques; Immunohistochemistry demonstration; Special microscopy-various types, Electron microscope, ultramicrotomy; Museum techniques, microphotography and other display material, teaching material development; Enzyme histochemistry, demonstration of phosphatases, dehydrogenases, oxidases and peroxidases; Transportation of different clinical materials to distant laboratories.

 **B.VOC-III (SEMESTER-V)**

**PAPER-IV**

**HAEMATOLOGY - V**

**Time : 3 Hrs. University Assessment : 80%**

**Subject Code : BVMLT-504 Internal Assessment : 20%**

 **Total Marks : 100**

 **Minimum Pass Marks : 40%**

**Note : Attempt five questions in all, selecting two questions from each section. Question No. 1 is compulsory (short answer type). Nine questions are to be spread over the entire syllabus. All questions carry equal marks.**

**Section-A**

Definition etiology and classification of anaemias; Laboratory investigation for megaloblastic anaemia; Laboratory investigation for iron deficiency anaemia; Laboratory investigation for haemolytic anaemia including classification and causes; Autohemolysis, acid hemolysis, changes in blood morphology due to anaemia

Methods of identification of abnormal haemoglobin including spectroscopy, hemoglobin electrophoresis, alkai denaturation test, sickle cell preparation.

**Section - B**

Leukemia : definition and classification, causes and detection of leukemia. Total leycocyte count in leukemia, multiple myeloma identification & clinical features; Cytochemical staining procedures in various hematopoietic disorders; Laboratory test for assessing bleeding disorders.

**B.VOC-III (SEMESTER-V)**

**PAPER-I**

**BIOCHEMISTRY - V**

**Subject Code : BVMLT-501**

**PRACTICAL**

1. Collection and Processing of Laboratory Specimens.

(a) Urine examination: Physical, Chemical, Microscopic and Biochemical (Organic and Inorganic).

(b) Stool examination

(c) Chemical examination of other body fluids : Cerebrospinal fluid (CSF), Pleural fluid, Ascitic fluid.

1. Volumetric analysis

(a) Preparation of standard acid solutions.

(b) Preparation of standard basic solutions.

1. (i) Titration of a mixture of a strong and a weak acid.

(ii) Titration of a mixture of a strong acid and strong base.

(iii) Titration of a mixture of a weak acid and strong base.

1. Preparation of quality control charts (Standard Deviation (SD), Coefficient of variation (CV )etc.)
2. Interpretation of quality control charts.

**B.VOC-III (SEMESTER-V)**

**PAPER-II**

**MICROBIOLOGY - V**

**Subject Code : BVMLT-502**

**PRACTICALS**

1. Determination of Biological oxygen demand (BOD) of water.
2. Determination of Chemical oxygen demand (COD) of water.
3. Demonstration of antibiotic sensitivity test.
4. Lab diagnosis of common bacterial infections
5. Lab diagnosis of common fungal infections.
6. Study of bacterial and fungal food poisoning.

**B.VOC-III (SEMESTER-V)**

**PAPER-III**

**PATHOLOGY - V**

**Subject Code : BVMLT-503**

**PRACTICALS**

1. To study the process of laboratory diagnosis of :

(a) Peritoneal and pericardial fluid

(b) Bronchoalveolar lavage fluid

(c) Hydatid cyst fluid

(d) Joint fluid

(e) Semen analysis

1. Isolation of chromosomal DNA from plant or bacteria or animal tissues.
2. Estimation of DNA by DPA method (Diphenylamine method)
3. Estimation of RNA by orcinol method.
4. Clinical enzymology and determination of transaminases, phosphatases, dehydrogenases and oxidases.
5. Simple assays for cell mediated immunity.

**B.VOC-III (SEMESTER-V)**

**PAPER-IV**

**HAEMATOLOGY - V**

**Subject Code : BVMLT-504**

**PRACTICALS**

1. Laboratory diagnosis of Haemoglobinopathies :
	1. Screening test for Sickle-cell anaemia
2. Sickle-cell preparation
	* 1. (ii) Solubility test
		2. (iii) Haemoglobin electrophoresis
	1. Screening test for megaloblastic anaemia
	2. Screening test for iron-deficiency anaemia
	3. Screening test for haemolytic anaemia
3. Laboratory diagnosis of Leukaemias

**B.VOC-III (SEMESTER-VI)**

**PAPER-I**

**BIOCHEMISTRY-VI**

**Time : 3 Hrs. University Assessment : 80%**

**Subject Code : BVMLT-601 Internal Assessment : 20%**

 **Total Marks : 100**

 **Minimum Pass Marks : 40%**

**Note : Attempt five questions in all, selecting two questions from each section. Question No. 1 is compulsory (short answer type). Nine questions are to be spread over the entire syllabus. All questions carry equal marks.**

**Section-A**

Principles of enzyme activity determination. Units for expressing enzyme activity. Factors affecting enzyme activity, Mechanisms responsible for abnormal enzyme levels.

Isoenzymes - creatine phosphokinase (CPK), creatine kinase (CK), Serum glutamic oxaloacetic transaminase (SGOT), and lactate dehydrogenase (LDH); serum glutamic pyruvic transaminase (SGPT), Cholinesterase HBDH, amylase, alpha amylase, lipase, aldolase and myoglobin.

Serum leucine, amino peptidase, alkaline and acid phosphatases, lactate dehydrogenase, creatine phosphokinase (CPK), Fructosamine test in semen. Analysis of renal biliary and prostatic stones, Tests of foetal well being by amniotic fluid, Analysis for alpha - foetoprotein and their clinical significance.

**Section-B**

Gastric analysis, free and total acidity, pentagastrin test, histamine and caffeine stimulation tests; Thyroid function test : triiodothyronine T3, prohormone of T3 (T4), thyroid-stimulating hormone (TSH), Free T3, Free T4, protein bound iodine (PBI) and thyroglobulin; Infertility profile : TSH, Follicle stimulating hormone (FSH),  Luteinizing hormone LH, Testosterone, estrogen, prolactin and Dehydroepiandrosterone (DHEA) sulphate.

Toxicology : Alcohol, heavy metals (Zinc, Mercury etc.) salicylates, drug abuse, screening and drug interference with laboratory findings.

Endocrinology : Estimation of growth hormone, Adrenocorticotropic hormone (ACTH), sex hormone binding globulin, Aldosterone, parathormon, cortisol and 17 - hydroxyprogesteron and their clinical significance.

**B.VOC-III (SEMESTER-VI)**

**PAPER-II**

**MICROBIOLOGY - VI**

**Time : 3 Hrs. University Assessment : 80%**

**Subject Code : BVMLT-602 Internal Assessment : 20%**

 **Total Marks : 100**

 **Minimum Pass Marks : 40%**

**Note : Attempt five questions in all, selecting two questions from each section. Question No. 1 is compulsory (short answer type). Nine questions are to be spread over the entire syllabus. All questions carry equal marks.**

**Section-A**

Serological Test : Widal, Antistreptolysin O (ASO), Liver Function test (LFT), C- Reactive Protein (CRP) , Rosewaller, Brucella, agglutination, Cold agglutinin, Venereal Disease Research Laboratory (VDRL), Treponema pallidum hemagglutination (TPHA), fluorescent treponemal antibody-absorption (FTA-ABS), Serological tests for fungal infection and skin tests, Advanced techniques in microbiology Counter Current Immunoelectrophoresis CCIEP, Co-agglutination, Gas liquid chromatography (GLC), High performance liquid chromatography (HPLC) etc, Rapid diagnostic methods and Automation in Microbiology; Culture and Drug sensitivity test : Culture, isolation and identification of pathogens from urine, pus and sputum and recording of recording of their results.

Principle of serological techniques used in virology – part 1 - Haemagglutination assay (HA) , Haemagglutination Assay Inhibition (HAI), Single Radial Haemolysis (SRH), Reverse Passive Haemagglutination Assay (RPHA), Indirect Haemagglutination Assay (IHA), Complement Fixation Test (CFT); Principles of serological techniques used in virology Part II : [Nuchal translucency](https://www.babycenter.com/0_nuchal-translucency-scan-nt-scan_118.bc) (Nt), Enzyme Linked Immunosorbent Assay (ELISA), Radio Immunoassay (RIA), [Indirect Fluorescent antibody](https://www.google.co.in/search?biw=1366&bih=662&q=Indirect+Fluorescent+antibody+IFA&spell=1&sa=X&ved=0ahUKEwiQraixwrrUAhVHPo8KHeRdD_sQvwUIHigA) (IFA) , Immuno - peroxidase test.

**Section-B**

**Parasitology**

Morphology and life cycle of protozoans- Free living Amoebae, *Balantidium*, *Toxoplasma*, Diagnosis, morphology and life cycle of trematodes *Schistosomes* (blood flukes), Intestinal Flukes

Serological and Immunological Techniques used in diagnosis - Gel – diffusion, Indirect Haemagglutination Assay (IHA), [Indirect Fluorescent antibody](https://www.google.co.in/search?biw=1366&bih=662&q=Indirect+Fluorescent+antibody+IFA&spell=1&sa=X&ved=0ahUKEwiQraixwrrUAhVHPo8KHeRdD_sQvwUIHigA) (IFA), Enzyme Linked Immunosorbent Assay (ELISA), Indirect Fluorescent antibody, Identification of adult forms- Mosquitoes, Flies, Ticks and fleas Animal care, handling and uses in parasitology. Preparation of parastic antigens and antisera, handling and operating of sophisticated equipments

. **B.VOC-III (SEMESTER-VI)**

**PAPER-III**

**PATHOLOGY - VI**

**Time : 3 Hrs. University Assessment : 80%**

**Subject Code : BVMLT-603 Internal Assessment : 20%**

 **Total Marks : 100**

 **Minimum Pass Marks : 40%**

**Note : Attempt five questions in all, selecting two questions from each section. Question No. 1 is compulsory (short answer type). Nine questions are to be spread over the entire syllabus. All questions carry equal marks.**

**Section-A**

Cells and organs of the immune system, Immunoglobulins, antibodies and humeral immune response, Allergy

Rheumatological diseases and investigations, Rheumatoid arthritis test (RA), Infection and the immune system, Cancer Immunology

**Section-B**

Tumor markers, Tissue typing for kidney transplant and bone-marrow transplant, Laboratory tests for demonstration of antigen, antigen-antibody reaction and cell mediated immunity.

Cervical cytology-basis of detection of malignant and premalignant lesions, Hormonal assessment with cytologic techniques and sex chromatin and pregnancy tests, Fine needle Aspiration cytology-principles, indications and utility of the technique with special emplasis on role of cytotechnician in Fine Needle Aspiration Cytology (FNAC) clinics.

**B.VOC-III (SEMESTER-VI)**

**PAPER-IV**

**HAEMATOLOGY - VI**

**Time : 3 Hrs. University Assessment : 80%**

**Subject Code : BVMLT-604 Internal Assessment : 20%**

 **Total Marks : 100**

**Minimum Pass Marks : 40%**

**Note : Attempt five questions in all, selecting two questions from each section. Question No. 1 is compulsory (short answer type). Nine questions are to be spread over the entire syllabus. All questions carry equal marks.**

**Section-A**

Haematological changes in systemic disorders : Their microscopic picture with identification and clinical features. Haematological aspects of pediatric and Geriatric age groups, haematological disorders in pregnancy and their blood picture. Haematological changes in acquired immune deficiency syndrome AIDS.

Various parasites in blood and their clinical significance. Lab investigations and methods of identification.

Haematological malignancies: Lab investigations in haematological malignancies.

**Section-B**

Various benign leucocyte reaction - Leukocytosis, Neutrophilia, Pancytopenia, Eosinophilia, Lymphocytosis, Infectious mononucleosis, leucopenias, Laboratory investigation for [Disseminated Intravascular Coagulation](http://emedicine.medscape.com/article/199627-workup) (DIC)

Mechanism of fibrinolysis, tests for fibrinolysis, Precautions to prevent haemolysis, Techniques available for cytogenetic studies, Use of radioisotopes in haemotology; Safety measures for handling radioisotopes.

**B.VOC-III (SEMESTER-VI)**

**PAPER-I**

**BIOCHEMISTRY - VI**

**Subject Code : BVMLT-601**

**PRACTICALS**

1. The study of progress curve obtained during the hydrolysis of p-nitrophenyl phosphate by serum alkaline phosphatase.
2. To study the variation of serum alkaline phosphatose activity with enzyme concentration.
3. The study of effect of temperature on the activity of alpha-amylase.
4. The study of thyroid function tests and infertility tests.
5. Estimation of :
	1. Cortisol
	2. Progesterone
	3. Testosterone
	4. Creatine kinase NAC (CK-NAC)
	5. Creatine kinase MB (CK-MB)
	6. Creatine phosphokinase (CPK)
	7. Serum glutamic oxaloacetic transaminase (SGOT)
	8. Serum glutamic pyruvic transaminase (SGPT)

**B.VOC-III (SEMESTER-VI)**

**PAPER-II**

**MICROBIOLOGY - VI**

**Subject Code : BVMLT-602**

**PRACTICALS**

1. Study of parasitology, Morphology and life cycle of - Free living Amoeba, Balantidium, Toxoplasma
2. Diagnosis of Morphology and life Cycle of trematodes - Schistosomes Intestinal Flukes, Blood Flukes
3. Identification of adult forms of mosquitoes, flies, ticks and fleas.
4. Study of serological techniques
5. Principles of serological techniques used in Virology - Part 1 : Haemagglutination assay (HA) , Haemagglutination Assay Inhibition (HAI), Single Radial Haemolysis (SRH), Reverse Passive Haemagglutination Assay (RPHA), Indirect Haemagglutination Assay (IHA), Complement Fixation Test (CFT)
6. Principles of Serological techniques used in Virology-Part-11 [Nuchal translucency](https://www.babycenter.com/0_nuchal-translucency-scan-nt-scan_118.bc) (Nt), Enzyme Linked Immunosorbent Assay (ELISA),Radio Immunoassay (RIA), [Indirect Fluorescent antibody](https://www.google.co.in/search?biw=1366&bih=662&q=Indirect+Fluorescent+antibody+IFA&spell=1&sa=X&ved=0ahUKEwiQraixwrrUAhVHPo8KHeRdD_sQvwUIHigA) (IFA) , Immuno - peroxidase test.
7. Serological test, Widal, Antistreptolysin O (ASO), Liver Function test (LFT), C- Reactive Protein (CRP), STS, Rose-Waaler Test.
8. Serological test; Brucella agglutination, Cold agglutinin test, Venereal Disease Research Laboratory (VDRL), Treponema pallidum hemagglutination (TPHA), fluorescent treponemal antibody-absorption (FTA-ABS)

5. Serological and Immunological Techniques used in diagnosis- Gel – diffusion, Indirect haemagglutination assay (IHA), [Indirect Fluorescent antibody](https://www.google.co.in/search?biw=1366&bih=662&q=Indirect+Fluorescent+antibody+IFA&spell=1&sa=X&ved=0ahUKEwiQraixwrrUAhVHPo8KHeRdD_sQvwUIHigA) (IFA), Enzyme Linked Immunosorbent Assay (ELISA), Indirect Fluorescent antibody

**B.VOC-III (SEMESTER-VI)**

**PAPER-III**

**PATHOLOGY - VI**

**Subject Code : BVMLT-603**

**PRACTICALS**

1. Tumor and cancer markers :
	1. Estimation of Alpha feto-proteins (AFP)
	2. Estimation of Carcino embryonic antigen (CEA)
	3. Estimation of Prostrate specific antigen (PSA)
2. Study of cervical cytology.

**B.VOC-III (SEMESTER-VI)**

**PAPER-IV**

**HAEMATOLOGY - VI**

**Subject Code : BVMLT-604**

**PRACTICALS**

1. Human immunodeficiency virus HIV test
2. Study of haematological disorders during pregnancy
3. Study of haematological aspects of Pediatric and Geriatric age groups.
4. Laboratory investigations in haematological malignancies.
5. Study of various types of bleeding disorders.

**BOOKS RECOMMENDED FOR READING**

**BIOCHEMISTRY**

|  |  |  |
| --- | --- | --- |
| **Sr. No.** | **Name of the Book Edition, Year** | **Name(s) of Author(s)** |
|  | Varley's Practical Clinical biochemistry  | A.H. Gowehlock |
|  | Lab Manual in Biochemistry  | E.A. Storey V.G. Makarova |
|  | Harper's Biochemistry | A.K. Murray |
|  | Introduction to Practical Biochemistry  | Plummer D.T. |
|  | Biochemistry | J.H. Ottaway D.K. APPS |
|  | Outline of Biochemistry | P.E. ConnP.K. StumpfR.H. Dol |
|  | An Introduction to Medical statistics  | Martine Bland  |
|  | Clinical Chemistry in Diagnosis and treatment  | E.J. ZilvnP.R. PanvalP.D. Maryne |
|  | Microanalysis in Medical Biochemistry | Wooten I.D.P. Freeman H. |
|  | Fundamental of Clinical Chemistry  | N.W. Tietz (Ed) |
|  | Clinical Chemistry (Principles and Techniques) | R.J. HenryD.C. CannonJ.W. Winkelman |
|  | Medical Laboratory Procedures Manual Vol. I, II, III | K.L. Mukherjee |
|  | Text book of Medical Biochemistry  | Ramakrishna  |
|  | Text book of Biochemistry | Vasudevan and Sree Kumari |
|  | Medical Laboratory procedures manual, Vol. I, II, III | K.L. Mukherjee |
|  | A manual of laboratory diagnostic test | Fischback |
|  | Practical clinical Biochemistry  | Harold Varley |
|  | Tietz's Text Book of Clinical Chemistry | N. Tietz |
|  | Clinical Chemistry - Theory, Analysis, Correlation  | Kaplan |
|  | Principles and Techniques of biochemistry and molecular biology  | Keith Wilson and Walker  |
|  | Lippincott's illustrated reviews Biochemistry | Pamela C. Champe |
|  | Text book of Biochemistry  | D.M. Vasudevan and Sreekumari |
|  | Todd-Sanford Clinical Diagnosis  | Laboratory methods  |

**PARASITOLOGY**

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| **Sr. No.** | **Name of the Book Edition, Year** | **Name(s) of Author(s)** |
|  | Diagnostic techniques in medical parasitology | Fleck and Moody |
|  | Tropical Medicine and Parasitology by. | Gold Smith and Heynemann |
|  | Essential Immunology | I.M. Rohit |
|  | Parasites : A guide to Laboratory Procedures and identifications | L.R. Ash and T.C. Orihel |
|  | Parasitic Diseases  | M. Katz |
|  | Immunodiagnosis of Parasitic diseases  | Walls and Sohantz  |
|  | Diagnostic Colour atles and Textbook of parasitology | - |
|  | Parasitology | N.c. Day |
|  | Text Book of parasitology | K.D. Chatterjee |
|  | parasitic diseases in Man | Richard Knight  |

**MICROBIOLOGY**

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| **Sr. No.** | **Name of the Book Edition, Year** | **Name(s) of Author(s)** |
|  | Clinical Microbiology | J. Stokes and G.L. Ridgeway |
|  | Mannual of Practical Medical Microbiology and Parasitology | T.R. Ob erhofer  |
|  | Introduction in Medical Microbiology | Anant-Narainyan |
|  | Practical Medical-Microbiology  | Mackie and MC Cathey |
|  | Laboratory Mannual and Work book for Microbiology in Health and Disease  | Robert Fuerst  |

**VIROLOGY**

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| **Sr. No.** | **Name of the Book Edition, Year** | **Name(s) of Author(s)** |
|  | Notes on Medical Virology | Timbery |
|  | Manual for rapid Laboratory diagnosis  | - |

**ANATOMY & HISTOPATHOLOGY**

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| **Sr. No.** | **Name of the Book Edition, Year** | **Name(s) of Author(s)** |
|  | Theory and practice of Histological Techniques  | Bancroft and Stevens  |
|  | Cellular pathology Techniques  | C.F.A. Culling  |
|  | Theory + Practical of Histological Techniques | Baneroft  |

**HAMATOLOGY AND CLINICAL PATHOLOGY**

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| **Sr. No.** | **Name of the Book Edition, Year** | **Name(s) of Author(s)** |
|  | An Introduction to Medical Laboratory Technilogy | F.J. Baker et al |
|  | Practical Haemotology | J.V. Dacia And  |
|  | Hematology for Medical Technologists  | Charles F. Seiverd  |
|  | Technical Hematology | Arthur Simmens  |
|  | Clinical Diagnosis and Management by Laboratory Methods  | Todd & Sanford  |
|  | Medical Laboratory Technology | Lynch |
|  | Blood Coagulation and Haemostatis  | Thomson J.  |
|  | Cellular Pathology |  Culling  |
|  | Theory and Practical of Histological Techniques | Bancroft  |
|  | Clinical Haematology  | Wintrobe's  |
|  | Practicals in Haematology | J.V. Dacie |
|  | Essentials of Haematology | Haufbrand  |