काशी हिन्दू विश्वविद्यालय

BANARAS HINDU UNIVERSITY

OUTLINES OF TESTS SYLLABI AND COURSE BACHELOR OF VOCATION (B. VOC.)

DEGREE PROGRAMME IN MEDICAL LABORATORY TECHNOLOGY

(2019 -20 ADMISSIONONWARDS)

(1st to 6th Semester)

COURSE STRUCTURE AND SCHEME OF
B.VOC. (MEDICAL LAB TECHNOLOGY)

(SEMESTER SYSTEM)

***Refer to Generic Components Common to all B.Voc. Courses**

Paper Code	Title	Generic/ Skill Component	Theory/ Practical	Internal (Theory)	External (Theory)	Internal (Practical)	External (Practical)	Credit
SEMESTER I								
***GEN - 101**	**Communication Skills**	**Generic**	**Theory**	30	70	--	--	6
***GEN - 102**	**Fundamentals of Information Technology**	**Generic**	**Theory**	30	70	--	--	6
MLT103	**Human Anatomy & Physiology I**	**Skill**	**Theory & Practical**	30	70		100	6
MLT104	**Laboratory Equipment and Phlebotomy**	**Skill**	**Theory & Practical**	30	70		100	6
MLT105	**Hematology**	**Skill**	**Theory & Practical**	30	70		100	6
SEMESTER II								
***GEN 201**	**Soft Skills and Personality Development**	**Generic**	**Theory**	30	70	--	--	3
GEN 202	**Introduction to Medical Technology Healthcare Systems**	**Generic**	**Theory**	30	70	--	--	3
MLT203	**Human Anatomy & Physiology II**	**Skill**	**Theory & Practical**	30	70		100	6
MLT 204	**Clinical Biochemistry-I**	**Skill**	**Theory & Practical**	30	70		100	6
MLT 205	**Analytical Laboratory Testing Process -I**	**Skill**	**Theory& Practical**	30	70		100	6
****SIT-201**	**Diagnostic Lab Training**	**Skill**	**Practical**	--	--		100	6

**** Diagnostic Lab Training of 4-6 weeks in a relevant Industry after 2nd Semester Examinations during summer break. Training report by the student to be submitted within in one week of start of 3rd Semester. Viva-Voce examination to be held within 3-weeks of the start of 3rd semester.**

Job Role: Medical Lab Technician (NSQF Level 4)

COURSE STRUCTURE AND SCHEME OF B.VOC. (MEDICAL LAB TECHNOLOGY)

SEMESTER III

Paper Code	Title	Generic/ Skill Compone	Theory/ Practical	Internal (Theory)	External (Theory)	Internal (Practical)	External (Practical)	Credit
*GEN 301	Value Education And Human Rights	Generic	Theory	30	70	--	--	6
GEN 302	Safe Laboratory Practices	Generic	Theory	30	70	--	--	6
BMLT 303	Parasitology and Medical Entomology	Skill	Theory & Practical	30	70		100	6
BMLT 304	Medical Microbiology-I	Skill	Theory & Practical	30	70		100	6
BMLT 305	Bacteriology, Mycology and Virology	Skill	Theory& Practical	30	70		100	6

SEMESTER IV

*GEN 401	Environmental Studies	Generic	Theory	30	70	--	--	3
GEN 402	Clinical Laboratory Management	Generic	Theory	30	70	--	--	3
BMLT 403	Histopathology	Skill	Theory & Practical	30	70		100	6
BMLT 404	Cytopathology	Skill	Theory & Practical	30	70		100	6
BMLT 405	Microbiology-II	Skill	Theory & Practical	30	70		100	6
**SIT-401	Summer Industrial Training						100	6

*Refer to Generic Components Common to all B.Voc. Courses

**** Summer Industrial Training of 4-6 weeks in a relevant Industry after 4th Semester Examinations during summer break. Training report by the student to be submitted within in one week of start of 5th Semester. Viva-Voce examination to be held within 3-weeks of the start of 5th semester.**

Job Role: Medical Lab Technician (NSQF Level 4)

COURSE STRUCTURE AND SCHEME OF
B.VOC. (MEDICAL LAB TECHNOLOGY)

SEMESTER V

Paper Code	Title	Generic/ Skill Component	Theory/ Practical	Internal (Theory)	External (Theory)	Internal (Practical)	External (Practical)	Credit
*GEN - 501	Critical Thinking and Elementary Statistics	Generic	Theory	30	70	--	--	6
502	Introduction to Biochemical Techniques	Generic	Theory	30	70	--	--	6
503	Clinical Immunology	Skill	Theory & Practical	30	70		100	6
504	Serology & Serological Lab Procedures	Skill	Theory & Practical	30	70		100	6
505	Clinical Biochemistry-II	Skill	Theory& Practical	30	70		100	6

SEMESTER VI

*GEN 601	Entrepreneurship Development Programme	Generic	Theory	30	70	--	--	6
602	Sensitization to Blood Banking and Infection Control	Generic	Theory	30	70	--	--	6
603	Project work and Comprehensive Viva	Skill	Practical				600	18

**** Project work start after end semester examination of 5th semester. It will be of at least 6 month. Project work and Comprehensive Viva done at the end of 6th Semester Examinations. A report by the student to be submitted in the 6th Semester.**

***Refer to Generic Components Common to all B.Voc. Courses**

Job Role: Medical Lab Technician (NSQF Level 4)

B.VOC. (MEDICAL LAB TECHNOLOGY)

SEMESTER I

SKILL PAPER

BMLT 103: HUMAN ANATOMY AND PHYSIOLOGY I (Credits 6)

Objectives: Basic understanding of organization of body cells, tissues, organs, organ systems, and glands in human body.

Instructions: The syllabus of this paper has been divided into four units. Examiner will set a total of nine questions comprising two questions from each unit, Question number one is compulsory of short answer type questions covering the whole syllabus. The students are required to attempt one question from each unit and the entire Compulsory Question No. 1. All questions carry equal marks

Section I

• Basic unit of body – Cell • The anatomical organization of body cells, tissues, organs, organ systems, membranes and glands in human body.• Introduction to different types of tissues: Anatomy, epithelial tissue, muscular tissue, nervous tissue Different types of organ systems. Brief Introduction of different types of body fluids ,secretions and excretions • Skeletal system: bones, joints and muscles.

Section II

Digestive Organs:

• Tongue • Teeth • Oral cavity • Pharynx • Oesophagus • Stomach • Small intestine • Large intestine • Liver, Pancreas and Spleen

Section III

Respiratory Organs:

• Nasopharynx • Oropharynx • Larynx • Trachea • Bronchi • Lungs • Thoracic cavity • Pleura and Pleural cavity

- **Circulation Organs:** Structure of Heart and Brief introduction of main blood vessels.

Section IV

Reproductive Organs: Male and Female Gonads

Nervous system and Sense organs: Brief Introduction of Central and Perpheral Nervous System

Anatomy of Brain , Spinal Cord,Nerves,Eye,Ear,Olfactory Receptors, Gustatory Receptors

Excretory Organs: • Cortex and medulla of Kidney • Ureter • Urinary Bladder & Urethra (male and female)

Reference Books:

Anatomy & Physiology:	Ross and Wilson
Anatomy and Physiology:	N Murgesh
Anatomy and Physiology for	Evelyn Pearce
Anatomy and Physiology for	Sears
Anatomy and Physiology for	Pearson
Human Anatomy:	Harie R. Berasari

PRACTICAL: BMLT 103

(*Study of various organs through Charts and models)

1. Study of the skeletal system of human beings.
2. To study human digestive system.
3. To study human respiratory system.
4. To study human circulatory system.
5. To separate the plasma and serum from given blood sample.
6. To study the compound microscope and parts.
7. Study of cell organelles.
8. To study brain.
9. To study eye.
10. To study spinal cord.

B.VOC. (MEDICAL LAB TECHNOLOGY)

SEMESTER I

SKILL PAPER

BMLT 104: LABORATORY EQUIPMENT AND PHLEBOTOMY (Credits 6)

Objectives:

• To gain broad understanding of care of laboratory glassware, equipment and instrument • To gain broad understanding of setting up, calibrating, operating, cleaning, maintaining, troubleshooting of laboratory equipment used in quantitative or qualitative analysis • To Calibrate and Validate the Clinical Laboratory instruments and glass wares. • To understand Microscopy, working principle, maintenance and applications of various types of microscopes

Instructions: The syllabus of this paper has been divided into four units. Examiner will set a total of nine questions comprising two questions from each unit, Question number one is compulsory of short answer type questions covering the whole syllabus. The students are required to attempt one question from each unit and the entire Compulsory Question No. 1.All questions carry equal marks

Section I

Brief understanding of laboratory planning and laboratory key learning outcome operations. Introduction to operation and safety precautions of common Laboratory Equipments. Principles and working of laboratory instruments Incubator, Hot Air Oven, Water Bath , Anaerobic Jar, Centrifuge, Autoclave, burettes & pipettes ,colorimeter, calibrating and validating, operating, cleaning, maintaining, troubleshooting of laboratory equipment used in quantitative or qualitative analysis. Autoclave – its structure, functioning, control and indicator, Micrometry

Section II

• Techniques of Disinfection • Sterilization : Definition, Classification and General Principle of Sterilization, Sterilization Techniques, Sterilization of rubber goods, laboratory equipment & other instruments • The cleaning and maintenance procedures of the machine • Identify the cause of errors or other problems or defects in equipments • Glassware – Description of Glassware, its use, handling and care • Importance and methods of cleaning of glass apparatus • Calibration of apparatus and glassware

Section III

• Microscopy, working principle, maintenance and applications of various types of microscopes:- Dark ground microscope. - Polarizing microscope.- Phase contrast microscope. - Interference microscope. - U.V. light microscope.

Section IV

Phlebotomy: General prospect, Medical terminology, blood collection methods, anticoagulants their uses, mode of action and their merits and demerits, Automation in blood collection, Patient rights, consent, safety first aid, Hospital waste management. Laboratory Investigation & Bleeding Disorders Laboratory preparation for coagulation tests.

Reference Books

At the Bench : A Laboratory Navigator Kathe Barker
At the Helm : A Laboratory Navigator Kathe Barker
Basic Medical Laboratory techniques Barbara H. Estridge et al
Instrumental Analysis Chatwal Anand
Laboratory Reference Jane Roskams
Medical Dictionary Oxford
Medical Informatics Mohan Bansal

PRACTICAL: BMLT 104

1. To study the compound microscope and its parts
2. Estimation of Clotting Time.
3. Estimation of Prothrombin time
4. Estimation of Plasma recalcification time
5. Estimation of Partial thromboplastin time
6. Estimation of Activated partial thromboplastin time
7. Estimation of Thrombin time
8. Use of neubauer's Chamber.
9. Blood collection and application of segregation code.
10. pH determination of buffers using pH Meter.

B.VOC. (MEDICAL LAB TECHNOLOGY)

SEMESTER I

SKILL PAPER

BMLT 105: HEMATOLOGY (Credits 6)

Objectives:

To gain understanding of blood and components of blood To gain knowledge of hematological Diseases and hematological Investigations.

Instructions: The syllabus of this paper has been divided into four units. Examiner will set a total of nine questions comprising two questions from each unit, Question number one is compulsory of short answer type questions covering the whole syllabus. The students are required to attempt one question from each unit and the entire Compulsory Question No. 1. All questions carry equal marks

Section I

• Introduction to hematology and laboratory organization Composition and functions of blood. and lymph.• Detailed study of Haemoglobin and its functions of hemoglobin• Blood groups including Rh. Factor• Detailed study of Reticulocytes• Formation of blood. Morphology of normal blood cells and their identifications• Heamostasis , Mechanism of blood coagulation. Fibrinolysis.

Section II

• Descriptive study of RBC abnormalities, Disorders related to RBC Normal white cell count & physiological variation Normal white cell count & physiological variation Hematological Diseases: Anemia and various types of anemia, Thalassemia, Polycythemia, hemolytic disease of new born, multiple myeloma, parasitic infections of blood Leukemia: definition and classification (General & FAB).

Section III

Mechanism of fibrinolysis test for fibrinolysis Platelet function tests and their interpretation Techniques available for cytogenetic studies Use of Radioisotopes in hematology Safety measures for handling Radioisotopes

Section IV

• Advanced techniques and future trends in field of hematology & blood banking • Advanced techniques and future trends in field of clinical pathology • Advanced techniques and future trends in field of histopathology & cytopathology

Reference Books

Clinical Haematology Christopher A. Ludlam
Practical Haematology J.B. Dacie
Practical Haematology (8/e) S ir John
Haematology (International edition) Emmanuel C.Besa
Haematology (Pathophysiological basis for clinical practice (3/e) Stephen M. Robinson
Haematology for students Practitioners Ramnik Sood
Hand book of Medical Laboratory Technology (2/e) V.H. Talib
Atlas of haematology (5/e) G.A. McDonald

PRACTICAL: BMLT 105

1. Cleaning of Laboratory glassware in hematology
2. Clinical significance ,specimen collection, laboratory investigation & preservation of blood for various hematological investigations .
3. Preparation of blood smear.
4. Haemocytometery, procedures for cell counts-visual as well as electronic
5. Total leukocyte count and Differential leukocyte count.
6. Determination of total erythrocyte(RBC) count and platelet counts. Errors involved and mean to minimize such errors. .
7. Haemoglobinometery, various methods of estimation of Hb, errors involved and standardization of instrument for adaptation for Hb estimation.
8. Romanowskydyes, preparation and staining procedures of blood smears.
9. Laboratory tests for assessing bleeding disorders.
10. Patelet function tests and their interpretation

B.VOC. (MEDICAL LAB TECHNOLOGY)

SEMESTER II

GENERAL PAPER

BMLT: 202 MEDICAL TECHNOLOGY & HEALTHCARE SYSTEMS (Credits 6)

Objective: • To Understand about Healthcare Service Providers • To develop broad understanding of the Role of MLT• To Understand Patient's Rights &Responsibilities

Instructions- The syllabus of this paper has been divided into four units. Examiner will set a total of nine questions comprising two questions from each unit, Question number one is compulsory of short answer type questions covering the whole syllabus. The students are required to attempt one question from each unit and the entire Compulsory Question No. 1. All questions carry equal marks

Section I

Introduction to medical technology

• Healthcare Systems, Laboratory and Delivery System • Health care service provider(primary, secondary & tertiary) • Understanding of Hospital Functions • Understanding of Diagnostic Centers and medical laboratory facilities • Understanding of Laboratory at different level (National / State / District)• Role of Medical Laboratory Technician • maintenance needs to be taken care by MLT • Understanding of Laboratory Test Results

Section II

• Use of laboratory related medical terminology in daily activities with colleagues, patients and family • Monitor and assure quality and quality assurance program • Organizations' policies and commitments towards quality assurance • Ethical Behavior • Patient's Rights &Responsibilities, Patient Comforts and Safety• Sensitivities involved in patient's right • Understanding of Patient Comforts and Safety• Medical laboratory technician's role in maintaining patient's rights

Section III

Patient's Environment

• Maintain a safe, healthy, and secure working environment • Importance of health, safety, and security in the workplace • Common Hazard • Create safety records and maintaining them • Organizational structure and the various processes related to reporting and monitoring • Procedure for accessing training, learning and development needs • To make the patient feel safe and comfortable while collection• Impact of comfort on patients health

Section IV

Personal Hygiene

• Importance and methodology of cleanliness, and hygiene environment in collection space • Concept of Healthy Living • Understanding & procedures of healthy Hygiene • Techniques of Grooming • Techniques of Use of PPE • Vaccinations against common infectious disease.

Reference Books

A Manual of Laboratory & Diagnostic Tests (6/ e) Frances Fischbach
Hand book of Medical Laboratory Technology (2/e) V.H. Talib
Clinical Diagnosis & Management by Laboratory method0 (20/e) John Bernard Henary
Textbook of Medical Laboratory Technology Godkar and Godkar

B.VOC. (MEDICAL LAB TECHNOLOGY)
SEMESTER II

SKILL PAPER
BMLT 203, HUMAN ANATOMY AND PHSIOLOGY (Credits 6)

Objectives: Basic understanding of physiology of different organ system of body.
Instructions- The syllabus of this paper has been divided into four units. Examiner will set a total of nine questions comprising two questions from each unit, Question number one is compulsory of short answer type questions covering the whole syllabus. The students are required to attempt one question from each unit and the entire Compulsory Question No. 1. All questions carry equal marks

Section I

- Nutrition- Different types of Nutrients and Vitamins
- Integumentary system: Structure of Skin and its functions.
- Digestive system: Physiology of digestion of food and its absorption.

Section II

- Lymphatic system: Different types of body fluids and their functions
- Spleen, lymph node and R.E. system
- Excretory System : Urine formation, osmoregulation and counter current mechanism.
- Cardiovascular system : Origin and regulation of heart beat, cardiac cycle, electrocardiogram, cardiac output, blood pressure and micro-circulation.

Section III

- Respiratory system- Transport of O2 and CO2, Oxygen dissociation curve of haemoglobin, Bohr effect, chloride(-) shift, Haldane effect
- Muscular System : Ultrastructure and physiological basis of skeletal muscle contractions.
- Reproductive System- Brief Intruduction to Female Reproductive System and Male Reproductive System
- Fertilization and Gametogenesis.

Section IV

- Neural Physiology- Structure of neuron, resting membrane potential, origin and propagation of impulse along the axon, synapse and myoneural junction.
- Endocrine System- Structure, and functions of hormones of thyroid, parathyroid, adrenal, pineal, hypothalamus, pituitary, pancreas, gonads, thymus.
- Hormones of alimentary canal and kidney.

Reference books

Textbook of Medical Physiology Guyton and Hall
Anatomy & Physiology Ross and Wilson
Anatomy and Physiology N Murgesh
Anatomy and Physiology for nurses Evelyn Pearce
Anatomy and Physiology: Understanding the Human Body Clark
Physiology & Health Education Gandhi & Goel
Endocrinology Headley
Human Physiology Andrew Davis
Manual of Endocrinology and Metabolism Norman Levin

PRACTICAL: BMLT 203

1. Preparation and storage of distilled water.
2. Study of systems mentioned in theory through Charts.
3. Study of various endocrine glands through permanent slides
4. To separate the plasma and serum from given blood sample.
5. Preparation of laboratory reagents and standard solutions, storage of chemicals.
6. Units of measurements. S.I. Units, measurement of volume.
7. Preparation and standardization of volumetric solutions.
8. Preparation of buffer solution and measurement of their pH.
9. To prepare different bulbs required in the laboratory.
10. To prepare the different concentration of solutions.

B.VOC. (MEDICAL LAB TECHNOLOGY)

SEMESTER II

SKILL PAPER

BMLT 204 CLINICAL BIOCHEMISTRY- I (Credits 6)

Objectives: To gain elementary knowledge of clinical Biochemistry

Instructions- The syllabus of this paper has been divided into four units. Examiner will set a total of nine questions comprising two questions from each unit, Question number one is compulsory of short answer type questions covering the whole syllabus. The students are required to attempt one question from each unit and the entire Compulsory Question No. 1. All questions carry equal marks

Section I

- Elementary Knowledge of Inorganic Chemistry: Structure of atom, atomic weight, molecular and equivalent weight. Acids, bases and salts. Acid Base Balance, pH, pH indicators pH-measurement (pH meter, pH paper, universal indicator). Normality,Molarity and Molality, Mole, Molar solutions, normal solutions, buffer solutions, percent solutions, saturated solutions, standard solutions • Radio isotopes and their use in Biochemistry

Section II

- Elementary Knowledge of Organic Chemistry: Organic compounds, aliphatic, aromatic, alcohol, ethers, phenols, acids, etc.
- Elementary Knowledge of Physical Chemistry- Osmosis, osmotic pressure, dialysis, surface tension, diffusion, hypotonic, hypertonic and isotonic solutions.Definition and classification of some colloids and crystalloids.

Section III

- Elementary Knowledge of Analytical Chemistry: : balances,- monopan, twopan, toppan, centrifuges, pH meter, colorimeter, spectrophotometer, florimeter, flame photometer, ion selective electrodes, urinometer, chromatograph, electrophoresis, densitometer. • Basic Steps of Analytic Techniques titrimetry photometry, Electrochemistry, Immuno - chemistry

Section IV

- Introduction, and properties of carbohydrates, proteins and fat. • Introduction and general properties of Nucleic acids and Enzymes • Elementary knowledge of Minerals, Electrolytes and hormones • Therapeutic Drug Monitoring • Metabolism of carbohydrates, proteins and fat. • Clinical enzymology , Enzyme Histochemistry and demonstrations of phosphatases, dehydrogenases oxidases and peroxidases etc.

Reference Books

A guidebook to Biochemistry Michael Yudkin

A Manual of Laboratory & Diagnostic Tests (6/ e) Frances Fischbach

Biochemistry Voet and Voet

Biochemistry Stryer

Biochemistry U. Satyanarayan. & U. Chakrapani

Clinical Biochemistry Richard Luxton

Clinical Diagnosis & Management by Laboratory method0 (20/e) John Bernard Henary

Clinical Biochemistry G. Guru

Handbook of Biochemistry M.A. Siddique

Textbook of Medical Biochemistry S. Ramkrishnan

PRACTICAL: BMLT 204

1. To prepare of the 1/10 N HCL
2. To find out the normality of given solution
3. Verification of Beer Lamber's Law.
4. Volumetric apparatus (pipettes, flasks, Cylinders) Calibration of volumetric apparatus.
5. Liver function tests.
6. Renal function tests.
7. Endocrine function tests,
8. Lipid profile.
9. Estimation of Acid Phosphatase (ACP).
10. Estimation of Amylase and lactate dehydrogenase, Creatinine, Creatine Phosphokinase (CPK) , CPK-MB.

B.VOC. (MEDICAL LAB TECHNOLOGY)

SEMESTER II

SKILL PAPER

BMLT 205 ANALYTICAL LABORATORY TESTING PROCESS-I (Credits 6)

Objectives: To gain broad understanding of chemicals/reagents useful in sample analysis. To gain broad knowledge of Routine Hematological Tests and Urine tests,Stool tests, Semen tests and sputum tests

Instructions- The syllabus of this paper has been divided into four units. Examiner will set a total of nine questions comprising two questions from each unit, Question number one is compulsory of short answer type questions covering the whole syllabus. The students are required to attempt one question from each unit and the entire Compulsory Question No. 1. All questions carry equal marks

Section I

• Collection and recording of biological specimens, Collection ,Handling and transpotation of Blood Sample • Correct method of blood sample collection,Collection methos of samples other than blood samples. • Routine Hematological Tests : • Examinations of sample for serum Urea and Uric acid Estimation of Essential electrolytes: Sodium, potassium, calcium, chloride and phosphorus etc. • Determination of blood sugar level of plasma (or serum) (a) Orthotoluidine method, (b) Glucose oxidase method Determination OD the serum urea nitrogen (a) Diacetyl monoxime method Determination of serum creatinine : Alkaline picrate method Determination of serum total cholesterol

Section II

• Determination of serum bilirubin a.Malloy and Evelyn b.DMSO method • Determination of TSH Laboratory investigation for megaloblastic anaemia • Laboratory investigation for iron deficiency Anaemia • Laboratory investigation for haemolytic anaemia including classification and causes • Laboratory investigation for disseminated intravascular coagulation(DIC) • Mechanism of fibrinolysis test for fibrinolysis Platelet function tests and their interpretation

Section III

• Erythrocyte sedimentation rate, factors influencing ESR and various procedures for its estimation with their significance. Haematocrit value by macro and micro methods their merits and demerits. Determination of pack cell volume (PCV) Physiological variations in HB, PCV, TLC and platelets • Determination and calculation of red blood indices MCH,MCH,MCHC • Determination of absolute Eosinophil count and Reticulocyte count• Determination of hematocrit, Enumeration of formed elements, Automated systems in hematology

Section IV

• **Examination of Urine.**

• Collection, Handling transportation of Urine, Routine examination of urine (physical examination of urine) rapid chemical tests of Urine • Determination of specific gravity of urine by urinometer and refractormeter. • Microscopic examination of urine

• Clinical significance and Detailed Examination of Urine • Biochemical Test Profile (Quantitative determination of Urine) • Amylase, Calcium, Chlorides, Creatinine, Sodium, Potassium, Glucose, Proteins, Urea nitrogen, uric acid bile pigments, ketone bodies, porphobilinogen, faccal occult blood.

Reference Books:

Textbook of Medical Laboratory Technology Godkar and Godkar

Fundamentals of Biochemistry. 3rd Edition (2008), Donald Voet & Judith Voet , John Wiley and Sons, Inc. USA

An Introduction to Practical Biochemistry (3rd Edition) – David T Plummer. Tata McGraw-Hill Publishing Company Limited, 1992

PRACTICAL: BMLT 205

1. Determination of haemoglobin concentration by a) sahil's method b) cyanmeth method.
2. Determination of total erythrocyte (RBC) count.
3. Determination of leukocyte (WBC) count.
4. Determination of pack cell volume (PCV) , erythrocyte sedimentation rate (ESR), red blood indices MCH,MCH,MCHC.
5. Examinations of sample for serum Urea and Uric acid and serum urea nitrogen (a) Diacetyl monoxime method
6. Estimation of Essential electrolytes: Sodium, potassium, calcium, chloride and phosphorus.
7. Determination of blood sugar level of plasma (or serum) (a) Orthotoluidine method, (b) Glucose oxidase method
8. Determination of serum bilirubin a.Malloy and Evelyn b.DMSO method
9. Laboratory investigation for anaemia • megaloblastic . iron deficiency Anaemia •
10. Routine examination and microscopy of urine.

B.VOC. (MEDICAL LAB TECHNOLOGY)

SEMESTER III

PAPER GENERAL

BMLT 302 SAFE LABORATORY PRACTICES (Credits 6)

Objectives:

To develop understanding and precautions to ensure Patient's Safety. Describe basics of first aid. To develop understanding and precautions to ensure self-safety. To gain understanding of importance of proper and safe disposal of bio-medical waste & treatment. To gain Elementary knowledge on Good Clinical Laboratory Practices

Instructions- The syllabus of this paper has been divided into four units. Examiner will set a total of nine questions comprising two questions from each unit, Question number one is compulsory of short answer type questions covering the whole syllabus. The students are required to attempt one question from each unit and the entire Compulsory Question No. 1. All questions carry equal marks.

Section I

Safety & First Aid

• Human health and Homeostasis, medical care in India, Medical Laboratories of developing countries • Basic causes of accidents, common types of laboratory accidents • Ethics, responsibility ,safety measure, • Basics of first aid precautions to ensure self-safety • Sample preservation and precautions while Transporting • First aid in laboratory understanding and precautions to ensure Patient's Safety • Common emergency conditions and what to do in medical emergencies • Basics of first aid

Section II

• **Biomedical Waste Management-I** Biomedical waste management in a clinical laboratory • Disposal of used samples, reagents and other biomedical waste e: Importance of Biomedical Waste. • Categories of bio-medical waste • Disposal of biological samples material. • Bio-medical waste – color coding, types of containers, transportation of waste • Disposal of Laboratory waste, Means of bio-medical waste treatment, NABL and SOP

• Categorize waste according to national, local and organizational guidelines • Appropriate approved disposal routes for waste • Appropriate containment or dismantling requirements for waste• How to make the waste safe for disposal

Section III

• Organizational and national waste management principles and procedures • Hazards and risks **Biomedical Waste Management-I** associated with the disposal and the importance of risk assessments and how to provide these • Personal protective equipment required to manage the different types of waste generated by different work activities • Actions and reporting procedures for any accidents, spillages and contamination involving waste • External agencies involved in the transport and receipt of your waste • Importance of segregating different types of waste and how to do this

• Safe methods of storage and maintaining security of waste and the permitted accumulation times

• Current national legislation, guidelines, local policies and protocols which affect work practice.

Section IV

• **Best Practices in Lab** Sensitization on current best practices in laboratory • Elementary knowledge on Good Clinical Laboratory Practices (GCLP) of WHO • Elementary Knowledge of laboratory safety guidance of OSHA (Occupational Safety and • Health Administration), U.S. Department of Labor • Elementary Knowledge of other current practices in laboratory used worldwide.

B.VOC. (MEDICAL LAB TECHNOLOGY)

SEMESTER III

SKILL PAPER

BMLT 303 PARASITOLOGY AND MEDICAL ENTOMOLOGY (Credits 6)

Objectives: To Understand the role of parasites and vectors in disease transmission, and the most appropriate control strategies.

Instructions- The syllabus of this paper has been divided into four units. Examiner will set a total of nine questions comprising two questions from each unit, Question number one is compulsory of short answer type questions covering the whole syllabus. The students are required to attempt one question from each unit and the entire Compulsory Question No. 1. All questions carry equal marks

Section I

• General characters and classification of protozoa of medical importance. • Morphology and life cycles of intestinal Protozon-Amoebac-Giardia. • Laboratory diagnosis of intestinal protozonal infection:- Amoebae-Giardia • Morphology and diagnosis of oral and vaginal flagellates - Trichomonas, - E.gingvalia • Morphology and life cycle of Haemoprotozoa - Malarial Parasite - Laboratory diagnosis of Malarial infection

Section II.

• Morphology and life cycles of Nematodes (Intestinal) -Ascari -Enterobions - Ancylostoma -Strongyloides- Laboratory diagnosis of intestinal Nematode infection. •Morphology and life cycle of Haemoflagellates. -Leishmania-Trypansomes, Laboratory diagnosis of Leishmania, Trypanosomes. • Morphology and life cycle of tissue and blood nematodes –Filaria – TrichinellDracuncullus • Lab. Diagnosis of tissue & blood nematode infection. Morphology and life cycle of intestinal cestodes -Taenia- Echinococcus -H.nana-D. latum • Laboratory diagnosis of cesstode infection -Hydatid-Cysticercosis • Life cycle, pathogenic, mechanisms and control of parasitic infections viz. amoebiasis, Kala-azar, toxoplasmosis, ascariasis, filarasis, hook worm infections.

Section III

• Culture techniques for protozon amoeba, Glardia, 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 of E. histolytica.-Giardia –Leishmania • Culture methods for helminthes • Putting up Casoni's test and its interpretation. • Examination of hydatid cyst and processing for preparation of antigen for Casoni's Test. • Examination and processing of Cysticercosis cyst.

Section IV

• Introduction to Entomology Identification of Adultworms- mosquitoes, flies, ticks and fleas • Animal care, handling and uses in parasitology. • Preparation of parasitic antigens, antigens and antisera • Handling and operating of sophisticated equipment • Laboratory processing, staining and examination of samples

Reference Books

Human Parasitilogy: By (author) Burton J. Bogitsh , By (author) Clint E. Carter , By (author) Thomas Oeltmann4th Revised edition Publication City/Country San Diego, United States Publisher Elsevier Science Publishing Co Inc.

Clinical Parasitology : A Practical Approach 2nd editionElizabeth A. Zeibig Publisher Elsevier - Health Sciences Division

PRACTICAL: BMLT 303

1. Introduction to operation of laboratory instruments and safety precautions.

2. Macroscopic examination of adult worms, cysts, tissues and processing of stool sample for routine examination.

3. Saline preparation for protozoan cysts and trophozoites.

4. Concentration procedures for helminthic ova and cyst. Examination and identification of ova and cyst of parasites of medical importance.

5. Study of malarial parasite.

6. Laboratory diagnosis of kalaazar.

7. Detection of trypanosomes(the causal agent of sleeping sickness)

8. Laboratory diagnosis of microfilaria(Wuchereria bancroftii)

9. Quantitative determination of serum (or plasma) igG class antibodies to toxoplasma gondii by ELISA

10. Determination of IgM class antibodies to toxoplasma gondii by ELISA

B.VOC. (MEDICAL LAB TECHNOLOGY)
SEMESTER III

SKILL PAPER
BMLT 304 MICROBIOLOGY I (Credits 6)

Objective: To give an overview of various aspects of General microbiology
Instructions- The syllabus of this paper has been divided into four units. Examiner will set a total of nine questions comprising two questions from each unit, Question number one is compulsory of short answer type questions covering the whole syllabus. The students are required to attempt one question from each unit and the entire Compulsory Question No. 1. All questions carry equal marks.

Section I

• Introduction and brief History, development, scope and applications of Microbiology. Nature of Microbial World : Prokaryotes and eukaryotes, growth pattern in microbes • Morphology and Structure of Microorganisms • Biotransformation of (a) D-Sorbitol to L-Sorbose. (b) Antibiotics.(c) Steroids • Growth and nutrition of microbes • Safety measures in microbiology. • Morphology ,General characteristics & fine structure of bacteria, fungi, actinomycete and algae • Classification of bacteria. • Organization of cell wall, cell membrane, flagella and capsules in bacteria. • Morphogenesis in bacteria, formation of spores and cysts. • Bacteriophages : Morphology, multiplication, detection and enumeration. • General characteristics actinomycete and algae • Morphology ,General characteristics and classification of pathogenic fungi. • Classification and general properties of Viruses • Morphology,Pathogenicity and laboratory diagnosis of human viruses.

Section II

• Methods of Microbiology isolation of pure cultures, theory and practice of sterilization. • Staining of microbes, Theory of Gram staining. • Preparation, uses and standardization of culture media. • Principles of staining methods and preparation of reagents. • Principles and methods of sterilization. • Uses and mode of action antiseptics and disinfectants. • Lab diagnosis of common Bacterial infections viz:- pyogenic infections, Respiratory tract infections, Meningitis, Diphtheria, • Whooping Cough, Gas gangrene, food poisoning, Enteric fever, Acute diarrhea diseases, cholera, Urinary tract infection, • Tuberculosis, Leprosy, Plague, Anthrax, Typhus fever, syphilis, Gonorrhea and other STD's.

Section III

• Disease oriented microbiology, culture & sensitivity test, aerobic, anaerobic techniques • Introduction to Fungi and parasitic fungi, specimen collection, Laboratory diagnosis of mycotic infections, Diagnostic mycology • Principles of Antigen-Antibody reactions. • Principles and mode of action of antibiotics and chemotherapeutic agents for bacteria and fungi.

Section IV

• 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 • Collection and handling of faecal specimen, Laboratory techniques in parasitological investigation of stool, Processing of specimens other than stool, Lab identification of human parasites • Collection, transportation and processing of clinical samples for microbiology investigations.

Reference Books

Mims' Medical Microbiology Richard Goering , Hazel Dockrell , Mark Zuckerman , Ivan M. Roitt , Professor Peter L. Chiodini Publisher Elsevier Health Sciences
Roitt's Essential immunology Delves, Peter J.,Martin, seamus J.Burton,Dennis .

PRACTICAL: BMLT 304

1. Preparation of culture media, spread plates, pour plates, selective media, differential media.
2. Isolation of bacteria by streak plate techniques for Lab diagnosis of common Bacterial infections viz:- pyogenic infections, Respiratory tract infections, Meningitis, Diphtheria,
3. Preparation of bacterial Smear.
4. Staining of smear, Gram's, hanging drop and monochrome staining (simple staining),
5. Study of motility of capsule.
6. Study of bacterial capsule.
7. Study of acid fast bacilli.
8. To perform qualitative widal test.
9. Study of Leprosy, Plague, Anthrax, Typhus fever, syphilis, Gonorrhea and other STD's
10. Study of Whooping Cough, Gas gangrene, food poisoning, Enteric fever, Acute diarrhea diseases, cholera, Urinary tract infection,

B.VOC. (MEDICAL LAB TECHNOLOGY)

SEMESTER III

SKILL PAPER

BMLT 305 BACTERIOLOGY, MYCOLOGY AND VIROLOGY (Credits 6)

Objectives: To learn the techniques of collection of samples, their processing and the identifications of the various pathogens, like bacteria, parasites, viruses, using different techniques. To provide vigorous training in the use of standard safety measures while handing highly infected material. To provide basic knowledge of the different diseases caused by various microorganisms is also imparted.

Instructions- The syllabus of this paper has been divided into four units. Examiner will set a total of nine questions comprising two questions from each unit, Question number one is compulsory of short answer type questions covering the whole syllabus. The students are required to attempt one question from each unit and the entire Compulsory Question No. 1. All questions carry equal marks

Section I

IDENTIFICATION OF BACTERIA: • Micrococci, Staphylococci, Streptococci, pneumococci, Corynebacteria, Escherichia, Klebsiella, • E-coli, Enterobacter, Proteus- providencia Salmonella, Shingella, Arizona, Citrobacter, Yersinia, • Pseudomonas, Vibrio, Haemophilus, Mycoplasma, Ricketssia, Chalmydia, Tricragents. • Introduction to important diseases caused by Streptococcus, Pneumococcus, Neisseria, Corynebacterium, Bacillus ,Clostridium tetani, Clostridium perfringens, enterobacteriaceae (Proteus, Shigella, Salmonella), Vibrio cholerae, Yersinia, Hemophilus, Mycobacterium, The operative pathogenic mechanisms, laboratory diagnosis, prevention and control of these diseases. • Systematic grouping of pathogenic bacteria. • Laboratory identification of infectious agents, Diagnosis of anaerobic infections ,idenifying characteristics of common pathogenic bacteria,Antimicrobial susceptibility test. IMViC, Urease, catalase, geletineliquification, coagulase, oxidase, sugar fermentation, antibiotic sensitivity test.

Section II

PATHOGENIC AND NEW-PATHOGENIC FUNGI:

• Introduction to Human mycotic infections viz Cryptococcosis, Dermatophytosis, Blastomycosis, Opportunisitc Mycosis; Candidiasis and Aspergillosis. • Candida, Cryptococci, Dermatophytes, Sporotrichoums, Histoplasma, Blastomyces, Coccidioides, Para-coccidiodes, Dematiaceous fungi, Mycetoma, Actinomyces, Nocardia and common laboratory contaminants. Biochemical tests used for identification of bacteria and fungi. • Antimicrobial sensitivity testing and assay methods for body fluids. Antimicrobial susceptibility testing for Mycobacteria. Preparation and standardization of antigens and antisera. • Lab diagnosis of fungal infections Superficial dermatophyte fungal infections, Candidiasis, creptococosis, Pulmonary infections, Mycetoma, other deep mycotic infections, subcutaneous fungal infections subcutaneous fungal infections spozotrichosis, chromoblastomycosis, Eye and Ear fungi infections

Section III

VIROLOGY:- • Structure of viruses, lysogenic cycle, lytic cycle, smallpox, polio, HIV,Hepatitis B• Morphology, pathogenesis, life cycle, laboratory diagnosis, prevention and control of viral diseases viz. Rabies, Polio, Small pox, Herpes, Measles, Influenza and AIDS • Introduction to use of different laboratory instruments and their safety precautions. • Collections, handling, and storage of samples for viral diagnosis. • Washing, cleaning and sterilization of Media and glassware in Virology. Chemotherapy of Viral diseases, Oncogenic Viruses, RNA/DNA Viruses,AIDS, Miscellaneous viruses.

Section IV

• Principles of biosafety hoods use of pipettes, syringes and other virus contaminated • Instruments in the laboratory. Mode of transmission of viral agents. Prevention of viral diseases. Immunity in viral infection • Demonstration of preservation of viruses, viral antigens, infects biological materials and viruses. • Different staining techniques used in virology. • Use of Embronated eggs in clinical Virology. • Principles of animal cell culture and their use in virology.

PRACTICAL: BMLT 305

1. Demonstration of staining procedures: Preparation of the following stains and demonstration of

viral inclusion bodies:

a) Seller's stain for Negri body demonstration.

b) Giemsa Stain for CMV and Herpes viral inclusions.

2. Preparation of reagents for serological tests: Phosphate buffered saline, Veronal buffered saline, Alsever's solution, Dextrose gelatin,Veronal buffer and Tris buffer.
3. Principles and performance of viral haemagglutination and Haemagglutination inhibition test.
4. Demonstration of Haemadsorption test,.
5. Demonstration of IHA tests.
6. Demonstration of RPHA tests.
7. Demonstration of complement fixation test.
8. Demonstration of Immunofluorescence test.
9. Demonstration of lmmunoperoxidase test.
10. Demonstration of ELISA for HbsAg detection.

B.VOC. (MEDICAL LAB TECHNOLOGY)

SEMESTER IV

GENERAL PAPER

BMLT 402 CLINICAL LABORATORY MANAGEMENT (Credits 6)

Objectives: To Understand the importance and method of Observing and reporting while dealing with patients. To Understand Guidelines for Collecting documentation. To maintain restful environment

Instructions- The syllabus of this paper has been divided into four units. Examiner will set a total of nine questions comprising two questions from each unit, Question number one is compulsory of short answer type questions covering the whole syllabus. The students are required to attempt one question from each unit and the entire Compulsory Question No. 1. All questions carry equal marks

Section I

• 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, KB1 • How to deal with various people. • Principles and processes for providing customer and personal services including needs assessment techniques • Quality service standards, alternative delivery systems, and customer satisfaction evaluation techniques.

Section II

• Observing and reporting• Quality control of clinical investigations, Automation in clinical biochemistry laboratory, laboratory organization • Management and maintenance of records.

• Understand the importance and method of Observing and reporting while dealing with patients during sample and report collection. • The relevant legislation, standards, policies, and procedures followed in the Organization• Role and importance of assisting other healthcare providers in delivering care• Supervise and guide other laboratory personnel• Manage people/patient effectively as per the guidelines. • The principles of leadership and guidance. • Importance and method of Observing and reporting while assisting the pathologists and other members of the team• Importance of verbally informing the person in authority• Research procedures and protocol: • The process of generating or using different sets of rules to combine or groupthings in different ways

Section III

• Documentation • Guidelines for documentation , Guidelines for Collecting documentation o Various types of records in laboratory set up • Uses and importance of records in laboratory set up o Essential requirement of records o Understand abbreviations and symbols o Enter, transcribe, record, store, or maintain information in written or electronic/magnetic form • Usage of LMIS(Laboratory information management system).

Section IV

• Professional Behavior in Healthcare Settings How to maintain restful environment , Business, mission, and objectives of the organization o General and Specific etiquettes to be observed on duty o Understand need for compliance of organizational hierarchy and reporting o legal and ethical issues o Importance of conservation of resources in laboratories • Effective working relationships with the people ,The importance of planning, prioritizing and organizing work,Efficient use of time, Importance of keeping the work area clean and tidy

Reference Books

Clinical Laboratory Management Lynne Shore

Medical Laboratory Management

B.VOC. (MEDICAL LAB TECHNOLOGY)

SEMESTER IV

SKILL PAPER

BMLT 403 HISTOPATHOLOGY (Credits 6)

Objectives: Elementary knowledge of specimen collection. Elementary knowledge of tissue fixatives Elementary knowledge of tissue processing, Logging of specimen, preparation of tissues , processing of tissues , Frozen section technique, Handling and embedding of small tissue fragments. o Understand about section cutting o Understand about Staining Staining Procedures Autoanalyzer, Tissue Processor, Microtome Elementary knowledge of Decalcification

Instructions- The syllabus of this paper has been divided into four units. Examiner will set a total of nine questions comprising two questions from each unit, Question number one is compulsory of short answer type questions covering the whole syllabus. The students are required to attempt one question from each unit and the entire Compulsory Question No. 1. All questions carry equal marks

Section I

- Introduction to histopathology and laboratory organization.
- Elementary knoledge of sample collection
- Reception, recording and labeling of histology specimens.

Section II

• Fixation and various tissue fixatives.Processing of histological tissues for paraffin-embedding. • Embedding and embedding media.

Section III

• Microtome-various types, their working principle and maintenance. • Microtome knives and knife sharpening. • Practical section cutting, cutting faults and remedies. • Routine staining procedures, mounting and mounting media.

Section IV

• Dye chemistry, theory and practice of staining. • Solvents mordents, accelerators and accentutators. • Uses of controls in various staining procedures. • Metachromasia and metachromatic dyes. • Haematoxylin stain. Its importance in histology. • Carbohydrates and amyloid – special stains and procedures. • Connective tissues trichrome staining and other special stains for muselefibres, elastic, reticulinfibres and collagen fibres. • Principles of metal impregnation techniques. • Demonstration and identification of minerals and pigments• Elementary knowledge of Decalcification.

Reference Books

Robbins Basic Pathology-Vinay Kumar , Abul K. Abbas , Jon C. Aster

Histopathology Guy Orchard , Edited by Brian Nation Publisher Oxford University Press

Text book of Histology,2nd edition,pal GP,Paras medical publisher.

Histology for Pathologists by Stacey E Mills MD

Sternberg's Diagnostic Surgical Pathology [2 - Volume Set] by Stacey E Mills MD

Anatomic Pathology Board Review, 2e by Jay H. Lefkowitch MD

Clinical Pathology Board Review, 1e 1 Har/Psc Edition by Steven L. Spitalnik MD (Author), Suzanne Arinsburg DO (Author), Jeffrey Jhang MD (Author)

Medical Laboratory Science-Theory and Practice: J Ochei and A. Kolhatkar

A Hand Book Of Medical Laboratory Technology By V.H.Talib

Inderbir Singh's Textbook of Human Histology with Colour Atlas and Practical Guide by Vasudeva Neelam

Medical Laboratory Technology : Methods and Interpretations Vol - 1 6th Edition by RAMNIK SOOD

PRACTICAL: BMLT 403

1. Tissue processing by using tissue processor.
2. Sharpening of the microtome knife.
3. Gross examination and fixation of the specimen.
4. Decalcification of calcified tissue.
5. Processing of the tissue by manual method.
6. Section cutting of paraffin wax embedded tissue.
7. To fix the section on the slide.
8. Staining of the tissue section by using hematoxylin and eosin staining method
9. Microscopic examination of permanent slides.
10.

B.VOC. (MEDICAL LAB TECHNOLOGY)
SEMESTER IV

SKILL PAPER

BMLT 404 CYTOPATHOLOGY (Credits 6)

Objectives: To collect exfoliative cytology smears, contact smears and perform applications for cytological examination (under supervision) and carry out routine and special training procedure on cytology smears. To organize the histopathology laboratory of the above services and provide basic equipment maintenance.

Instructions- The syllabus of this paper has been divided into four units. Examiner will set a total of nine questions comprising two questions from each unit, Question number one is compulsory of short answer type questions covering the whole syllabus. The students are required to attempt one question from each unit and the entire Compulsory Question No. 1. All questions carry equal marks

Section I

- Cytoplasmic constituents and their demonstration
- Brief introduction of cytology and cytopathology
- Elementary knoledge of sample collection and transportation
- Exfoliative Cytology-Specimen Preparation
- Diagnostics Exfoliative cytology: Preparation of specimen
- Preparation of specimens for cytological evaluation
- Elementary knowledge of precautions to be taken for gynaecological samples
- Elementary knowledge of specimen collection,trasportation and preservation of precautions to be taken for non gynaecological samples

Section II

- Exfoliative Cytology- Staining Techniques Diagnostics Exfoliative cytology: Cytological Stains and Staining Techniques
- Understanding of Fluid Specimen
- Cytological stains, Papanicolaou stain , other and special stains
- Staining techniques
- Mounting of cell sample

Section III

- Characteristics of benign and malignan cells Cervical cytology-basis of detection of malignant and premalignant lesions Hermoral assessment with cytologic techniques and sex chromatis and pregnancy tests.

Section IV

- Fine needle aspiration cytology (FNAC) • Purpose of fine needle aspiration, Aspiration cytology principles, indications and utility of the technique with special emphasis on role of cytotechnician in FNAC clinics
- Procedure of fine needle aspiration and section cutting.
- Preparation for the procedure
- Educate the patient about procedure
- Calm down the anxious patients

Reference Books:

Practical Principles of Cytopathology Revised 1st Edition by Richard M. DeMay (Author)

Diagnostic Cytopathology: Expert Consult: Online and Print, 3e 3rd Edition by Winifred Gray MB BS FRCPath (Author), Gabrijela Kocjan MD MB BS Spec Clin Cyt (Zagreb) FRCPath(London) (Author)

Diagnostic Cytopathology Essentials1st Edition Authors: Gabrijela Kocjan Winifred Gray Tanya Levine Ika

Kardum-Skelin Philippe Vielh: Churchill Livingstone

PRACTICAL: BMLT 404

1. Cytochemical staining procedure in various haemopioetic disorders
2. Techniques available for cytogenetic studies
3. Use of Radioisotopes in hematology
4. Safety measures for handling Radioisotopes
5. Fine needle aspiration cytology (FNAC) observation.
6. Pregnancy tests.
7. Cytoplasmic constituents and their demonstration.
8. Exfoliative Cytology-Specimen Preparation.
9. Understanding of Fluid Specimen.
10. Mounting of cell sample.

B.VOC. (MEDICAL LAB TECHNOLOGY)

SEMESTER IV

SKILL PAPER

BMLT 405 MICROBIOLOGY - II (Credits 6)

Objectives:

To learn the techniques of collection of samples, their processing and the identifications of the various pathogens, like bacteria, parasites, viruses, using different techniques. To provide basic knowledge of the different diseases caused by various microorganisms is also imparted, their processing and the identifications of the various pathogens, like bacteria, parasites, viruses, using different techniques. To provide training in the use of standard safety measures while handing highly infected material. To provide basic knowledge of the different diseases caused by various microorganisms is also imparted.

Instructions- The syllabus of this paper has been divided into four units. Examiner will set a total of nine questions comprising two questions from each unit, Question number one is compulsory of short answer type questions covering the whole syllabus. The students are required to attempt one question from each unit and the entire Compulsory Question No. 1. All questions carry equal marks

Section I

• Preservation of microbes and Iyophilisation methods. • Total and viable counts of bacteria. • Testing of disinfeetants-Rideal-Walker, Chick-Martin and In-use tests. • Preparation and standardization of vaccines and immunization schedule. • Bacteriological examination of water, milk, food and air. • Nosocomial infections and sterility testing of I/V fluids and processing of various samples for hospital infeetions. • Toxin-Antitoxin assays and pathogenicity tests. • Epidemiological markers of microorganisms-Serotyping, Bacteriophage and Bacteriocine typing methods.

Section II

• SEROLOGICAL TESTS: Widal, ASO, LFT, CRP, Rosewaller, Brucella agglutination, cold agglutination, VDRL, TPHA, FTA-ABS. • Advanced techniques in microbiology-ELISA, RIA, CCIEP, Co-agglutination GLC, HPLC etc. • Rapid diagnostic methods and Automation. in Microbiology.

Section III

• Micro-organisms in tissues- various staining technique for their demonstration • Identification of Nucleic acids, DNA and RNA special stains and procedures • Cytoplasmic constituents and their demonstration.

Section IV

• Advanced techniques and future trends in field of microbiology • Updated on advanced techniques and future trends in field of diagnostic microbiology • Updated on advanced techniques and future trends in field of molecular diagnostic technique • Updated on advanced techniques and future trends in field of tele-pathology

PRACTICAL: BMLT405

1. Preservation of microbes and Iyophilisation methods.
2. Total and viable counts of bacteria.
3. Testing of disinfectants-Rideal-Walker.
4. Chick-Martin and In-use tests.
5. Preparation and standardization of vaccines and immunization schedule
6. Lab diagnosis of common bacterial infection .
7. Widal Test.
8. VDRL test.
9. Serological tests for fungal infections and skin tests.
10. Demonstration of –ELISA.

B.VOC. (MEDICAL LAB TECHNOLOGY)

SEMESTER V

SKILL PAPER

BMLT 502 BIOCHEMICAL TECHNIQUES (Credits 6)

Objective: To get basic knowledge of Spectroscopic, Electrophoretic, Chromatographic and Radio Isotopic Techniques

Instructions- The syllabus of this paper has been divided into four units. Examiner will set a total of nine questions comprising two questions from each unit, Question number one is compulsory of short answer type questions covering the whole syllabus. The students are required to attempt one question from each unit and the entire Compulsory Question No. 1. All questions carry equal marks

Section I

- 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.

SECTION II

- Electrophoretic Techniques : Principles and applications of the following electrophoresis techniques. Paper and gel electrophoresis, high voltage electrophoresis, SDS-PAGE : Discontinuous electrophoresis,isotachophoresis, 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**.**

Section III

- Chromatographic Techniques :Introduction to Chromatography • 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 exhange and Exclusion chromatography. Affinity chromatography

Section IV

- 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

Reference Books

Introduction to Instrumentation in Life Sciences by Prakash Singh Bisen, Anjana Sharma

Principles and Techniques of Biochemistry and Molecular Biology,7th edition Wilson K.M., Walker J.M., Cambridge University Press, UK (2010),

Biochemical spectroscopy. Vol 46 of Methods in Enzymology. (1995) Kenneth Sauer. Academic Press, USA

Modern experimental biochemistry 3rd edition Publisher, USA.edition. (2000) Rodney Boyer. Prentice Hall

Analytical Biochemistry, 3 edition, (1998), David Holmes, H.Peck , Prentice Hall, UK.

An Introduction to Practical Biochemistry (3rd Edition) – David T Plummer. Tata McGraw-Hill Publishing

PRACTICAL of BMLT 502

1. Separation and identification of amino acids.
2. Paper chromatography
3. Thin layer chromatography
4. Separation of phospholipids by thin layer chromatography.
5. Preparation of starch from potato and its hydrolysis by salivary amylase.
6. Estimation of lactic acid in blood before and after exercise.
7. Gel Electrophoresis of Nucleic Acids

B.VOC. (MEDICAL LAB TECHNOLOGY)

SEMESTER V

SKILL PAPER

BMLT 503 CLINICAL IMMUNOLOGY (Credits 6)

Objective: To gain elementary knowledge about Immunology. To understand the basics of Humoral Immunity, Cell Mediated Immunity and Antigen-Antibody Interactions

Instructions- The syllabus of this paper has been divided into four units. Examiner will set a total of nine questions comprising two questions from each unit, Question number one is compulsory of short answer type questions covering the whole syllabus. The students are required to attempt one question from each unit and the entire Compulsory Question No. 1. All questions carry equal marks

Section I

- Immunity/Immune system, innate immunity, adaptive immunity, cells and organs involved in immune system
- 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.
- Infection and immune system, Cancer Immunology

Section II

- Humoral Immune Response, Antibodies / Immunoglobulins, Structure, function and type of antibodies, Antigentic-combining regions of antibodies, factors influencing antibody production, Genetic model, MultigeneOrganisation, generation of antibody diversity.

Section III

- 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.

Section IV

- 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.

Reference Books

Immunology 5th ed Janis Kuby, W.H.Freeman & Co Ltd; 5th Revised edition.

Fundamental Immunology 5th edition (August 2003): by William E., Md. Paul (Editor) By Lippincott Williams & Wilkins Publishers

Essential Immunology, Ivan M. Roit (1994)– Blackwell Scientific Pub, Oxford.

Cellular and Molecular Immunology, 3rd ed, Abbas, Saunders; 7 edition (11 June 2011)

Practical immunology, Frank Hay, 4th Edition , Blackwell Science

Medical Microbiology, Anantnarayan 3. Introduction to Practical Biochemistry, D.T. Plummer, Tata MacGraw Hill

A Handbook of Practical Immunology – G P Talkwar

Text Book of Medical Biochemistry, Praful Godkar. Bahalani Publishers.

Immunology byRiott

Immunology by Rao, C.V.

Immunology by Roitt, Jonathaanrostoff and David Male

Immunology and Serology by Joshi

Practical of BMLT 503

1. Antigen-antibody interactions
2. Agglutination
3. Precipitation
4. Blood grouping
5. Immunodiffusion

B.VOC. (MEDICAL LAB TECHNOLOGY)

SEMESTER V

SKILL PAPER

BMLT 504 SEROLOGY: INTRODUCTION & SEROLOGICAL LAB PROCEDURES (Credits 6)

Objectives: To provide basic kwoledge of serology, serlogical techniques and serological tests.

Instructions- The syllabus of this paper has been divided into four units. Examiner will set a total of nine questions comprising two questions from each unit, Question number one is compulsory of short answer type questions covering the whole syllabus. The students are required to attempt one question from each unit and the entire Compulsory Question No. 1. All questions carry equal marks

Section I

- Antigens, antibodies, structure and classes of antibodies, monoclonal antibodies and its uses.
- Collection and preparation of specimen, Epidemiological markers of microorganism serotyping,
- 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

Section II

- Serological Tests-Widal, ASO, LFT, CRP, Rosewaller, brucella agglutination, cold agglutiration, VDRL, TPHA, PTA-ABS
- Lab diagnosis of fungal infections Superficial dermatophyte fungal infections, Candidiases, creptococosis, Pulmonary infections, Mycetoma, other deep mycotic infections, subcutaneous fungal infections subcutaneous fungal infections spozotrichosis, chromoblastomycosis, Eye and Ear fungi infections

Section III

- Serological tests for fungal infections and skin tests
- Advanced techniques in microbiology ELISA, RIA, CCIEA, Co-agglutination GLC, HPLC etc.
- Rapid diagnostic methods and Automation in Microbiology.
- Principles of Serological techniques used in virology- ELISA, RIA, IF, Immuno peroxidase test

Section IV

- Principles of serological techniques used in Virology-Part 1:HA, HAI, Had, SRH,RPHA, IHA, CFT, CIEP
- Principles of Serological techniques used in Virology-Part-11 Nt, ELISA, RIA,IF, Immuno-peroxidase test

Reference books

Clinical Immunology and Serology: A Laboratory Perspective (Clinical Immunology and Serology (Stevens) Paperback – Import, 1 Dec 2009by Christine Dorresteyn Stevens

Immunology & Serology in Laboratory Medicine, 5th Edition By Mary Louise Turgeon, EdD, MLS(ASCP)CM

Kuby Immunology By Judy Owen , Jenni Punt , Sharon Stranford Publisher W.H.Freeman & Co Ltd

PRACTICALS of BMLT 504

1. Serological tests Serological test for syphilis (STS),Agglutination- 4 tests ,C-reactiveprotein test (CRP) ,Rheumatoid arthritis test (RA) ,Serodignosis of streptococcal infection .HBsAg, HIV-1(Rapid TriDot test) Widal test, Tuberculine test
2. SEROLOGICAL TESTS: Widal, ASO, LFT, CRP, Rosewaller, Brucella agglutination, cold agglutination, VDRL,
TPHA, FTA-ABS.
3. Principles of Serological techniques used in virology- ELISA, RIA, IF, Immuno peroxidase test \
4. Serological tests for fungal infections and skin tests
5. Advanced techniques in microbiology ELISA, RIA, CCIEA, Co-agglutination GLC, HPLC etc.
6. Rapid diagnostic methods and Automation in Microbiology.

B.VOC. (MEDICAL LAB TECHNOLOGY)

SEMESTER V

SKILL PAPER

BMLT 505 CLINICAL BIOCHEMISTRY - II (Credits 6)

Objectives: Clinical enzymology. Elementary knowledge of Hormones Elementary knowledge of Minerals and Electrolytes To Understand about Therapeutic Drug Monitoring

Instructions: The syllabus of this paper has been divided into four units. Examiner will set a total of nine questions comprising two questions from each unit, Question number one is compulsory of short answer type questions covering the whole syllabus. The students are required to attempt one question from each unit and the entire Compulsory Question No. 1. All questions carry equal marks

Section I

• Glucose tolerance test, insulin tolerance test, gastric analysis, Xylose absorption test • Clearance test for renal function • Analysis of calculi and CSF • Automation in clinical biochemistry laboratory

Section II

• Mechanism and testing in detail. Bone marrow in detail Detailed Examination of Stool• Detailed Examination of Semen• Detailed Examination of Sputum• Detailed Examination of CSF, and other body fluids like pleural fluid, pericardial,peritoneal,synovial,ascitic fluid**.**

Section III

• Advanced techniques and future trends in field of biochemistry • Advanced techniques and future trends in field of clinical pathology

Section IV

• Describe archiving protocol emphasizing on storage and retrieval of samples, • Specimens data and records, • Describe source of error/ interference/ quality of work and initiate corrective action as applicable • Describe assessment of results to initiate follow-up testing, Understanding of chemicals/reagents useful in sample analysis • Understanding of maintaining record of inventory, test results, etc. • Inspect the availability of medical supplies or diagnostic kits • Differentiation between clinically significant and insignificant findings, • Able to establish and monitor quality assurance programs or activities to ensure the accuracy of insignificant findings, • Quality control of clinical investigations, Able to establish and monitor quality assurance programs or activities to ensure the accuracy of laboratory results

Reference Books

A guidebook to Biochemistry Michael Yudkin
A Manual of Laboratory & Diagnostic Tests (6/ e) Frances Fischbach
Biochemistry Voet and Voet
Biochemistry Stryer
Biochemistry U. Satyanarayan. & U. Chakrapani
Clinical Biochemistry Richard Luxton
Clinical Diagnosis & Management by Laboratory method0 (20/e) John Bernard Henary
Clinical Biochemistry G. Guru

Practical of BMLT 505

1. Glucose tolerance test.
2. insulin tolerance test
3. Gastric analysis
4. Xylose absorption test
5. Clearance test for renal function
6. Analysis of calculi and CSF
7. Automation in clinical biochemistry laboratory
8. Detailed Examination of Stool , Semen & Sputum
9. Detailed demonstrations of examinations of bone marrow, C S F .
10. Examination of body fluid like pleural fluid, pericardial, peritoneal, synovial, ascitic fluid.

B.VOC. (MEDICAL LAB TECHNOLOGY)

SEMESTER VI

SKILL PAPER

BMLT 602, SENSITIZATION TO BLOOD BANKING AND INFECTION CONTROL (Credits 6)

Objectives: To understand blood transfusion reaction. To understand the importance and methodology of cleanliness, and hygiene environment. To understand the practices to curb infection

Instructions- The syllabus of this paper has been divided into four units. Examiner will set a total of nine questions comprising two questions from each unit, Question number one is compulsory of short answer type questions covering the whole syllabus. The students are required to attempt one question from each unit and the entire Compulsory Question No. 1. All questions carry equal marks

Section I

• Components of blood• Immuno- hematology in detail• ABO blood group system in detal • Rh blood group system in detail• Methodology to identify blood groups

Section II

• Different aspects of Blood transfusion techniques• Investigation of transfusion reaction.
• Transfusion of various components of blood

Section III

• Serum immunoglobulin• Different aspects of working in blood• Storage of Blood

Section IV

Infection control and prevention • Practices to curb infection- Hospital borne infections• Prevention and treatment of needle stick injury - Management of blood and body substance spills in the health care setting• The path of disease transmission: - paths of transmission including direct contact and penetrating injuries - risk of acquisition - sources of infecting microorganisms including persons who are carriers, in • The incubation phase of the disease or those who are acutely ill• Aspects of infectious diseases including: - opportunistic organisms, pathogens

Reference Books

Atlas of haematology (5/e) G.A. McDonald
Clinical Haematology Christopher A. Ludlam
Practical Haematology J.B. Dacie
Practical Haematology (8/e) S ir John
Haematology (International edition) Emmanuel C.Besa
Haematology (Pathophysiological basis for clinical practice (3/e) Stephen M. Robinson
Haematology for students Practitioners Ramnik Sood
Hand book of Medical Laboratory Technology (2/e) V.H. Talib
Handbook of Blood Banking and Transfusion Medicineby Rao Gundu HR, Jagannathan Latha, Eastlund Ted
Modern Blood Banking & Transfusion Practices Hardcover – 2012by Denise M Harmening
Textbook of Blood Banking and Transfusion Medicine - Elsevier eBook on VitalSource, 2nd Edition By Sally V. Rudmann, PhD, MT(ASCP)SBB, CLS
Textbook of Blood Banking and Transfusion Medicine by Sally V. Rudmann
Hospital Epidemiology and Infection Control by C. Glen Mayhall
Hospital Acquired Infections: Prevention and Control Paperback – Import, 2010 by Purva Mathur
Hospital Infection Control Guidelines: Principles and Practice by Singh Sanjeev, Gupta

Practical of BMLT 602

B.VOC. (MEDICAL LAB TECHNOLOGY)

SEMESTER VI

SKILL PAPER

BMLT 603 **PROJECT (DIAGNOSTIC/MEDICAL)** **Credits 18**

Objectives:

Instructions: