SGT UNIVERSITY
SHREE GURU GOBIND SINGH TRICENTENARY UNIVERSITY
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Faculty of Allied Health Sciences

Bachelor of Science (Medical Laboratory Technology)(BMLT)

Syllabus

2017

Bachelor of Science (Medical Laboratory Technology)
(BMLT)
Syllabus Semester system

BMLT
Semester 1
Paper 1
ANATOMY

Theory: 35 Hours

Objective: Students to have an overview of human body and are not required to learn in depth.

Introduction: human body as a whole
Definition of anatomy and its subdivisions
Anatomical nomenclature and terminology (planes & positions)
Surface Anatomy of main structures and vessels

Histology
Cell and its organelles and various types of tissues –Classification with examples

Locomotion and support (with relevant applied anatomy)
Musculo Skeletal system-Classification
Cartilage – definition, types with example
Bone -- Classification with examples, functions, parts, blood supply of long bones. Ossification of bone.
Joints –Classification of joints with examples, synovial joint in detail, common movements of joints with range of motion.
Muscular system: Classification of muscles with examples, function of main muscles.
Bones of the body (region wise): Bony architecture of upper limb, lower limb, skull (including the mandible) thorax. Vertebral column: cervical thoracic lumbar, sacral and coccyx vertebrae intervertebral disc (in brief).

Cardiovascular system (with relevant applied anatomy)
Heart-Size, location, chambers.
Circulation -Systemic & pulmonary
Great vessels of the heart, branches of aorta.
Overview of blood vessels of upper extremity and lower extremity

Lymphatic system- (with relevant applied anatomy)
Salient features of lymphatic organs (spleen, tonsil, thymus, lymph node)

Gastro-intestinal system (with relevant applied anatomy)
Parts of the gastrointestinal tract
Gross anatomy of Tongue, stomach, small and large intestine, liver, gall bladder pancreas and other digestive organ& related applied anatomy

Respiratory system (with relevant applied anatomy)
Parts of respiratory system with salient gross features of lung
Brief description of intercostal muscles and para-nasal air sinuses
Related applied anatomy

ANATOMY PRACTICAL - **15 Hours**

Practical & demonstration : Practicals to be conducted with respect to theory and with radiograph of related courses.

1. Identification of epithelium and tissue with examples.
2. Identification of bones of axial & appendicular skeleton with important bony landmarks.
3. Identification of heart & its chambers with great vessels
4. Surface anatomy of main arteries, veins and nerves.
5. Identification of parts of respiratory system with salient features of lungs.
6. Marking of quadrants of abdomen and identification of abdominal and pelvic organs.

Semester 1
Paper 2
PHYSIOLOGY

Theory: 35 hours

Objective: Students to have an overview of human physiology and are not required to learn in detail.

Cell Physiology:
Cell structure in brief
Tissue formation, repair
Membranes & glands- functions
Alterations in disease

Muscular System & Skeletal System:
Bone formation & growth, Functions
Muscle movements,
Muscle tone,
Physiology of contraction,
Maintenance of posture
Alteration in disease

Nervous system
Functions of Neuroglia & Neurons
Nerve –Impulse: Definitions and mechanism
Functions of brain, Spinal cord, cranial and spinal nerves
Cerebrospinal fluid-composition, Circulation and functions
Reflex arc, reflex action and reflexes
Autonomic functions
Pain: Somatic, visceral and referred Pain
Autonomic Nervous system
Alternations in disease
.

Blood & Circulatory System:
Blood formation,
Blood composition,
Blood groups,
Blood coagulation
Hemoglobin: Structure, synthesis and Breakdown, variation, estimation

Respiratory System:

Functions of respiratory organs
Pulmonary ventilation, lung Volumes & capacities
Mechanics of respiration
Gaseous exchange in lungs
Carriage of oxygen and carbon-dioxide
Exchanges of gases in tissues
Regulation of respiration
Alterations in disease.

Digestive System:
Functions of organs of digestive tract,
Movements of alimentary tract,
Digestion in mouth, stomach,
Small intestine,
Absorption of food,
Functions of liver, gall bladder and pancreas
Metabolism of carbohydrates, proteins and fats

Semester1
PHYSIOLOGY Practical: 20hours

1. Haemoglobinometry
2. WhiteBloodCellcount
3. RedBloodCellcount
4. DeterminationofBloodGroups
5. Leishman'sstainingandDifferentialWBCcount
6. DeterminationofpackedcellVolume
7. Erythrocytesedimentationrate[ESR]
8. CalculationofBloodindices
9. DeterminationofClottingTime,BleedingTime

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Semester 1

Paper 3

BIOCHEMISTRY

Theory : 35 Hours

SPECIMEN COLLECTION:

Types of Specimens
Method of specimen collection (Blood, serum, Urine and others)
Pre-analytical & analytical variables
Use of preservatives in specimen collection
Use of proper Anticoagulants in specimen collection

INTRODUCTION TO LABORATORY APPARATUS:

Overview of the functioning of Biochemistry clinical laboratory.

Introduction to glass wares:

Pipettes and their Calibration (different types of pipettes like graduated, volumetric and automated pipettes) .
Burettes and Beakers.
Flasks and their applications (volumetric, conical and round bottomed).
Reagent Bottles (graduated , common, Wash bottles and specimen bottles).
Funnels and their uses.
Measuring cylinders.

Introduction to the laboratory instruments and their maintenance:

Use care and maintenance.

Waterbath
Oven
Incubators

BIOCHEMISTRY PRACTICALS **15 hours**

pH Meter

General tests of biomolecules

General tests of carbohydrates
General test of proteins

Urine analysis

Normal urine
Abnormal constituents of urine

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Semester 1

Paper 4

MICROBIOLOGY

Theory: 35 Hours

- **Microscopy**

Light microscope, Dark field, Phase contrast microscopy, Fluorescent & Electron microscopy

- **Sterilization and Disinfection**

Physical Methods of Sterilization
Chemical Methods of Sterilization
Methods of Disinfection

- **Growth, Nutrition & Metabolism of Bacteria**

- **Bacterial genetics**

- **Bacterial Culture and Identification**

Culture Media & Transport Media

Sample collection and transport Methods

Aerobic Bacterial Culture Techniques

Anaerobic Bacterial Culture Techniques

Smear preparation & Staining methods

Principle and techniques of biochemical Test

- **Mechanisms of drug resistance**

- **Antimicrobial susceptibility testing**

Diffusion Methods
Dilution Methods

MICROBIOLOGY PRACTICAL **15 Hours**

- **Microscope**

Light Microscope

- **Staining**

Grams staining
ZN staining

- **Preparation of commonly used culture media**

Nutrient Agar
Blood Agar
Chocolate agar
Mac Conkey agar
Muller Hinton agar

- **Culture methods**

Streak method
Lawn method
Stroke method
Stab method
Pour Plate method
Liquid method

- **Antibiotic susceptibility test**

Diffusion methods
Dilution Methods

BMLT
Semester 1
Paper 5
PATHOLOGY

Theory: 35 Hours

Basic Pathology:
Pathology & its branches
Normal cell and its functions
Various types of microscope & light microscope in details.

Haematology
Introduction to hematology and laboratory Organization.
Formation of Blood
Composition and functions of blood
Various anticoagulants, their uses, mode of action and their merits & demerits.
Collection & preservation of blood for various hematological investigations.
Normal hematological indices (MCV, MCH, MCHC, PCV)
Normal and absolute values in hematology.
Quality assurance in hematology.
Various methods of estimation of Hb involved and standardization of instrument.
Haemocytometery:- Procedure of cell count, visual as well as electronic red cell, Leucytes and platelet count.
Romanowsky dyes, preparation and staining procedure of blood smears.
Morphology of normal blood cells and their identification.
ESR & Factors influencing ESR and various procedures for its estimation.

PATHOLOGY PRACTICAL **15 hours**

Hemoglobin estimation – Sahli's method
Peripheral blood film (PFB), Preparation, staining by leishman stain & examination.
Cell counts by Neubauer chamber – RBCs, WBC, Platelets.
ESR & PCV estimation

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SEMESTER 1
PAPER 6
COMMUNICATION SKILL AND PERSONALITY DEVELOPMENT

Total: 40 hours

Unit I
Listening Comprehension

- Speeches
- Interviews
- audio-video clippings followed by exercises
- Introduction to Communication
- Importance of Communication
- Barriers to Communication and ways to overcome them

Unit II
Conversation Skills

- Greetings and introducing oneself
- Framing questions and answer
- Role play
- Buying: asking details etc
- Word formation strategies
- Vocabulary building: Antonyms, Synonyms, Affixation, Suffixation, One word substitution

Unit III
Reading Comprehension

- Simple narration and Stories
- Simple Passages
- Newspaper and articles clippings
- Note Making
- Paragraph Writing
- Comprehension
- Report Writing: types, characteristics
- Introduction to Letter Writing

Unit IV:
Pronunciation

- Pronunciation
- Syllable and Stress
- Intonation and Modulation

UNIT V

Writing Comprehension

- Letters: types, format, style
- Précis Writing
- Paragraph: Order, Topic sentence, consistency, coherence
- Report and Proposal

Project Writing: Features, Structure

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Semester 2

Paper 1

ANATOMY

Theory: 35 Hours

Objective: Students to have an overview of human body and are not required to learn in depth.

Urinary system (with relevant applied anatomy)

Parts of urinary system

Salient gross features of kidney, urinary bladder, ureter and urethra

Reproductive system

Parts of male and female reproductive system with salient gross features of testis & uterus, ovary and fallopian tube

Endocrine glands

List of the endocrine glands, their position and salient gross features

Hormones produced by each endocrine glands

Nervous system

Classification of the nervous system, Definitions of central, peripheral and autonomic nervous system

Neuron- structure and classification, neuroglia

Names of lobes of Cerebrum and cerebellum, parts of brainstem (salient features only) .Cerebrospinal fluid and its circulation, names of cranial nerves, spinal nerve, meninges, ventricles (salient features only)

Sensory organs

Skin: Its appendages and functions

Eye: parts of eye and its structure

Ear: parts of ear- external, middle and inner ear and contents**..**

Embryology

Spermatogenesis & oogenesis

Ovulation, fertilization, Placenta, Fetal circulation.

ANATOMY PRACTICAL - **15 Hours**

Practical & demonstration : Practicals to be conducted with respect to theory and with radiograph of related courses.

1. Identification of brain with lobes, cerebellum and spinal cord**.**
2. Identification of bones of the body region-wise – Upper limb, Lower Limb, Head and neck, Thorax, Abdomen.
3. Radiographs region-wise – Upper limb, Lower Limb, Head and neck, Thorax (with Normal chest radiograph showing heart shadows), Abdomen and pelvis
4. Identification of organs and parts of male and female reproductive system
5. Identification of tongue, palate, trachea, oesophagus, thyroid gland

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Semester2

Paper2

PHYSIOLOGY

Theory: 35hours

Excretory system:
Functions of kidneys,
Composition of urine
Mechanism of urine formation
Regulations of body temperature
Fluid and electrolyte balance
Alterations in disease

Sensory Organs:
Functions of skin, eye, ear, nose, tongue
Alterations in disease

Endocrines
Functions of pituitary, Pineal gland, Thymus, Thyroid, Parathyroid,
Pancreas,
Suprarenal & placenta
Alterations in disease

Reproduction
Reproduction of cells-DNA, Mitosis, Meiosis, Spermatogenesis, Oogenesis
Functions of female reproductive organs:
Functions of breast, female sexual cycle
Introduction to embryology
Functions of male reproductive organs:
Fertility system
Alterations in disease

Lymphatic and Immunological system:
Circulation of lymph
Immunity
Formations of T- Cells and B- Cells
Types of Immune response
Antigens
Cytokines

Antibodies

Semester2
PHYSIOLOGY Practical: 20hours

1. Haemoglobinometry
2. White Blood Cell count
3. Red Blood Cell count
4. Determination of Blood Groups
5. Leishman'sstainingand Differential WBC count
6. Determination of packed cell Volume
7. Erythrocyte sedimentation rate[ESR]
8. Calculation of Blood indices
9. Determination of Clotting Time, BleedingTime
10. Blood pressure recording
11. Auscultation for Heart Sounds
12. Artificial Respiration

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Semester 2

Paper 3

BIOCHEMISTRY

Theory : 35 Hours

INTRODUCTION TO LABORATORY APPARATUS:
Overview of the functioning of Biochemistry clinical laboratory.
Introduction to glass wares:

Test tubes and serum tubes.
Test tube draining rack, bottle racks, Pipette stands, tripod stand, wire gauze and Bunsen burner.
Cuvettes and their application in colorimetery and spectrdophotometry.
Bottle Dispensers and their Maintenance.
Maintenance, Care and cleaning of laboratory glassware.

Introduction to the laboratory instruments and their maintenance:
Use care and maintenance.

Water Distillation Plant and Deionizers
Refrigerators
Centrifuges
Laboratory Balance and Direct Readout Electrical Balances
Colorimeter
Spectrophotometer
pH Meter and its Calibration

CONVENTIONAL AND SI UNITS USED IN THE LABORATORY
Molecular and equivalent weight
Normality, molality, molarity
Concentrations of solutions by w/w, w/v, v/v etc.
Preparation of standard solutions
Molar solutions and Percent solutions

DILUTIONS of solutions or samples:
Preparation of a stock standard and working standard.
Proper method of dilution of a solution or a laboratory sample.
Serial dilutions of samples
Saturated and supersaturated solutions
Significance of volumetric flask in preparing standard solutions,

Basic concept of acids, bases salts and indicators
Acid, base, salts and buffers
Indicators and their Functions
Buffers of the body

BIOCHEMISTRY PRACTICALS **15 hours**

pH Meter

Acid, base, salts and buffers

Demonstration of pH meter

General tests of biomolecules

General test of lipids

Colorimetry

Princilples of colorimetry (Lambert and Beer's laws and their verification)

Standard curve

Estimation of Blood sugar

Estimation of serum proteins.

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Semester 2

Paper 4

MICROBIOLOGY

Theory: 35 Hours

- **Immunology- I**
- **Immunity**
- **Antigen & Antibody**

- **Immunology - II**

Antigen antibody reactions I

Precipitation, Agglutination

Antigen antibody reactions II

Complement fixation, Neutralization, ELISA, RIA, IF

- **Morphology, Classification & infection caused by Microorganisms (in brief)**

Bacteria

Morphology, Classification

Human infection caused by bacteria

Viruses

Morphology, Classification

Human infection caused by Viruses

Fungi

Morphology, Classification

Human infection caused by Fungi

Parasites

Morphology, Classification

Human infection caused by Parasite

- **Systemic Bacteriology**

Morphology, culture characteristic, identification, diseases caused and laboratory diagnosis of following bacteria.

Staphylococcus,
Streptococcus,
Streptococcus pneumonae
Neisseria,
Corynebacterium,
Clostridium,
Mycobacteria,
Bacillus,
Shigella,
Salmonella,
E.coli,

Klebsiella, Proteus,
Vibrio, Pseudomonas
Spirochetes

MICROBIOLOGY PRACTICAL **15 Hours**

Identification of bacterial culture
Colony characteristics
Morphological characteristics

Bio medical waste
Use of colour coded bags
Black
Blue
Red
Yellow
Demonstration of Sterilization & Disinfection method
Autoclave
Hot Air oven
Water bath
Inspissator
Chemical Sterilization
Collection of specimen
From outpatient units
Inpatient units
Minor operation theatre
Major operation theatre for sterility testing
Disinfection of wards, OT and Laboratory
Visit to CSSD
Demonstration of personal protective equipment
Sterility testing Methods

BMLT
Semester 2
Paper 5
PATHOLOGY

Theory: 35 Hours

Clinical Pathology
Normal urine- Physical and chemical properties.
Body fluid sample such as CSF, pleural fluid & Ascitic fluid –normal values.
Semen – Normal

Basic Transfusion medicine
History and discovery of blood group system.
ABO and Rhesus blood group system.
Other blood group system.

Histopathology
Grossing, Tissue Processing, Fixation, section cutting & staining with Haematoxylin & eosin with other special staining.
Biomedical waste management

PATHOLOGY PRACTICAL **15 hours**

1. BT & CT determination
2. ABO/Rh blood grouping by slide methods- Forward & reverse grouping
3. Urine examination – complete (Physical & chemical examination for glucose, proteins, bile salts & ketone bodies).
4. Semen analysis – Physical, Chemical & Neubauer's chamber counting.

BMLT
SEMESTER 2
PAPER 6
FUNDAMENTALS OF COMPUTER SCIENCE

Total: 40 Hours

1. **Introduction**:
   What are computers, Application areas, Characteristics & limitations, Evolution of computers, Classification& generations of computers, Data representation in computer memory (numbering system)

2. **Computers Architecture /Organization:**
   Basicarchitecture, Functional Block diagram, Types of computers on the basis of purpose, Signal and Portability.
3. **Hardware:**
   CPU their generations and performance parameters, Input, output and storage devices.
   Primary (Main) Memories (RAM, ROM, Types of RAM and ROM, Cache Memory, Registers and types of registers, Storage Evaluation Criteria, Memory Capacity),
   Secondary Storage Devices: (Magnetic Disk, Floppy and Hard Disk, USBs, Optical Disks CD-ROMs)

4. **Software:**
   Types: System Software (Machine Level Languages, Operating Systems, Device Specific Drivers), Higher Level Languages, and Applications

5. Languages: Machine Language, Assembly Languages, Programming Languages. Use of Compilers, Assemblers, Linkers, Loaders and interpreters in programming languages
6. Operating System: Booting/Start Up Procedure of machines, Introduction to Operating System, Functions and Classification of Operating Systems, Basic introduction to DOS, UNIX/LINUX OS, Windows
7. HTML, Use of Multimedia, Computer aided teaching and testing
   Application Software MS office (Word, Excel and Powerpoint)

8. **Basic Introduction to Computer Networks:**
   Data Communication, Network devices (Hub, Switches, Modems, and Routers etc), LAN, LAN topologies, WAN, MAN, Internet: Introduction, Basics of E-mail, Web browsers (IE, Google Chrome, and Mozilla Firefox),
9. Structure of Universal Resource Locator, Domains (.com, .in, .country specific, .org and rationale behind them), IP address, Backbone network, Network connecting devices, HTTP, DNS, Network Security and Search Engine.

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Semester 3

Paper 1

BIOCHEMISTRY

Theory: 35 Hours

1. **To understand the structure of cell**
   a) Prokaryotic and Eukaryotic Cell
   b) Cell Membrane
   c) Subcellular Organelles and their functions
2. **Functioning and importance of enzymes**
   a) Classification and mechanism of action of enzymes
   b) Factors affecting enzyme activity
   c) Clinical importance of enzymes and iso enzymes
   d) Use of enzymes as reagents
3. **Basic Biochemistry of molecules**
   a) Overview of biochemistry of – Carbohydrates, Lipids, Proteins, Nucleic Acids

BIOCHEMISTRY II PRACTICALS: 20 Hours

- **Auto pipettes**

Working and calibration of auto pipettes of different types

- **Estimation on semi automated Biochemistry analyzers**

Standardization and calibration of semi automated, Biochemistry Analyzers

Estimation of various biochemical parameters like using semi automated biochemistry analyzers Lipid Profile

Glucose
Calcium
Phosphorus

- **Auto Analyzer**

Demonstration of working on fully automated Biochemistry Analyzer

- **Urine analysis**

Analysis of urine for abnormal constituents

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Semester 3

Paper 2

MICROBIOLOGY

Theory: 40 Hours

Mycology

1. Morphology
2. Classification of fungi
3. cultivation of fungi
4. stains used in mycology
5. Lab diagnosis of fungal Infections
6. Superficial Mycoses:
    a. Dermatophytes,
    b. Candidiasis.
7. Subcutaneous Mycoses:
    a. Mycetoma,
    b. Rhinosporidium, and Sporotrichosis
8. Systemic Mycoses:
    a. Histoplasmosis, Blastomycosis
    b. Cryptococcosis
9. Opportunistic Fungi:
    a. Aspergillosis, Pencillosis,
    b. Zygomycosis, Pneumocystis

Parasitology

1. Classification and morphology of Protozoa
2. Classification and morphology and Helminthes.
3. Structure, life cycle pathogenesis & laboratory diagnosis of following parasites

- Protozoa :

a) Entamoeba,

b) Trichomonas and Giardia,

c) Plasmodium,

d) Lieshmania

e) Toxoplasma,

f) Cryptosporidium & other coccidian parasites.

- Helminthes :

a) Taenia,

b) Echinococcus.

c) Ascaris,

d) Ancylostoma, Strongyloides,

e) Trichuris, &Enterobius,

f) Filaria

MICROBIOLOGY-II PRACTICAL 15 Hours

Mycology::

1. Demonstration of fungi using KOH , Lactop henol cotton blue and India ink
2. Colony characteristics and Microscopic examination and identification tests for :
3. Candida and Cryptococcus,
4. Dermatophytes
5. Aspergillus sp
6. Miscellaneous fungi
7. Slide culture technique

Parasitology

1. Stool examination: Saline mount, Iodine mount
2. Stool concentration techniques
3. Preparation of thick and thin smears
4. Preparation and staining technique of Leishman's stain and Giemsa stain
5. Demonstration of malarial parasite in peripheral smear
6. Rapid test for malaria and QBC

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Semester 3

Paper 3

PATHOLOGY

Theory: 35 Hours

Fundamentals of applied histology

Microscopy – working principle, maintenance and applications, & various types of microscope.
Dark ground microscope, Polarizing microscope, Phase contrast microscope, interference microscope, U.V light microscope.
H&E Stain & its importance.
Connective tissue stain, trichrome staining and other special stains.
Principle of metal impregnation techniques.
Principles of immunohistochemistry and its techniques.

Cytology

Stains cytological preparation with special emphasis on MGG, Papanicolour Stains.
Special stains like PAS, Mucicarmine, Alcian blue.
Cytological screening and quality control in cytology laboratory.

Haematology

Hematopoesis & stem cell.
Aneamias:- Types, classification, definition & microcytic hypochromic & macrocytic anemia
Bone marrow aspiration composition and function
Staining of bone marrow smears and preparation of histological section
Haemoglobin:- Its synthesis, functions and degradation
Haemoglobin pigments and their measurement
Abnormal haemoglobins and their means of identification & estimation
LE Cell phenomenon, and various methods of its demonstration.
Coagulation factors.
Haemostatic mechanism and theories of blood coagulation & Hemophilia
Preparation of packed cells and various fraction of blood for transfusion purposes.

PATHOLOGY III PRACTICAL 20 Hours

1. Coomb's test direct & indirect.
2. Urine – Microscopic examination.
3. Reticulocytes, count - preparation, staining & corrected retic count.
4. Semen analysis- physical and chemical & microscopy with Methylene blue staining for morphology.
5. Body fluid analysis (CSF, Pleural, Peritoneal/ascetic fluid)- Physical, Chemical, M/E.

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Semester 3

Paper 4

ENVIRONMENTAL STUDIES

Theory: 60 Hours

Unit 1:

The Multidisciplinary nature of environmental studies

- Definition, scope and importance.
- Need for public awareness.

Natural Resources

Renewable and non-renewable resources: Natural resources and associated problems.

- Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.
- Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams benefits and problems.
- Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
- Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
- Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies.
- Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

Unit 2:

Ecosystems

- Concept of an ecosystem.
- Structure and function of an ecosystem.
- Producers, consumers and decomposers.
- Energy flow in the ecosystem.
- Ecological succession.
- Food chains, food webs and ecological pyramids.

Biodiversity and its conservation

- Hot-spots of biodiversity.
- Threats to biodiversity : habitat loss, poaching of wildlife, man-wildlife conflicts
- Conservation of biodiversity : In-situ and Ex-situ conservation of biodiversity.

Unit 3:

Environmental Pollution

Definition, causes, effects and control measures of:-

a. Air pollution
b. Water pollution
c. Soil pollution
d. Marine pollution
e. Noise pollution
f. Thermal pollution
g. Nuclear hazards

- Solid waste Management : Causes, effects and control measures of urban and industrial wastes.
- Fireworks, their impacts and hazards
- Pollution case studies.
- Disaster management : floods, earthquake, cyclone and landslides.

Unit 4 :

Social Issues and the Environment

- From Unsustainable to Sustainable development
- Urban problems related to energy
- Water conservation, rain water harvesting, watershed management
- Resettlement and rehabilitation of people; its problems and concerns. Case studies.
- Environmental ethics: Issues and possible solutions.
- Consumerism and waste products.
- Environmental Legislation (Acts and Laws)
- Issues involved in enforcement of environmental legislation

Human Population and the Environment

- Population growth, variation among nations with case studies
- Population explosion – Family Welfare Programmes and Family Planning Programmes
- Human Rights.
- Value Education.
- Women and Child Welfare.

BMLT

Semester 4

Paper 1

BIOCHEMISTRY

Theory: 35 Hours

4. **Organ function tests**
   a) Kidney function tests
   b) Liver function tests
   c) Thyroid function tests
   d) Pancreatic function tests
5. **Clinical Biochemistry**
   a) Specimen collection and processing
   b) Analytical variables
   c) Glucose tolerance test
   d) Electrophoresis
   e) Chromatography
   f) Biohazards in the laboratory
   g) Porphyrias
   h) Jaundice
   i) Quality control
   j) Preparing of reports

BIOCHEMISTRY II PRACTICALS: 20 Hours

1. **Estimation on semi automated Biochemistry analyzers**
   a) Standardization and calibration of semi automated, Biochemistry Analyzers
   b) Estimation of various biochemical parameters like using semi automated biochemistry analyzers
      –LFT
      - KFT
      - SE
      - Cardiac markers (CK-MB and CK total)
      - GTT and GTC
      - 24 hour urinary creatinine, calcium and proteins
2. **Blood Gas Analysis**
   a) Standardization and calibration of Blood Gas Analyzer
   b) Blood Gas Analysis and reporting
3. **Quality control**
   a) Various quality control measures used in the laboratory and how to maintain the quality

BMLT

Semester 4

Paper 2

MICROBIOLOGY

Theory: 40 Hours

Virology

i. General properties of Viruses
ii. Collection, transportation and storage of samples for viral diagnosis.
iii. Cultivation of viruses.
iv. Bacteriophages.
v. Herpes viruses ,
vi. Viral Hepatitis,
vii. Human Immunodeficiency Viruses ,
viii. Rabies,
ix. Poliomyelitis,
x. Influenza Viruses
xi. Rubella, Mumps , Measles
xii. Rota virus.
xiii. Japanese encephalitis & Dengue,
xiv. Chikungunya, Kyasanur Forest disease
xv. Human Onocogenic Viruses.

Specimen processing

- Blood
- Sputum, throat swab, nasopharyngeal swab, Swabs (pus, wound)
- CSF and other body fluids, Stool and rectal swabs.

Applied Microbiology

Hospital infection control
Health care associated infection
Emerging infectious diseases

MICROBIOLOGY-II PRACTICAL **15 Hours**

Virology

I. Spot tests/ELISA : HBV,HCV,HIV, Dengue X2

II. Demonstration of embryonated egg inoculation

III. Demonstration of cell culture techniques and Cytopathic effect

Demonstration of heamagglutination and heamagglutination inhibition assay

BMLT

Semester 4

Paper 3

PATHOLOGY

Theory: 35 Hours

General Pathology

Inflammation:- Definition, causes, types & various cells of inflammation.

Immunity:- Definition, types of antigens & various types of antibodies.

Hypersensitivity:- Definition with types & examples.

Neoplasia:- Definition, classification, difference between benign & malignant tumors in brief, various modes of invasion and diagnosis in brief.

Infections:- Malaria, tuberculosis, dengue & AIDS in brief.

Nutritional diseases:- Fat & water soluble vitamins, Rickets, Scurvy.

Fundamentals of transfusion Medicine:

Compatibility of tests in blood transfusion.

Complications and hazard of blood transfusion

Laboratory investigation of transfusion reactions and mismatched transfusion.

Various component of blood:- Separation & its uses.

PATHOLOGY III PRACTICAL **20 Hours**

1. Sickling test for sickle cell anemia.
2. Osmotic fragility test.
3. LE Cell preparation & estimation.
4. PT & APTT Test.
5. BT & CT Test with clot retraction time.

BMLT

Semester 5

Paper 1

BIOCHEMISTRY

Theory: 35 Hours

1. **Basic concept of metabolism and their applied aspects**
   a) Overview of biochemistry of carbohydrates, lipids and proteins
   b) Overview of metabolism of Carbohydrates ;like Glycolysis, Gluconeogenesis, Glycogen Metabolism, HMP Shunt and TCA Cycle
   c) Structure of hemoglobin

2. **Basic Concepts of Hormones**
   a) Classification of Hormones
   b) Mechanism of surface acting hormones and steroids hormones
   c) Hormonal assessment in various endocrinal disorders

3. **Bio-Safety and Waste Disposal**
   a) Biohazards in biochemistry laboratory and methods to prevent them
   b) Proper disposal of biomedical wastes

PRACTICALS **20 Hours**

1. **Chromatography**
   a) Chromatography ; Definition, types, Rf Value, Description of paper chromatography and applications

2. **Blood Gas analyzer and ISE**
   a) Standardization, calibration and working Blood gas analyzer and ISE
   b) Sampling and reporting the BGA and SE reports

BMLT
Semester 5
Paper 2
MICROBIOLOGY

Theory: 35 Hours

A. Immunology

1. Microbial pathogenicity

2. Immunity:

i) Innate immunity

ii) Acquired immunity(adaptive immunity) Active and passive immunity

3. Components of immune system :

i) Organs of immune system

ii) B Lymphocytes and plasma cells

iii) T lymphocytes and their subsets and Natural killer cells

iv) Macrophages and dendritic cells

4. Immune response

i) Humoral immunity

ii) Cell-mediated immunity

5. Types of hypersensitivity reactions

6. Autoimmunity

7. Cytokines

8. Antigen & Antibody

i) Antigens

ii) Types of antibodies and classes of immunoglobulins

9. Complement

10. Types of antigen-antibody reactions

i) Precipitation, Agglutination

ii) Complement Fixation Test, Neutralization

iii) ELISA, Immunofluorescence ,Radioimmunoassay, Opsonisation

11. Monoclonal Antibodies

12. Transplantation immunology and HLA typing

MICROBIOLOGY-III PRACTICAL. 15 Hours

Antibiotic sensitivity testing-Kirby Bauer method

Immunology Serological tests

Specimen collection, Principle, Methods, Procedure

Demonstration of HIV, HCV, HBC, Dengue,

Rapid test for Malaria,

Demonstration of ASO, CRP, RA, Widal, VDRL, Typhidot

Applied

Biomedical Waste management

Maintenance of equipment

BMLT
Semester 5
Paper 3
PATHOLOGY

Theory: 35 Hours

APPLIED HISTOLOGY

Handling of fresh histological specimens (Tissues).
Lipids-identification and demonstration.
Micro-organism in the tissues-various staining, techniques for their demonstration and identification.
Immunohistochemistry-common antigens and their applications.
Electron microscope, working principles, components and allied techniques for electron microscopy.
Museum techniques.

Cytology

Cervical cytology :- Basis of detection of malignant & premalignant lesion.
Aspiration cytology:- Principles, indications and utility of the techniques
Staining:- Pap stain, H&E stain & Giemsa stain.
Cytology of various body fluids.

Cytogenetics

Introduction, terminology, classification & nomenclature.
Blood groups:- Types & Bombay blood groups.
Sex chromatin & identification
Chromosomes in neoplasia & oncogenes/anti-oncogenes.
Culture of bone marrow cells and peripheral blood lymphocytes.
Characterization of human chromosome by various banding techniques

PATHOLOGY III PRACTICAL 20 **Hours**

1. Cytology – various techniques in FNAC & Staining
2. Cytology of Body fluids
3. Bone marrow aspiration & biopsy techniques with staining
4. Histopathology – Grossing, processing, block making cutting, staining & mounting
5. Special stains – H&E Stain Giemsa stain, Pap stains, PAS Stain & various others stains
6. Blood banking- components separation.
7. Antibody titre

BMLT

Semester V

Paper 4

RESEARCH METHODOLOGY & BIO STATISTICS

Theory: 60 Hours

Introduction

Meaning, definition, characteristics of statistics
Importance of the study of statistics
Branches of statistics
Statistics and health science including nursing
Parameters and estimates
Descriptive and inferential statistics
Variables and their types
Measurement scales

Tabulation of Data

Raw data, the array, frequency distribution

Basic principles of graphical representation
Types of diagrams - histograms, frequency polygons, smooth frequency polygon, cumulative frequency curve, Normal probability curve

Measure of Central Tendency

Introduction: Uses, applications and practical approach
Definition and calculation of mean - ungrouped and grouped data
Meaning, interpretation and calculation of median ungrouped and grouped data
Meaning and calculation of mode
Comparison of the mean, and mode
Guidelines for the use of various measures of central tendency

Measure of Variability

Introduction: Uses, applications and practical approach
The range, the average deviation or mean deviation
The variance and standard deviation
Calculation of variance and standard deviation for ungrouped and grouped data
Properties and uses of variance and Standard deviation

Sampling Techniques

Introduction: Uses, applications and practical approach

Criteria for good samples

Application of sampling in Community
Sampling methods, sampling and non-sampling errors
Sampling variation and tests of significance

BMLT

Semester 6

Paper 1

BIOCHEMISTRY

Theory: 35 Hours

1. Basic concept of metabolism and their applied aspects

a) Diabetes Mellitus
b) Atherosclerosis
c) Myocardial infarction
d) Nephrotic and Nephritic Syndrome

2. Clinical Enzymology

Clinical importance of Enzymes and Isoenzymes in pathological disorders

3. Immunoassay

Structure of Immunoglobulins
ELISA
Immunoassay based analysis

4. Releasing biochemistry reports

How to analyze and release final reports
Precautions required before release of reports

PRACTICALS 20 **Hours**

1. Fully Automated Biochemistry analyzers

Standardization, calibration and working on fully automated biochemistry analyzers (Clinical and CLIA)
Trouble Shooting of the Analyzers

2. ELISA

Standardization, calibration and working on ELISA
Hormonal analysis using ELISA

3. Quality Control

Clinical aspects of the quality control in the biochemistry laboratory
Internal and External Quality Control

BMLT
Semester 6
Paper 2
MICROBIOLOGY

Theory: 35 Hours

B. Systematic Bacteriology

Classification, Morphology, Genotypic & Phenotypic characteristics, Pathogenesis, Disease caused, Lab Diagnosis & Prophylaxis of Rare pathogens

a) Mycoplasma, Chlamydia, Legionella,
b) Actinomycosis & Nocordia
c) Rickettsia

C. Applied Microbiology

1. Bacteriology of Water, Milk, and Air

2. Laboratory Diagnosis of

- Urinary Tract Infections
- Diarrhea & Dysentery
- Meningitis
- Blood stream infection
- Respiratory infection
- Sexually Transmitted Diseases
- Viral hepatitis
- HIV
- Skin, soft tissue & wound infection

3. Molecular techniques in diagnostic microbiology-PCR, DNA hybridization etc

4. Biomedical waste management

5. Biosafety levels and biosafety cabinets

6. Health care associated infections

7. Universal Precautions

8. Occupationally acquired infections in health care settings

9. Vaccination for health care personnel

10. Maintenance of laboratory records, Audit

MICROBIOLOGY-III PRACTICAL. **15 Hours**

Staining

i) Grams staining
ii) ZN staining
iii) Albert's staining

Hanging drop preparation

Culture methods

I. Culture media
II. Culture techniques

Introduction to biochemical reactions

Identification of bacterial culture

i) Colony characteristics
ii) Morphological characteristics
iii) Motility study

Interpretation of biochemical reactions

Antibiotic sensitivity testing-Kirby Bauer method

BMLT
Semester 6
Paper 3
PATHOLOGY

Theory: 35 Hours

Immunopathology

Cells of the immune system.
Immunoglobulins, antibodies and humoral immune response.
Auto immune disease & investigation.
Infection and the immune system
Cancer immunology
Tissue typing for kidney transplant.
HLA Antigen
Various grafts & graft versus host disease (GVHD).
Monoclonal antibodies.

Haematology

Definition and classification of hemolytic anaemias :- Sickle cell anemia & Thalassemia.
Laboratory investigation for haemolytic anaemia including classification & causes.
Leukemia; definition and classification
Laboratory investigations for disseminated intravascular coagulation (DIC), Hemophilia
Mechanism of fibrinolysis; tests for fibrinolysis.
Platelet function test and their interpretation.
Electrophoresis :- Principles and application in hematology

Transfusion medicine & blood banking

Blood groups:- Types & Bombay blood group
Blood donor selection.
Methods of bleeding donors.
Blood containers, anticoagulants and storage of blood.
Coomb's test and its significance.
Screening of blood for infective material
Blood components, preparation & component therapy.
Transfusion reactions and work up
Blood bank organization, standards, procedures, techniques and quality control.
HLA Antigens

PATHOLOGY III PRACTICAL **20 Hours**

1. Plasma hepatoglobin

2. Hemosiderinuria
3. Fetal hemoglobin
4. Electrophoresis of various hemoglobin
5. Sickening test
6. Investigation for G6PD Deficiency