

SANKALCHAND PATEL UNIVERSITY, VISNAGAR

Faculty of Allied Sciences



**Structure, Teaching Scheme and Syllabus of
Bachelor of Science (Medical Laboratory Technology)**

॥ अथातो ज्ञानजिज्ञासा ॥

Program Code: AS101

With effect from: Academic Year 2022-23

Program Name: Bachelor of Science (Medical Laboratory Technology)

Program Code: AS101

Abbreviation Name: B.Sc. (MLT)

Year: First

With effect from: 2022-23

Course Code	Course Name	Teaching Hours		Theory (Marks)				Practical (Marks)				Total (Marks)
		L	P	University Assessment		Continuous Assessment		University Assessment		Continuous Assessment		
				Min	Max	Min	Max	Min	Max	Min	Max	
1AS1010101	Human Anatomy	60	30	32	80	8	20	--	--	--	--	100
1AS1010102	Human Physiology	60	30	32	80	8	20	--	--	--	--	100
1AS1010103	Pathology	60	30	32	80	8	20	--	--	--	--	100
1AS1010104	Microbiology	60	30	32	80	8	20	--	--	--	--	100
1AS1010105	Biochemistry	60	30	32	80	8	20	--	--	--	--	100
1AS1010106	Health-Care	30	15	16	40	4	10	--	--	--	--	50
Total		330	165									550

Note: 1. There shall be no University Practical Examination.

2. Compulsory hospital posting of 360 hours shall be applicable.



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Program Name: Bachelor of Science (Medical Laboratory Technology)

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Year: Second

With effect from: 2022-23

Course Code	Course Name	Teaching Hours		Theory (Marks)				Practical (Marks)				Total (Marks)
		L	P	University Assessment		Continuous Assessment		University Assessment		Continuous Assessment		
				Min	Max	Min	Max	Min	Max	Min	Max	
1AS1010201	Pathology	60	45	32	80	8	20	16	40	4	10	150
1AS1010202	Microbiology	60	45	32	80	8	20	16	40	4	10	150
1AS1010203	Biochemistry	60	45	32	80	8	20	16	40	4	10	150
1AS1010204	Bio-Ethics	20	-	16	40	4	10	--	--	--	--	50
Total		200	135									500

Note: 1. Compulsory Laboratory posting of 530 hours shall be applicable.

Program Name: Bachelor of Science (Medical Laboratory Technology) **Program Code:** AS101

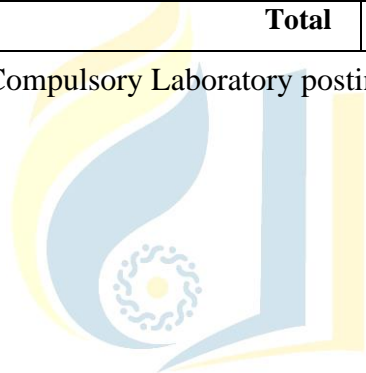
Abbreviation Name: B.Sc. (MLT)

Year: Third

With effect from: 2022-23

Course Code	Course Name	Teaching Hours		Theory (Marks)				Practical (Marks)				Total (Marks)
		L	P	University Assessment		Continuous Assessment		University Assessment		Continuous Assessment		
				Min	Max	Min	Max	Min	Max	Min	Max	
1AS1010301	Pathology - I	60	25	32	80	8	20	12	30	8	20	150
1AS1010302	Pathology - II	60	20	32	80	8	20	12	30	8	20	150
1AS1010303	Microbiology - I	60	25	32	80	8	20	12	30	8	20	150
1AS1010304	Microbiology -II	60	20	32	80	8	20	12	30	8	20	150
1AS1010305	Biochemistry - I	60	--	32	80	8	20	--	--	--	--	100
1AS1010306	Biochemistry - II	60	45	32	80	8	20	32	80	8	20	200
Total		360	135									900

Note: 1. Compulsory Laboratory posting of 600 hours shall be applicable.



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**First Year Syllabus
of
Bachelor of Science (Medical Laboratory Technology)**



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Theory classes: 60 hours, Practical classes: 30 hours

Unit 1. Introduction: human body as a whole Theory:

- Definition of anatomy and its divisions
- Terms of location, positions and planes
- Cell and its organelles
- Epithelium-definition, classification, describe with examples, function
- Glands- classification, describe serous & mucous glands with examples
- Basic tissues – classification with examples

Practical:

- Histology of types of epithelium
- Histology of serous, mucous & mixed salivary gland

Unit 2. Locomotion and support Theory:

- Cartilage – types with example
- Bone – Classification, names of bone cells, parts of long bone, microscopy of compact bone, names of all bones, vertebral column, intervertebral disc, fontanelles of fetal skull
- Joints – Classification of joints with examples, synovial joint (in detail for radiology)
- Muscular system: Classification of muscular tissue
- Names of muscles of the body

Practical:

- Demo of all bones showing parts, radiographs of normal bones & joints
- Demonstration of muscles of the body (as functional groups)

Unit 3. Cardiovascular system Theory:

- Heart-size, location, chambers, exterior & interior
- Blood supply of heart
- Systemic & pulmonary circulation
- Branches of aorta, common carotid artery, subclavian artery, axillary artery, brachial artery, superficial palmar arch, femoral artery, internal iliac artery
- Inferior venacava, portal vein, portosystemic anastomosis
- Great saphenous vein
- Lymphatic system- cisterna chyli & thoracic duct
- Names of regional lymphatics, axillary and inguinal lymph nodes in brief

Practical:

- Demonstration of heart and vessels in the body
- Normal chest radiograph showing heart shadows

Unit 4. Gastro-intestinal system Theory:

- Parts of GIT, Oral cavity (lip, tongue (with histology), tonsil, dentition, pharynx, salivary glands, Waldeyer's ring)
- Oesophagus, stomach, small and large intestine, liver, gall bladder, pancreas
- Radiographs of abdomen

Unit 5. Respiratory system Theory:

- Parts of RS, nose, nasal cavity, larynx, trachea, lungs,
- Names of paranasal air sinuses

Practical:

- Demonstration of parts of respiratory system.
- Normal radiographs of chest

Unit 6. Urinary system

Theory:

- Kidney, ureter, urinary bladder, male and female urethra

Practical:

- Demonstration of parts of urinary system
- Radiographs of abdomen-IVP, retrograde cystogram

Unit 7. Reproductive system Theory:

- Parts of male reproductive system, testis, vas deferens, epididymis, prostate (gross)
- Parts of female reproductive system, uterus, fallopian tubes, ovary (gross & histology)
- Mammary gland – gross

Practical:

- Demonstration of section of male and female pelvis with organs *in situ*
- Radiographs of pelvis – hysterosalpingogram

Unit 8. Endocrine glands Theory:

- Names of all endocrine glands in detail on pituitary gland, thyroid gland, parathyroid gland, suprarenal gland – (gross)

Practical:

- Demonstration of the glands

Unit 9. Nervous system Theory:

- Neuron
- Classification of NS
- Cerebrum, cerebellum, midbrain, pons, medulla oblongata, spinal cord with spinal nerve (Gross Anatomy)
- Meninges, Ventricles & cerebrospinal fluid
- Blood supply of brain (In Brief)
- Cranial nerves (Only Names)

Practical:

- Demonstration of all part of brain

Unit 10. Sensory organs:

Theory:

- Skin: Skin-histology
- Appendages of skin
- Eye: Parts of eye & lacrimal apparatus
- Extra-ocular muscles & nerve supply
- Ear: parts of ear- external, middle and inner ear and contents

Practical:

- Demonstration and histology of eyeball

Unit 11. Embryology:

Theory:

- Spermatogenesis & oogenesis
- Ovulation, fertilization
- Placenta

There shall be no University Practical Examination.

REFERENCE BOOKS

- 1 William Davis (P) understanding Human, Anatomy and Physiology MC Graw Hill
2. Human Anatomy for Nursing & Allied Sciences - 1st edition, Dr. M.K. Anand, Dr. Meena Verma, The Arora Medical Publishers Pvt.Ltd
3. Fattana, Human anatomy, (Description and applied), Saunder's & C P Prism Publishers, Bangalore – 1991
4. ESTER . M. Grishcimer, Physiology & Anatomy with Practical, Considerations, J.P. Lippin Cott. Philadelphia

Course code: 1AS1010102

Course Name: Human Physiology

Theory classes: 60 hours, Practical classes: 30 hours

Theory:

Unit 1. Blood and Muscle Physiology:

- Compositin & Fucnction of Blood
- Erythropoesis and Blood group
- Hemostasis
- Neuromuscular junction

Unit 2. Digestive System and Excretary System

- Movement and Alimentary tract
- Deglutition and Mechanism of Vomiting, Diaherrea
- Digestive juices
- Micturition
- Function of Kidney
- Regulation of acid-base balance

Unit 3. Cardiovascular and Respiratory Sustum

- Heart rate and sound
- Blood pressure
- Mechanism of breathing
- Oxygen and Carbon dioxide Transport
- Pulmonary volume and capacity

Unit 4. Endocrinology and Reproductive System

- Contraceptives Measures and Menstrual cycle
- Puberty
- Pregnancy and Lactation
- Hormones of Pituitary, Thyroid & Parathyroid Glands
- Hormones of Adrenal Gland and Pancreas

Unit 5. Nervous System and Special Senses

- Neuron and Neuroglia
- Properties of nerve fibre
- Reflex mechanism and Receptors
- Mechanism of vision and hearing
- Taste and smell

Practical:

- Hb
- RBC & WBC Count
- Blood Group
- BT & CT
- Arterial Blood Pressure
- Pulse, Heart rate, Breathing rate
- Thermometry
- Pragnancy Test
- 1st, 2nd & 8th Cranial nerve
- Examination of sensory system, motor system & reflex

There shall be no University Practical Examination.

REFERENCE BOOKS

1. Guyton (Arthur) Text Book of Physiology. Latest Ed. Prism publishers
2. Ganong (William F) Review of Medical Physiology. Latest Ed. Appleton
3. Jain AK, Concise Physiology, Latest Ed.

Course code: 1AS1010103

Course Name: Pathology

Theory classes: 60 hours, Practicals: 45 hours

PATHOLOGY

Unit 1. Histo Pathology

- Introduction to Histo Pathology
- Receiving of Specimen in the laboratory
- Use & care of Microscope
- Various Fixatives, Mode of action, Preparation and Indication.
- Tissue processing for routine paraffin sections
- Section Cutting
- Staining of tissues - H& E Staining
- Bio-Medical waste management

Unit 2. Clinical Pathology

- Introduction to Clinical Pathology
- Collection, Transport, Preservation, and Processing of various clinical Specimens
- Urine Examination – Collection and Preservation of urine.
- Physical, chemical, Microscopic Examination

Unit 3. Haematology

- Introduction to Haematology
- Normal constituents of Blood, their structure and function.
- Collection of Blood samples
- Various Anticoagulants used in Haematology
- Laboratory safety guidelines
- SI units and conventional units in Hospital Laboratory
- Hb, PCV, ESR

Unit 4. Blood Bank

- Introduction
- Blood grouping and Rh Types

Practical:

Pathology

- Blood Grouping Rh typing.
- Hb Estimation, Packed Cell Volume[PCV], Erythrocyte Sedimentation rate{ESR}
- Bleeding Time, Clotting Time.
- Histopathology – Section cutting and H &E Staining.[For BSc MLT only]

There shall be no University Practical

Examination. REFERENCE BOOKS

- ◆ Bancroft : Theory and Practical of Histology techniques
- ◆ Textbook of Clinical Blood Banking Science by Zmijewski.
- ◆ Manual for Clinical Pathology by Sabitry Sanyal
- ◆ Practical Pathology by Dr.P.Chakraborty & Gargi Chakraborty
- ◆ Haematology for students and practitioners by Ramnik Sood
- ◆ Histological techniques by K.Laxminarayan
- ◆ Practical Pathology by Dr.K.Uma Chaturvedi & Tejsindersingh

Course code: 1AS1010104

Course Name: Microbiology

Theory classes: 60 hours, Practicals: 45 hours

Unit-1 Historical development & microbiology

- History and Pioneers in Microbiology: Contributions of Antony Van Leeuwenhoek, Louis Pasteur, Joseph Lister, Robert Koch (Koch's Postulates). Nobel prize awarded for research in Microbiology
- Development in medical microbiology & immunology

Unit-2 Microscopy

- Microscopy: instruments, Types of microscopic techniques
- Details of Light Microscope (Principles, Techniques & Applications)
- Principle & Application of following microscope: Dark Field Microscopy, Phase contrast microscopy, Fluorescent Microscopy, Confocal microscopy & Electron Microscopy

Unit-3 Morphology & classification

- Nomenclature and classification of microbes (in brief)
- Size & Shape
- Morphology of bacteria: Structures of a bacterial cell and their functions
- Physiology of Bacteria: Nutrition, Gaseous requirement, temperature requirement and other growth requirements

Unit-4 Immunology

- Immunity (in brief)
- Infection: Sources of infection, Modes of transmission, Factors predisposing to microbial Pathogenicity, Types of infectious diseases
- Types of Vaccine & Immunization schedule

Unit-5 Sterilisation and Disinfection

- Sterilisation and Disinfection (in detail)
- Principles and use of equipments of sterilization (Namely Hot Air Oven, Autoclave, Inspissator & Pasteurization)
- Anti septic and disinfectants

Unit-6 General microbiology

- Culture media in diagnostic bacteriology.
- Culture methods
- Identification of bacteria-biochemical tests
- Antimicrobial sensitivity test

Unit 7. Hospital infection

- Causative agents, transmission methods,
- Prevention and control Hospital infection.
- Blood Born Infections

Principles and practice Biomedical waste management

Practical: Microbiology

1. Compound Microscope.
2. Grams stain
3. Acid Fast staining
4. Demonstration and sterilization of equipments – Hot Air oven, Autoclave, Bacterial filters.
5. Demonstration of commonly used culture media, culture methods:
Nutrient broth, Nutrient agar, Blood agar, Chocolate agar, Mac conkey medium, LJ media, Robertson Cooked meat media,
6. Visit to hospital for demonstration of Biomedical waste management.

There shall be no University Practical Examination.

REFERENCE BOOKS

- Anathanarayana & Panikar Medical Microbiology
- Roberty Cruickshank – Medical Microbiology – The Practice of Medical Microbiology
- Essentials of Medical Microbiology by Apurba S. Sastry & Sandhya Bhat
- Silvertone : Introduction to Medical Lab. Technology



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Theory classes: 60 hours, Practical classes: 30 hours

Theory

Unit.1 Introduction, specimen collection and Handling

- Introduction to Bio-chemistry including code of ethics for Medical Lab technicians and Medical Lab Organization.
- Reception, Registration and Bio-chemical parameters investigated.
- Types of vials used in blood /specimen collection
- Anticoagulants
- Preservatives
- Blood collection
- Precautions
- Safety, first aid, Biological and chemical hazards
- Processing of samples
- Preservation
- Disposal of samples
- Introduction to laboratory apparatus :
 1. Pipettes - different types (Graduated, volumetric, Pasteur, Automatic etc.), Calibration of glass pipettes
 2. Burettes, Beakers, Flasks, Funnels, Cuvettes,

Unit 2. Units of measurements and Basics of Instrumentation

- Conventional and SI units
- Molecular weight, equivalent weight of elements and compounds, normality, molarity,
- Preparation of molar solutions, normal solutions, Percent solutions

Unit.3 Carbohydrates :

Definition, biological importance, classification, qualitative tests, Digestion & Absorption

Unit.4 Lipids :

Definition, biological importance, classification, Acid value, Iodine value, saponification value, Digestion & Absorption.

Unit.5 Aminoacids and Proteins :

Definition, biological importance, classification, qualitative tests, Digestion & Absorption.

Unit.6 Vitamins :

Vitamins : Classification of Vitamins, Sources, Daily requirements, Deficiency diseases. (In Brief)

Unit.7 Enzymes

Nature, Classification, Factors affecting enzyme activity, Enzyme Inhibition

Unit.8 Nucleic acids- Chemistry and functional aspects

Purine bases, Pyrimidine bases, nucleosides, Nucleotides, DNA & RNA, Their functions

Practical:

- Reception and registration
 - Collection of Capillary blood
 - Collection of Venous blood
 - Separation of Serum from clotted blood
 - Separation of plasma from blood
 - Lab glass ware
 - a) Identification b) Handling c) Care and Maintenance d) Uses
 - Lab instruments
 - a) Centrifuges b) Balances c) Photo Electric colorimeter d) Spectrophotometer
 - Preparation of
 - a) Percentage solutions b) Normal solutions c) Molar solutions
1. Qualitative identification of tests of sugars
 2. Qualitative identification of tests of proteins
 3. Qualitative identification of tests for amino acids

There shall be no University Practical Examination.

REFERENCE BOOKS

- Text book of Biochemistry by Satynarayan
- TEITZ – Clinical chemistry
- Vasudevan (DM) Sreekumari(S) Text book of Biochemistry for Medical students, Latest Ed
- Varley – Clinical chemistry
- Kaplan – Clinical chemistry

Course code: 1AS1010106

Course Name: Health Care

Theory classes: 30 hours

Unit 1. Introduction to Health

- ◆ Definition of Health
- ◆ Determinants of Health
- ◆ Health Indicators of India
- ◆ Health Team

Unit 2. Health Policy and Programmes

- Concept.
- National Health Policy
- National Health Programmes (Briefly Objectives and scope)
- Population of India and Family welfare programme in India

Unit 3. Introduction to Nursing

- What is Nursing? Nursing principles.
- Inter-Personnel relationships.
- **Bandaging:** Basic turns; Bandaging extremities; Triangular Bandages and their application.
- Nursing Position, Bed making, prone, lateral, dorsal, dorsal re-cumbent, Fowler's positions, comfort measures, Aids and rest and sleep.
- **Lifting And Transporting Patients:** Lifting patients up in the bed. Transferring from bed to wheel chair. Transferring from bed to stretcher.

Unit 4. Bed Side Management:

- Giving and taking Bed pan, Urinal:
- Observation of stools, urine. Observation of sputum,
- Understand use and care of catheters, enema giving.
- **Methods Of Giving Nourishment:** Feeding, Tube feeding, drips, transfusion
- Recording of body temperature, respiration and pulse,
- **Simple aseptic technique:** Sterilization and disinfection.
- Surgical Dressing: Observation of dressing procedures

Unit 5. First Aid :

- Syllabus as for Certificate Course of Red Cross Society



**Second Year Syllabus
of
Bachelor of Science (Medical Laboratory Technology)**

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Course code: 1AS1010201

Course Name: Pathology

Teaching Hours: Theory: 60 hours, Practicals: 45 hours

Theory:

Unit 1. Hematology

- Hemopoiesis, Stem cells, formed elements and their functions
- Anticoagulants used in various hematological studies
- Routine hematological tests and normal values
- Determination of Hemoglobin and Hematocrit
- Enumeration of RBC, WBC & Platelets
- Absolute Eosinophil count
- Reticulocyte count
- Calculation of Red cell Indices
- Preparation of staining of blood film for morphology of red cells and differential count.
- Automated Hematology cell counter
- **Special Hematological tests:**
 - Sickling tests
 - Osmotic fragility test
 - Determination HbF and HbA2
 - Hemoglobin Electrophoresis
 - Investigation of G6PD deficiency
 - Plasma haptoglobin and demonstration of hemosiderin in urine
 - Tests for Autoimmune hemolytic anemia
- **Hemostasis and Coagulation**
 - Normal hemostasis, mechanism of blood coagulation and normal fibrinolytic system
 - Collection of blood and anticoagulants used in coagulation studies
 - Investigation of hemostatic mechanism-BT, CT, whole blood coagulation time test, PT,PTT.
 - Thrombin Time, Plasma Fibrinogen, FDP, D-Dimer
 - Demonstration of LE cells.

Unit 2. Immunohematology

1. ABO Blood group and Rh system
2. Subgroups of A and B , Other blood groups and Bombay group
3. Cross matching

Unit 3. Histopathology

Instrumentation:(a) Automated Tissue Processor
(b) Microtome, Microtome-knives, Knife sharpener
(c) Freezing microtome and Cryostat

- Techniques :** (a) Routine paraffin section cutting
(b) Frozen section and Cryostat section studies

Mounting techniques: Various mountants and mounting

techniquesUnit 4. Cytology

1. Normal cell structure, functions, cytologic criteria of malignancy
2. Instruments in Cytology
3. Types of specimens, methods of collection & preparation of cell block
4. Different fixatives and methods of fixation
5. Staining : (a) Papanicolaou's stain- principle , preparation and staining techniques
(b) May Grunwald Giemsa stain
(c) H & E stain

Female Genital tract

1. Normal cytology
2. Techniques of collection of specimen for cervical cytology study
3. Hormonal cytology and cytological indices

Respiratory tract and Urinary tract

1. Normal cytology
2. Collection of sample, preparation of smears and staining

PRACTICALS

1. Determination of Hemoglobin and Hematocrit
2. Red blood cell count
3. Total white blood cell count
4. Platelet count
5. Differential count of white blood cells
6. Absolute Eosinophil count
7. Reticulocyte count
8. Paraffin section cutting
9. Staining by Hematoxylin & Eosin and other special stains

Course code: 1AS1010202

Course Name: Microbiology

Teaching Hours: Theory: 60 hours, Practicals: 45 hours

Theory:

Unit 1. Immunology:

- Antigens
- Immunoglobulins
- Complement System
- Structure & Function of Immune system (Including Monoclonal Antibody)
- Antigen and antibody reactions
- General Features of antigen-antibody reaction
- Precipitation, Agglutination
- Neutralisation, Opsonisation
- Immunofluorescence, RIA, EIA
- Western Blot
- Immunochromatography

UNIT-2 Bacterial genetics

- Structure & functions of genetic material
- Extrachromosomal genetic elements
- Genotypic & Phenotypic variation
- Genetics mechanism of drug resistance in bacteria

Unit 3. Mycology.

- The morphology and reproduction in fungi
- Classification of fungi
- Morphology, diseases caused and lab diagnosis of:-
- Opportunistic fungi- Cryptococcus, Candidiasis, Aspergillus, Zygomycetes.
- Fungi causing superficial mycoses- Dermatophytes, Tinea Nigra
- Subcutaneous mycoses- Mycetoma.
- Systemic Mycosis

Unit 4.Parasitology Protozoology-

- Entamoeba histolytica*
- Giardia*
- Toxoplasma*
- Malaria
- Leishmania*
- Trichomonas*

Helminthology

- Cestodes - *Taenia*, *E. granulosus*, *D.latum*, *H.nana*
- Trematodes – *Schistosoma Fasciola*
- Nematodes – *Ascaris*, *Ancylostoma deudenale*, *Strongyloides*, *Trichuris*, *Trichinella*,
Filarial worms

PRACTICALS

General Microbiology:

- Staining: Gram's , Acid fast
- Sterilization methods
- Media preparation
- Culture methods

Parasitology:

1. Stool examination for parasitic eggs/cysts
 - a. Saline mount
 - b. Iodine mount
 - c Concentration methods

Mycology:

1. Slide culture technique
2. KOH mount
3. Identification of fungal cultures:
 - Colony characteristics and Microscopic examination of *Candida*, *Aspergillus*
Species



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Course code: 1AS1010203

Course Name: Biochemistry

Teaching Hours: Theory: 60 hours, Practicals: 45 hours

UNIT 1. Basic Instrumentation

- Colorimetry: Photoelectric methods, instrumentation, principles and laws involved, Operation, maintenance, applications.
- Spectrophotometry: Principle, types and applications.
- Weighing: Different types of balances used, care and maintenance.
- pH meter-Principle, Use, care and maintenance of pH meter and electrodes
- Basic lab operations like -Separation of Solids from liquids,
 - a) Centrifugation: Principle, Different types of Centrifuges, care and maintenance, applications
 - b) Filtration using funnel

UNIT 2. Carbohydrates

- Digestion & Absorption of Carbohydrates.
- Carbohydrate Metabolism: Glycolysis, TCA Major metabolic pathways, and its importance
- Gluconeogenesis
- Glycogen Metabolism
- HMP Shunt Pathway
- Galactose Metabolism
- Fructose Metabolism
- Amino sugars Metabolism

UNIT 3. Lipids

- Digestion & Absorption of Lipids
- Fatty acid oxidation
- Fatty acid synthesis
- Metabolism of Phospholipid
- Cholesterol metabolism

UNIT 4. Proteins

- Digestion & Absorption of Proteins
- Protein metabolism : Transamination, Deamination, Decarboxylation of amino acid
- Formation of ammonia, Detoxification of ammonia
- Urea cycle & disorders (Hepatic Coma)
- Special products formed from amino acids- in brief
(**Glycine**-Haeme, Purines, Glutathione, **Serine**-Choline, **Glutamic acid**- GABA, **Tyrosine**- Melanin, Epinephrine, Non epinephrine, Dopamine, **Tryptophan**- Serotonin and **Histidine**- Histamines)

UNIT 5. Nucleic acids

- Replication
- Transcription
- Translation

UNIT 6. Vitamins & Minerals

- Minerals : Calcium, Iron, Phosphorus, Iodine, Sodium & Potassium.
- Vitamins : Water soluble and Fat soluble (Including Deficiency Disease)

UNIT 7. Biophysics

- Viscosity, Surface tension, colloids, Osmotic pressure

Unit 8. Water & Electrolyte Balance

- Water Balance & Electrolyte.
- Blood Buffers.
- Acid Base balance & disorders.

PRACTICALS: Biochemistry

1. Qualitative analysis of carbohydrates, proteins, amino acids.
2. Estimation blood sugar and Blood Urea
3. CSF Analysis
4. Bile Analysis
5. Acid hydrolysis of starch
6. Enzyme hydrolysis of starch
7. Qualitative screening test for normal and abnormal urine sample.
8. Protein precipitation, separation of proteins, electrophoresis of serum
9. Colour reaction of protein.

SUGGESTED BOOKS :

1. Dr. Praful B. Godkar, Text Books of Medical Laboratory Technology
2. Anathanarayana & Panikar – A Text Book of Medical Microbiology
3. Monica Cheesbrough, District Laboratory Practice in Tropical countries – Part I & Part II
4. P. Chakraborty- A Text Book of Microbiology
5. Chatterjee , KD – Parasitology
6. Vasudevan & Shreekumar : Biochemistry for Medical students
7. Dacie, Practical Haematology
8. K.Laxminarayan : Histological techniques
9. Dr. Mukherjee, Medical Laboratory Technology, Volume I , II & II
10. Silvertone : Introduction to Medical Lab. Technology
11. Manual for Clinical Pathology by Sabitry Sanyal
12. Harper's Biochemistry

Course code: 1AS1010204

Course Name: Bio-Ethics

Goals

1. Provide a sense of responsibility and professionalism when interacting with patients, peers, fellow employees, and other health care providers.
2. Communicate effectively and professionally.
3. Instill the importance of honesty and professionalism in the workplace.

By the end of this module, the student should be able to:

1. Exhibit behavior consistent with the ethical practice of Medical Technologist.
2. Maintain confidentiality of all patients and test results.
3. Demonstrate an appreciation for the special knowledge and talent of other members of the health care team.
4. Explain the transmission of the AIDS/HIV and state how the virus affects the Immunesystem.

Methods of Presentation

Lecture, Discussion, Audio-Visual materials

Duration : 20 hours COURSE CONTENT

1. Definition of medical ethics. **1 hour**
2. History of Medical Ethics: **2 hour**
 - Indian perspectives : Charaka, Susruta, Code of ethics
 - The Hippocratic Oath
 - International & Indian code of Medical Ethics
3. Ethical problems of life **2 hour**
 - Right to life, prenatal screening / sex selection Abortion, feticide
 - Assisted reproductive technologies
 - Care of terminally ill
 - Euthanasia
4. Family and society in medical ethics: **1 hour**
 - HIV / AIDs
5. Etiquette and mannerism **2 hour**
6. Good communication skill **2 hour**
 - Truthfulness, Building trust, Honesty with patients
 - Communication with colleagues, seniors and subordinates
7. Confidentiality **1 hour**
 - Malpractice, negligence
8. Code of ethics: (Please refer Annexure for elaborations) **1 hour**
 - Duties to Patients **1 hour**
 - Duties to Colleagues and other Professionals: **1 hour**
 - Duties to Yourself: **1 hour**
 - Duties to Society: **1 hour**
 - Duties to your Profession: **1 hour**
 - Specific issues: **1 hour**

There will no Practical Exam for this course.

SUGGESTED BOOKS/LITERATURE:

1. MEDICAL ETHICS, by C.M.Francis, Jaypee Brothers
2. Current Problems in Medical ethics, by George V. Lobo, St. Paul's Society, Allahabad.
Ethics for Doctors, Nurses & Patients by H.P. Dunn, St. Pauls Bandar, Mumbai



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ANNEXURE

CODE OF ETHICS: Medical Technology

Code of Ethics, under different categories, has been elaborated hereunder as applied to the profession of Medical Technician/Technologist. It is however suggested that these elaborations are only indicative and not exclusive. There could be many more situations/events, depending on the nature of work involved in different types of specialization of Medical Technology; which would also be deemed to be a part of the curriculum as and when identified.

1. Code of Ethics: Duties to Patients:

- accountability for the quality and integrity of the services they provide.
 - respect patients' privacy and dignity
 - treat patients politely and with consideration
 - apply the principle of informed consent as an on-going process
 - recognize the rights of patients to maintain confidentiality of information in the course of professional duties, unless they agree to disclosure or the law demands
 - patients' permission before sharing information with their spouses, partners or relatives.
 - always seek to give priority to the service to be provided to patients solely on the basis of clinical need.
- Code of Ethics: Duties to Colleagues and other Professionals:
- Should not make a patient doubt a colleagues' knowledge or skills by making comments about them that cannot be fully justified.
 - Work with and respect other health care professionals in pursuit of the best healthcare possible for all patients.
 - Should not discriminate against colleagues, including professionals applying for posts, because of views of their race, culture, ethnicity, social status, lifestyle, perceived economic worth, age, gender, disability, communicable disease status, sexual orientation, religious or spiritual beliefs, or any condition of vulnerability.
 - Refrain from speaking ill of colleagues or other health care professionals.
 - Actively strive to establish cooperative and respectful working relationships with other health care professionals with the primary objective of ensuring a high standard of care for the patients they serve.
 - Share their knowledge with colleagues and promote learning.
- Code of Ethics: Duties to Yourself :
- Maintain and improve the standard of your performance by keeping your professional knowledge and skills up to date throughout your working life. In particular, regularly take part in educational activities that relate to medical laboratory science.
 - Acknowledge the limits of your professional knowledge and competence. Do not pretend to know everything.
 - Use equipment and laboratory ware correctly and with care.
 - Refrain from engaging in activities that may affect your health and lead to impairment.
 - Aware laws and regulations governing medical laboratory technology and shall apply them in the practice of your profession.
 - Not wasting reagents and other laboratory supplies unnecessarily.

- Never taking anything from place of work that does not belong to you
- Code of Ethics: Duties to Society
 - Refrain from providing a service that is not needed, whether it provides financial gain or not.
 - Refrain from unnecessary wastage, and from participating in improper financial arrangements, especially those that escalate costs and disadvantage individuals or institutions unfairly.
 - Dedicate to serve the healthcare needs of the public
- Code of Ethics: Duties to your Profession
 - Uphold and maintain the dignity and respect of medical laboratory profession and strive to maintain a reputation of honesty, integrity and reliability.
 - Contribute to the advancement of the profession by improving the body of knowledge, adopting scientific advances that benefit the patient, maintaining high standards of practice and education, and seeking fair socioeconomic working conditions for members of the profession.
- Specific issues: Any other issues specific to a particular specialization of Medical Technology profession not categorized in any of the above.



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**Third Year Syllabus
of
Bachelor of Science (Medical Laboratory Technology)**



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Hematology and Immunoematology

Hematology

Anemias

Classification, Clinical Features, Cause, and Investigation of Iron deficiency anemia, Megaloblastic anemia, Haemolytic Anemia.

Leukemias

Classification, Clinical Features, Cause, and Investigation of all leukemia Hematology and Quality Control.

- **Hemostasis and Coagulation**
Assay of clotting factors
- **Bone marrow Examination**
 - (a) Needle aspiration and surgical biopsy technique
 - (b) Preparation of smears and staining

Immunoematology (Blood Banking)

Principles of Blood transfusion:

- (a) Blood donor selection
 - (b) Methods of bleeding donors
 - (c) Blood containers, anticoagulants and storage of blood
 - (d) Coomb's test and its significance
 - (e) Screening of blood for infective material
 - (f) Blood components, preparation & component therapy
 - (g) Autologus Blood transfusion
 - (h) Transfusion reactions
 - (i) Haemolytic Disease of Newborn
- Blood Bank organization, Standards, Procedures, Techniques and Quality control

PRACTICALS

HEMATOLOGY

- RBC count
- WBC count
- Platelet Count
- P.C.V and Blood Indices
- ESR
- Differential WBC count
- PS Examination – I
- PS Examination – II
- Sickling Tests
- Hb. Electrophoresis

BLOOD BANKING

- Cross Match Test
- Coomb's Control Cell preparation
- D^u Test
- Direct Coomb's Test
- Indirect Coomb's Test
- Anti D Titer
- Screening of Donor's blood for infective agents(HIV, Hepatitis B, Syphilis, Malaria)
- Transfusion reaction work up
- Preparation of blood components



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Clinical Pathology, Histopathology, Cytology and Cytogenetics**Clinical Pathology**

Complete examination of Urine, all body fluids, C.S.F and Stool.

Histopathology**Staining techniques: Special stains for Carbohydrates, Connective tissue,**

- Nervous tissue, Bone tissue, Collage fibers, Elastic Fibers, Lipids, Organisms, fungi, parasites, pigments and deposits in tissues
- Maintenance of records and filing of slides
- Application of computers in Pathology
- IHC, Quality Control, Automation in Histopathology

Cytology**Female Genital tract**

Cervical cytology screening for malignant and nonmalignant conditions, raditation changes follow up.

- **C S F and Effusions**
 1. Cytology of CSF in inflammatory, nonmalignant & malignant Conditions
 2. Cytology of effusions in nonmalignant and malignant conditions
- **Glands – Breast, Thyroid and Lymph nodes**

Fine needle aspiration cytology of glands and other soft tissue mass

Cytogenetics

- Introduction to cytogenetics, terminology, classification and nomenclature of human chromosomes
- Sex chromatin identification

PRACTICAL**CLINICAL PATHOLOGY**

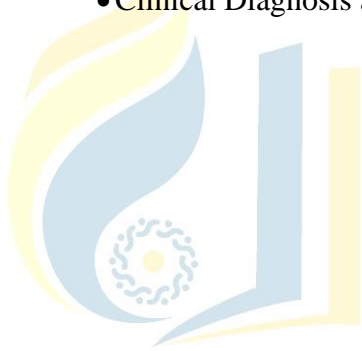
- Urine examination R & M
- CSF Examination R & M
- Pleural Fluid Examination R & M
- Ascitic Fluid R & M
- Synovial Fluid R & M
- Stool for R & M

HISTOPATHOLOGY & CYTOLOGY

- Hematoxylin & Eosine Stain
- PAS & Other special Stain
- Papanicolaou's stain
- May Grunwald Geimsa staining
- Tissue Processing
- Block Making

List of Reference Books:

- Clinical haematology : Wintrobe's
- De-Gruchy's Clinical haematology in medical practice : Franki
- Practical haematology : Dacie & Lewis
- Blood banking and transfusion medicine : Makroo
- Haematology for students and practitioners: Dr. Ramnik Sood
- Clinical Diagnosis and management by laboratory methods: John Bernard Henry (20thEdi)



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Course code: 1AS1010303

Course Name: Microbiology-I

IMMUNOLOGY AND SYSTEMIC BACTERIOLOGY

IMMUNOLOGY

Immune System

- Major Histocompatibility Complex
- Immune Response:
 - Humoral Immune response, Primary & secondary immune response, Fate of antigen in tissue, Production of antibodies
- Cellular Immune Response: Scope of CMI, Indication of CMI & Cytokines
- Immunological tolerance

Hypersensitivity Reactions, Auto-immunity & Immunodeficiency disease

- Hypersensitivity: Classification and Immunological basis
- Auto-immunity: Mechanisms and classification of auto immune disorders
- Immunodeficiency Diseases: Immunological basis of Primary and secondary Immunodeficiency Diseases

Basic of Tumor & Transplantation Immunology

- Classification of transplants, Allograft reaction
- Graft-vs-host reaction
- Tumor immunology: Tumor antigens Immunological surveillance.

SYSTEMIC BACTERIOLOGY

Classification, Morphology, culture characteristics, Pathogenesis, Disease caused, Lab Diagnosis & Prophylaxis

Gram Positive Bacteria

- Staphylococcus
- Streptococcus
- Pneumococcus
- Corynebacteria
- Clostridia

Gram Negative Bacteria

- Enterobacterales (E.coli, Klebsiella, Proteus, Salmonella, Shigella)
- Neisseria
- Vibrio
- Pseudomonas
- Brucella
- Haemophilus

Spirochetes

- Treponema
- Leptospira

Mycobacteria

- M. tuberculosis
- M. leprae
- Atypical Mycobacteria

PRACTICALS

BACTERIOLOGY

1. Staining-
 - Grams staining
 - b. ZN staining
 - c. Alberts staining
2. Hanging drop preparation (Motility of Bacteria)
3. Culture methods of Bacteria
4. Biochemical reactions of Gram Negative and Gram Positive Bacteria.
5. Identification of bacterial culture
 - a. Colony characteristics
 - b. Morphological characteristics
 - c. Motility study
 - d. Interpretation of Biochemical reactions
6. Antibiotic sensitivity testing- Kirby Bauer method



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VIROLOGY AND APPLIED MICROBIOLOGY

Virology

- General properties of virus,
- Lytic Cycle and Lysogeny, One step Growth curve
- Cultivation of viruses,
- Cytopathic effect
- Classification of Virus, Vrioids & Prions

Morphology, Cultivation, Pathogenesis, Clinical Feature, Lab Diagnosis & Prophylaxis of Following Viruses

Herpes virus, Adenovirus, Polio virus, Influenza virus, Mump, Measles, Rubella, Rabies Virus, Dengue virus, Hepatitis viruses, Oncogenic viruses, and HIV, ARBO virus, Rotavirus

APPLIED MICROBIOLOGY

Clinical Microbiology applied to Tropical Medicine and Recent advances:

- Aetiology and Laboratory diagnosis of Respiratory infections, Urinary tract infections, Pyrexia of unknown origin, Meningitis, Septicemia, Diarrhoeal diseases & food poisoning, STI
- Prevention and Control of Hospital acquired infections
- Immunoprophylaxis: Newer vaccines
- Principal and Practice of Hospital waste disposal
- Automation in Microbiology
- Bacteriology of Water, Milk and Air.
- Bio-terrorism

Emerging and Re emerging Infectious disease

Re – Emerging and Resurging disease, Factors responsible for emergence and re emergence of infectious disease.

PRACTICALS

Applied bacteriology- Practical

- Immunology: Serological tests:
- Specimen collection
- Principle
- Methods.
- Procedure

- Normal values/ Significant titer
- Interpretations

Limitations: of all the following tests

- Widal (Slide and Tube)
- ASO
- CRP
- RPR/VDRL/TRUST
- RA
- ELISA for detection of HBsAg /p 24 Ag. and anti HIV antibody detection
- Rapid test for detection of Malaria, Typhoid, AIDS, and Hepatitis

Reference Book:

1. Text book of microbiology: Anant Narayan & Paniker's
2. Text book of microbiology: Chakraborty
3. Microbiology: Prescott, Harley and Klein's
4. Parasitology: K.D. Chatterjee
5. Medical Lab. manual for Tropical countries: Monica Chessbrough
6. Practical Medical Microbiology: Mackey & Mac Cartney



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General Biochemistry**Theory:****UNIT 1. Cell Biology**

- Nucleus
- Golgi Apparatus
- Mitochondria
- Structure of plasma membrane
- Transport mechanism: Active transport, passive diffusion, facilitated transport, Transport system: uniport, symport, antiport, Cotransport, proton pump, Transport of macromolecules

UNIT 2. Instrumentation

- Chromatography, Flame photometry, Fluorimetry
- Autoanalysers, electrolyte analyzer, Gas analyzer
- RIA, Radioactive isotopes, ELISA, Chemiluminescence, Electrophoresis

UNIT 3. Nucleotides

- Metabolism of Purine & Gout
- Metabolism of Pyrimidines

UNIT 4. Hormones

- Classification of Hormones
- Hypothalamic Hormones
- Anterior Pituitary Hormones
- Posterior Pituitary Hormones
- Thyroid stimulating Hormones
- Hormones of adrenal Cortex
- Hormones of Gonads
- Gastrointestinal Hormones

UNIT 5. Nutrition

- Basal Metabolic Rate (BMR)
- Measurement of BMR
- Factors affecting BMR
- Significance of BMR
- Balance Diet
- Glycemic index
- 2. Nutrition Disorders Protein Energy malnutrition
- Kwashiorkor
- Marasmus

UNIT 6. Genetics

- Brief history of development of genetics- Basic principles of heredity in humans, Pattern of inheritance, Genetic disease in human,

UNIT 7. Xenobiotics and Antioxidants

- Detoxification.
- Phase reaction.

Clinical and Applied Biochemistry**Theory:****UNIT 1. Carbohydrates**

- Blood sugar regulation (Hormonal)
- Abnormalities - Diabetes mellitus
- Glucose Tolerance Test
- Glycated-Hemoglobin

UNIT 2. Lipids

- Lipoprotein metabolism in health and disease -Chylomicrons, VLDL, IDL, LDL andHDL
- Lipid profile and Atherosclerosis
- Fatty liver

UNIT 3. Proteins

- In born errors of amino acid metabolism
1. Homocystinuria,
 2. Alkaptonuria,
 3. Phenylketonuria
 4. Albinism
 5. Plasma proteins and associated disorders.
 6. Immunoglobulins
 7. Tissue Proteins, Collagen, Elastin.

UNIT 4. Clinical enzymology

- Diagnostic & therapeutic use of enzymes
- Isoenzymes

UNIT 5. Function Test

- Liver function test
- Renal function tests
- Thyroid function tests
- Cardiac function test
- Pancreatic function test

UNIT 6. Molecular Biology

- Nucleic acid isolation: DNA isolation, RNA isolation
- Electrophoretic separation of Nucleic acid
- Amplification techniques: Gene amplification (PCR, Reverse-transcriptase PCR, Realtime PCR)
- DNA recombinant Technology
- Blot techniques, RFLP, VNTR, Gene Library

UNIT 7. Biochemical aspect of Cancer.

- Carcinogens, oncogenes & on cosuppressor genes.
- Tumor markers.
- Anticancer drugs.

UNIT 8. Quality Control and Biostatistics

- **Quality Control:**
 - Definition: Precision, accuracy, Specificity, Sensitivity, Standard and Control
 - Quality Control Programme
 - Levy – Jenning Chart
 - Internal Quality Control
 - External Quality Control
 - Basic Components of Quality Control
 - a) Pre analytical components errors
 - b) Analytical components errors
 - c) Post analytical components errors

- **Biostatistics**
 - Definition
 - Population mean
 - Correlation Coefficient
 - Standard Deviation and Standard error.

BIOCHEMISTRY-PRACTICAL

PRACTICALS:

- Specimen Collections: Urine, Blood, Gastric juice,
- Accuracy, precision and quality control – L. J. Chart
- Enzymes: Amylase (salivary and Pancreatic), Alkaline Phosphatase, Acid Phosphatase, SGOT, SGPT, LDH and CPK- demonstration on auto analyzer.
- Liver function tests: Estimation of Bilirubin – total conjugate and unconjugate, Urobilinogen,
- Determination of serum lipids – cholesterol, triglycerides and lipoprotein fractionation.
- Inorganics – Determination of calcium in serum, serum phosphates, chloride sodium and potassium.
- RFT, Creatinine clearance test
- Cardiac markers
- GTT
- Electrophoresis (Protein)

List of Reference Books:

Textbook of Biochemistry	: D.M Vasudevan, Sree Kumari S
Textbook of Biochemistry	: U. Sataynarayan
Medical clinical biochemistry	: M.N.Chatterjee
Clinical guide to lab test	: M.M. Tietz.