

B.Sc. MLT (Medical Laboratory Technology)

Semester I

Course Code	Course Title	L	T	P	Credit
MLT 401	Fundamentals of Medical Laboratory Technology	2	0	2	3
MLT 402	Human Anatomy and Physiology-I (Theory)	2	0	0	2
MLT 403	Human Anatomy and Physiology-I (Practical)	0	0	4	2
MLT 404	Introduction to Health	3	0	0	3
MLT 405	Communication and presentation skills.	2	0	0	2
MLT 406	Applied General Maths	2	0	0	2
MLT 407	English for Professionals-I	2	0	2	3
MLT 408	Value and moral education	2	0	0	2
MLT 410	Remedial Biology	2	0	0	2

Semester II

S No	Course Code	Course Title	L	T	P	Credit
1.	MLT 440	Fundamentals of Medical Laboratory Technology & Biomedical Techniques	2	0	2	3
2.	MLT 441	Human Anatomy and Physiology-II (Theory)	2	0	0	2
3.	MLT 442	Human Anatomy and Physiology-II (Practical)	0	0	4	2
4.	MLT 443	General Biochemistry	2	0	2	3
5.	MLT 444	English for Professionals- II.	2	0	2	3
6.	MLT 445	Community Health	2	0	0	2
7.	MLT 446	Basic Electronics and Computers application	2	0	2	3
8.	MLT 447	Biostatistics.	2	0	0	2

Semester III

S No	Course Code	Course Title	L	T	P	Credit
1.	MLT 451	General Hematology -Theory	2	0	0	2
2.	MLT 452	General Hematology -Practical	0	0		2
3.	MLT 453	Clinical Pathology-Theory	2	0		2
4.	MLT 454	Clinical Pathology-Practical	0	0	4	2
5.	MLT 455	General Bacteriology-Theory	2	0	0	2
6.	MLT 456	General Bacteriology-Practical	0	0	4	2
7.	MLT 457	Clinical Biochemistry I-Theory	2	0	0	2

8.	MLT 458	Clinical Biochemistry I-Practical	0	0	4	2
9.	MLT 459	Biostatistics	2	0	0	2
10.	SCS 415	Environmental Sciences-I	2	0	0	2

Semester IV

S No	Course Code	Course Title	L	T	P	Credit
1.	MLT 501	Clinical Biochemistry II -Theory	2	0	0	2
2.	MLT 502	Clinical Biochemistry II-Practical	0	0	4	2
3.	MLT 503	Bacteriology and Serology- Theory	2	0	0	2
4.	MLT 504	Bacteriology and Serology-Practical	0	0	4	2
5.	MLT 505	Virology	2	0	0	2
6.	MLT 506	Hematology -Theory	2	0	0	2
7.	MLT 507	Hematology-Practical	0	0	4	2
8.	MLT 581	Study Tour	0	0	10	5
9.	SCS 416	Environmental Sciences-II	2	0	0	2

Semester V

S No	Course Code	Course Title	L	T	P	Credit
1.	MLT 521	Parasitology	2	0	2	3
	MLT522	Cytology and Cytotechnology -Theory	2	0	0	2
3.	MLT 523	Cytology and Cytotechnology -Practical	0	0	4	2
4.	MLT 524	Immunohaematology & Blood banking-Theory	3	0	0	3
.5	MLT 525	Immunohaematology & Blood banking-Practical	0	0	4	2
6.	MLT 526	Cytogenetics and Tissue culture	2	0	0	2
7.	MLT 527	Advanced Diagnostic Techniques	2	0	0	2
8.	MLT 528	Entrepreneurship	2	0	0	2

Semester VI

S No	Course Code	Course Title	L	T	P	Credit
1.	MLT 551	Immunology	2	0	0	2
2.	MLT 552	Mycology	0	0	4	2
3.	MLT 553	Basic Tissue Pathology	2	0	0	2
4.	MLT 554	Histopathology & Histopathological techniques	0	0	4	2
5.	MLT 555	Marketing of Health services	2	0	0	2
6.	MLT 591	Project	0	0	10	5
7.	MLT 592	Comprehensive Viva	0	0	10	5

SEMESTER-VII&VIII

1. Project
2. Internship (one year)

SEMESTER I

FUNDAMENTAL OF MEDICAL LABORATORY TECHNOLOGY

1. Basic laboratory principles
2. Code of conduct of medical laboratory personnel.
3. Organization of clinical laboratory and role of medical laboratory technician
4. Safety measures

5. Medical laboratory professional - professionalism in laboratory workers, code of conduct, communication between physician and lab technician
6. Common glasswares in clinical laboratory.
7. Cleaning, care and maintenance of glasswares.
8. Calibration of pipellets and other volumetric apparatus.
9. Laboratory instruments.
 - Microscopes-Principles, parts, use, care and maintenance of Light microscope, Electron microscope, Fluorescent microscope, Dark ground microscope, Phase contrast microscope etc
 - Centrifuge
 - Water bath
 - Refrigerators
 - Autoclave
 - Hot air oven
 - Mixer
 - Water distillation apparatus.
10. General approach to specimen collection, transport and disposal.
11. Anticoagulants- E.D.T.A, Dipotassium salts of EDTA Double oxalate, single oxalate, sodium citrate. Sodium Fluoride.
 12. preparation of solution: Normal solution, Buffer solution, Percent solution, normal saline, Molar solution.
 13. preparation of Normal saline
 14. methods of measuring liquids, weighting solids.
 15. clinical Laboratory records.
12. Modern Laboratory set up.
13. Quality control in clinical laboratories, basic outline

HUMAN ANATOMY & PHYSIOLOGY- I (THEORY)

1. Scope of anatomy and physiology and basic terminology used in these subjects.
2. Structure of cell. Its components and their functions and cell division.
3. Elementary Tissues of the Human body: epithelial connective, muscular and nervous tissues, their sub-types, movements of joints
4. Osseous system: Structure, composition and function of skeleton,
5. Haemopoietic system: Compositions and functions of blood and its elements, their disorders, blood groups and their significance, mechanism of coagulation.
6. Lymph and Lymphatic system: compositions and formulation and circulation of Lymph: Basic physiology and functions of spleen.
7. Cardiovascular system: Basic anatomy of the heart, physiology of the heart, blood vessels and circulation, Basic understanding of cardiac cycle, heart sounds and electrocardiogram. Blood pressure and its regulation.

HUMAN ANATOMY AND PHYSIOLOGY-I (PRACTICAL)

- Study of human skeleton
- Study of different systems with the help of charts and models.
- Microscopic studies of different tissues
- Recording of body temperature, pulse rate and blood pressure basic understanding of Electrocardiogram –PQRST waves and their significance

INTRODUCTION TO HEALTH

1. Health-Different definitions.
2. Concept of health, Concept of well being, standard of living, quality of life, Hygiene.
3. Dimensions of health, positive health, spectrum of health, spectrum of disease, Responsibility for the health.
4. Determinants of health.
5. Indicators of health. Indices-PQLI, HDI, GDI
6. Levels of health care, concept of control and prevention.
7. Health team concepts, health service philosophies.
8. Concept of causation, surveillance, Monitoring
9. Modes of Intervention.
10. Organization of health system-State, national level
11. Health Programmes with reference to malaria, tuberculosis, MCH and HIV/AIDS

COMMUNICATION AND PRESENTATION SKILLS

1. Communication: Definition, meaning.
2. Importance of Communication in Health
3. Functions of Communication.
4. Communication channels-Definition dimension and classification, selection of communication channels.
5. Feedback in communication –Feedback process, effect of feedback in health communication.
6. Problems in communication-various types of problems.
7. Mass communication e.g. Radio, television, traditional systems like nukkad natak, drama, puppet show
8. Inter personal communication: Lecture method (IPC).
9. Intrapersonal communication like demonstration, group discussions, seminars symposium, workshop, conference, CME, communication network
10. Various ways of creating awareness about health related issues

11. Counseling, pre test counseling, post test counseling

ENGLISH FOR PROFESSIONALS

SECTION I

Etiquette – Telephone, Table (Different ways of enhancing oneself)

Parts of Speech

Tens

Vocabulary.

-Synonyms.

-Antonyms.

-One word substitute.

-Homophones.

-Homonyms.

SECTION II

Composition

- 1) Orientation to different types of letter – Social, Business (formal & informal)
- 2) Essay writing – Descriptive, Narrative and Reflective.
- 3) Precis or Summary writing.

SECTION III

Practical/ Spoken English

Through the conversation and discussion try to focus on developing their ability to talk about objects and experiences around them.

1. JAM session.

2. Conversation.

3. Group discussion.

4. Role-plays.

VALUE AND MORAL EDUCATION

1. My country and my people, being and becoming an Indian, nationalism and internationalism.
2. Some life issues, love, sex and marriage, men and money, value of time, meaning of work, human communication, human suffering, addiction and ecology, women's issues.
3. Preparation of a career, choice of vocation, motivation for study and research, the present educational system, curriculum and syllabus, teaching methods, examination and work experience.
4. Definition of value education, Moral and Ethics, Laws and morale based on ten Commandments and two great commandments.
5. Discovery of self, self awareness, growth of intellect- Men's Spiritual Nature, Emotions, will respect of life, liberty, property, truth reputation.
6. Sin, Origin of sin, manifestation of sin, the results of sin, the remedy of sin, sin as an act, sin as a state, sin as a nature.
7. Conscience- as defined in Oxford dictionary and Winston dictionary, types of consciousness (such as evil, convicted, purged, pure, weak, good, void of offence).

REMEDIAL BIOLOGY:

- Term biology and its use, cell structure, cell organelles and its functions
- Cell division
- Difference in plant and animal cells
- Basic introduction of various systems of the body
- Brief introduction to genetics

BASIC ELECTRONICS AND COMPUTER APPLICATIONS

2.1 Introduction to computers

2.2 History of computer development and respective generation: Need to use computers, Applications in Laboratory and in general.

Computer classification; Mainframe, Mini and Microcomputers, Comparison of Analog and Digital computers, Hardware and Software, Calculator and Computer.

2.3 Operating systems: Introduction to types of operating systems, UNIX, MS-DOS etc. RAM, ROM, Virtual Memory etc.

2.4 Types of Languages: Conventional languages, their advantages, Limitation C, Pascal, FORT PAN and Programming of these languages.

2.5 Introduction to computer Networks: Architecture of seven layers of communications.

2.6 Introduction to Data structure: Like Queues, list, trees, Binary trees algorithms, Flow chart, Structured systems, Analysis and development, Ingress-SQL, gateways etc. statistics, Methodologies

Basic Language: Constants and variables: Character set, constants, variables, naming the variables, getting data in to memory, LET, INPUT, READ, DATA, Print statement.

Expressions: Arithmetic expression, Hierarchy of operations, rules of Arithmetic, Evaluation of expressions, Relational expressions, logical operations, Library functions.

Printer Control: Comma and semicolon central, the TAB function, PRINT, LPRINT, functions, subroutines, subscribed variables.

2.7 Computer graphics.

2.8 Computer applications in clinical Laboratory.

**Typing, saving, open, save files, PowerPoint Presentations, Microsoft word, excel sheet, how to search data, workable knowledge of Internet
Cyber etiquette**

Practical:

Exercises based on the following are to be dealt

- 1) Computer operating systems like UNIX, MS-DOS etc.
- 2) Simple program in BASIC.
- 3) Study of software packages like WORD-STAR, LOTUS-123 etc.

GENERAL MATHEMATICS

ENVIRONMENTAL SCIENCE-I

SECOND SEMESTER

FUNDAMENTALS OF MEDICAL LABORATORY TECHNOLOGY & BIOMEDICAL TECHNIQUES

- 1) Common Lab accidents and ways for its prevention
- 2) First aid in the clinical laboratory
- 3) Storage and handling of dangerous chemicals
- 4) Common Laboratory hazards
- 5) Waste disposal in the labs
- 6) Medico legal aspects of Lab technology
- 7) Medical Laboratory Ethics

BIOMEDICAL TECHNIQUES

- 8) Methods of qualitative analysis.
- 9) Bimolecular Principles, experimental procedures and application of chromatography: Paper, Thin layer, affinity, gel filtration, Gas-liquid and HPLC.
- 10) Principles, Procedures and application of Electrophoresis
- 11) Polyacrylamide gel, agarose gel and cellulose acetate
- 12) Quantitative methods: Principles and applications of photometry

- 13) Spectrophotometry, Fluorometry, Ion selective procedures, flame photometry, Atomic absorption spectrophotometer.
- 14) Isotopes: Detection and measurement of radioactive isotopes, application of isotopes in research and clinical biochemistry.
- 15) PCR, ELISA, RIA, Biochemical analyzers.

ANATOMY AND PHYSIOLOGY II –(THEORY)

1. Digestive System: Gross anatomy of the gastro-intestinal tract, function of its different parts including those of liver, pancreas and gall bladder, various gastrointestinal secretions and their role in the absorption and digestion of food.
2. Respiratory system: Anatomy of respiratory organs & its functions, respiration, mechanism and regulation of respiration, respiratory volumes and vital capacity.
3. Central Nervous System: Functions of different parts of brain and spinal cord. Neurohumoral transmission in the central nervous system, reflex action electroencephalogram, specialized functions of the brain, Cranial nerves and their functions.
4. Autonomic Nervous System: Physiology and functions of the autonomic nervous system. Mechanism of neurohumoral transmission in the A.N.S.

5. Excretory system: Various parts, structures and function of the kidney and urinary tract, Physiology of urine formation and acid-base balance.
6. Reproductive System: Male and female reproductive systems and their hormones, physiology of menstruation, coitus and fertilization. Sex differentiation, spermatogenesis and oogenesis.
7. Endocrine System: Basic anatomy and physiology of the of Pituitary, Thyroid, Parathyroid, Adrenals, Pancreas, Testes and ovary, their hormones and functions.
8. Sense Organs: Basic anatomy and physiology of the eye (vision), ear (hearing), taste buds, nose (smell) and skin (superficial receptors).

9. Introduction to Community Health
 - a. Concepts of health and disease: Disease causing agents and prevention of disease.
 - a. Classification and food requirements: Balanced diet, nutritional deficiency disorders, their treatment and prevention, specifications for drinking water.
 - b. Demography and family planning: Medical termination of pregnancy.
 - c. First Aid: Emergency treatment of shock, snakebites, burns, poisoning, fractures and resuscitation methods.

HUMAN ANATOMY PHYSIOLOGY-II (PRACTICAL)

- Study of different systems with the help of charts and models.
- Microscopic studies of different types of cells & tissues.
- Slides showing inflammation, benign and malignant tissue
- Study of Contraceptive devices.
- Determination of vital capacity, experiments on spirometry.
- Study of First aid box.

COMMUNITY HEALTH

1. General concepts of health and diseases with reference to natural history of disease with pre-pathogenic and pathogenic phase. The role of socio-economic and cultural environment in health and diseases-Epidemiology and scope.
2. Public health administration-An overall view of the health Administration set up at centre and state level.
3. The National Health Programmes- National Health programmes including tuberculosis, malaria, MCH and HIV/AIDS.
4. Health problems in vulnerable groups-Pregnant and lactating women and infants and school going children-occupational groups, geriatrics.
5. Occupational Health- Definition, scope-Occupational diseases, prevention of occupational diseases and hazards.

6. Social security and other measures for the protection of occupational hazards, accidents and disease. Details of compensation acts.
7. Family planning objectives of National family planning methods. A general idea of advantages and disadvantages of the method.
8. Mental Health- community aspects of mental health; role of physiotherapists, therapists in mental health problems such as mental retardation etc.
9. Communicable disease-An overall view of the communicable disease. Classification according to the principal mode of transmission. Role of insects and their vectors.
10. International health agencies.

ENGLISH FOR PROFESSIONALS-II

SECTION I

Grammar

- 1) Narration.
- 2) Voice change (Use of passive voice particularly in scientific and official writing).
- 3) Use of articles and preposition.
- 4) Figures of speech.
- 5) Vocabulary
 - The language of Doctor and Patient.
 - General description and Medical dicription.

- Medical terminology – roots.
 - Prefixes and suffixes.
 - Medical abbreviations.
- 6) Punctuation.
 - 7) Common errors in English.

SECTION II

- 1) Precis writing.
- 2) Report writing (with special stress on scientific/technical reports, preparing field/observation report).
- 3) Letter writing/application writing (Social, business letter, applying for a job, for higher studies, Preparing curriculum vitae, subscribing to a journal, letters to the Editor).
- 4) Essay writing.

SECTION III

Practical/Spoken English

- 1) Conversation.
- 2) Group discussion.
- 3) Presentation.
- 4) Role plays.
- 5) Front Desk management, Fixing appointments, getting information – Managing medical representatives, able to answer FAQs, lab reports writing, telephoning in a hospital: the object is to practice fluent conversation.

GENERAL BIOCHEMISTRY- (THEORY)

- 1) Carbohydrates: Classification, chemistry, properties of metabolism. monosaccharides, disaccharides, and polysaccharides. Carbohydrate metabolism

2) Proteins: Classification of proteins and amino acids, their properties structure of proteins and amino acids. Plasma proteins, general reaction of amino acids.

3) Lipids – Classification of lipids, properties of fatty acids, phospholipids and sterols Biosynthesis of lipids and lipid metabolism.

4) Nucleic acid chemistry -Metabolism, products of hydrolysis, synthesis and degradation of purines and pyrimidines, nucleosides and nucleotides. Structure of DNA- primary and secondary structure, different forms of DNA
-RNA - Structure and functions.
-Synthesis of DNA & RNA, protein synthesis.

5) Specimen collection & Transport-General methods of collection, Transportation, Preservation, Storage of Biochemical specimens.

PHYSICAL BIOCHEMISTRY

1) Definition of chemistry and its branches, important terminology substance. Elements, compounds, Eq. weight mixture etc

2) Acid, Bases and salt

3) pH, Buffer solution

4) Indicators

5) Preparation of Standard solutions

- Percent solution
- Normal solution
- Molar solution

6) Various grades of chemical reagents including LNR, evidity test

GENERAL BIOCHEMISTRY -(PRACTICAL)

1. Reactions of carbohydrates Monosaccharide, Disaccharides
Fructose, Lactose, sucrose, Starch, Glycogen.
2. Reactions of Proteins Color reactions reaction of albumin, Globulin,
peptones, gelatin and casein.
3. Preparation of standard solutions.
4. De ionized and double distilled water

HAEMATOLOGY (THEORY)

- Blood and its constituents
- Origin, Development, maturation and fate of blood cells.
- Collection of blood –capillary and venous blood collection, various anticoagulants and their uses, advantages and disadvantages.
- Different types of haemocytometers, their ruling and uses.
- ERYTHROCYTES – morphology of RBC in health and disease, functions of RBC, RBC counting, diluting fluids used, erythrocyte indices
- LEUCOCYTES –Structure, function morphology, leucocyte count, absolute eosinophil count, variation in WBC count.
- PLATELETS – Structure and function counting of plalalets, diluting fluids, causes of thrombocytopenia/ thrombocytosis.

- PRINCIPLES OF STAINING- Romanowsky stains, preparation and use of buffer solutions in staining.
- PREPARATION OF BLOOD SMEAR –Thin smear, thick smear, wet preparation and buffy coat preparation, Leishman staining differential leukocyte count (DLL) with recognition of abnormal blood cells.
- Quality control methods in cell counts Automatic blood cell counter.
- Bone marrow aspiration – Indications aspiration, preparation of bone marrow smears, morphologic study of bone marrow films and its differential count.
- Identification of parasites (Malaria) microfilaria, L D bodies, typanosoma in blood and bone marrow films.
- Supravital staining technique- principle and uses, demonstration and counting of reticulocytes, .composition and preparation of brilliant cresyl blue stain.
- Principles and different methods of determining ESR and PCV, advantages and disadvantages, Clinical significance of ESR and PCV normal values.
- Hemoglobin – Structure and function, Estimation of hemoglobin- principles, techniques, advantages and disadvantages methods of identification of abnormal hemoglobin, HB electrophoresis, Alkali denaturation tests and sickling phenomenon HB-F and its demonstration.

HAEMATOLOGY (PRACTICAL)

- Different methods of blood collection & Preparation of anticoagulant bottles
- Hemoglobin
- TLC
- RBC count

- Platelet count
- ESR
- PCV
- Differential leukocyte count
- Absolute eosinophil count
- Reticulocyte count.
- Examination of Bone marrow smears

CLINICAL PATHOLOGY-(THEORY)

Urine

Collection of urine and its preservation, 24 hour urine collection for protein. Physical examination of urine – examination of urine for colors, cloudiness, specific gravity, reaction and pH. Chemical examination of urine. Microscopical examination of urine- Urine sediment preparation, types of sediments and its examination.

Faeces

Collection and preservation, examination of motion for color, mucus, consistency, ova, ameba, cysts, parasites, puscells, RBC and crystals. Detection of occult blood in stool, concentration techniques.

Sputum

Method of collection for various purposes including AFB fungal, malignant cells and others. Microscopic examination of sputum, sputum for AFB.

Semen

method of collection examination of semen for time for liquefaction, volume, colour, reaction pH, motility of sperm, sperm count and other findings staining and morphological study of spermatozoa, semen fructose determination, Antisperm antibodies

CSF

General introduction method of CSF collection, Transport of CSF, examination of CSF, colour, turbidity and fibrin clot (Cob web), total and differential leukocyte count. CSF examination by gram's staining and acid fast staining, biochemical tests, clinical significance of CSF analysis in various meningitis and encephelitis and interpretations.

Other body fluids

Methods of collection, transport and macroscopic and microscopic examination of ascetic fluid, pleural fluid, pericardial fluid and synovial fluid.

Pregnancy tests

Different methods of testing and chronic gonadotropin assay with urine

CLINICAL PATHOLOGY (PRACTICAL)

- Urine-collection, processing, physical, chemical and microscopic examination.
- Collection, preservation and examination of stool
- Sputum collection and microscopy. examination of sputum for AFB.
- Analysis and examination of semen-physical examination, sperm motility, morphological study of sperms, fructose determination in semen.
- Analysis of CSF, microscopical and chemical examination of CSF.
- Macroscopic and microscopic examination of Ascitic fluid, Pleural fluid, pericardial fluid and synovial fluid.

Books Recommended:

- Lynch's Medical Laboratory Technology-Raphel
- Medical laboratory methods-Dr.Ramnic sood.
- Text Book of Medical Laboratory Technology-Godkar

GENERAL BACTERIOLOGY-THEORY

1. History of microbiology – classification of microorganism – Prokaryotes and Eukaryotes
2. Morphology of bacteria – size, shape and arrangement of bacterial cell – cell wall, cytoplasmic membrane, flagella, fimbriae and pilae, cytoplasmic matrix, nucleoid, cytoplasmic inclusions.
3. Bacteria – Bacterial growth curve, growth requirements
4. Stains –simple stain, negative stain, differential stain, special stain.
5. Sterilization and disinfection – Definition physical agents – (sunlight, Drying, Dryheat, Moist heat, filtration, Radiation, Ultrasonic and sonic vibration)
6. Chemical- (Alcohols, Aldehydes, Dyes, Halogens, Phenols, Gases)
7. Culture methods (streak culture, Pour plate culture, Stab culture, Anaerobic culture methods)
8. Identification of bacteria sero-typing and sub-typing, phage typing.
9. Bacterial genetics- methods of gene transfer – Transformation-mechanism, natural and artificial, Transduction-mechanism, generalized and specialized transduction, lysogenic conversion, Conjugation-Properties of F-plasmid, HFr strains, col factor, Mechanism

10. Bacteric Culture

11. Antibacterial antibiotics and their mode of action.

12. Normal bacterial flora of human body.

13. Automation in microbiology

14. Quality control in clinical microbiology laboratory.

GENERAL BACTERIOLOGY-(PRACTICAL)

- Sterilization techniques.
- Staining techniques-Gram stain, Acid fast stain, Albert stain.
- Study of motility of bacteria, Hanging drop preparation.
- Preparation of different culture media and Biochemical media.
- Culture techniques
- Isolation of bacteria on Nutrient agar, Blood Agar, MacConkey agar
- Biochemical reactions-Sugar fermentation test, Oxidation-Fermentation test, Urease test, Citrate test, TSI, M.R., V.P.
- Antibiotic sensitivity test-MIC, MBC, Agar dilution, Broth dilution, Disc diffusion etc
- Anaerobic culture methods.

CLINICAL BIOCHEMISTRY-I (THEORY)

1) COLORIMETRY – principle and its working

2) CARBOHYDRATES-blood sugar and its types, diabetes mellitus, complications of diabetes mellitus, test for blood sugar carbohydrates digestion and absorption

- 3) LIPIDS - digestion and absorption. Metabolism- synthesis of fatty acids, oxidation of fatty acids, cholesterol biosynthesis and regulation, biologically important compounds synthesized from cholesterol, lipotropic factor and Laboratory tests for cholesterol
- 4) PROTEINS -Digestion and absorption metabolism, synthesis and degradation of amino acids.
- 5) LIVER FUNCTION TESTS - Bile pigment metabolism, jaundice and its type, tests for liver function.
- 6) RENAL FUNCTION TESTS – Functions of Kidney, disease of kidney, Renal Function Tests.
- 7) GASTRIC FUNCTION TESTS– Functions of stomach, tests for gastric function.
- 8) UROLITHIASIS - Formation of calculi, composition and types of calculi. Examination of calculi

CLINICAL BIOCHEMISTRY-I (PRACTICAL)

- Estimation of glucose
- Estimation serum of creatinine
- Estimation of serum bilirubin
- Estimation of serum albumin
- Estimation of SGPT by UV kinetic
- Estimation of serum triglycerides
- Estimation of serum cholesterol
- Estimation of serum HDL cholesterol
- Estimation of serum uric acid
- Estimation of serum urea
- Estimation of total protein, AG Ratio, Globulin Fraction
- Estimation of serum alkaline phosphatase

CLINICAL BIOCHEMISTRY II-(THEORY)

- 1) ENZYMES – Definition, nature of enzymes, km value and its determination co enzymes, factors influencing enzyme enzyme inhibition, mechanism of enzyme action, Isoenzymes, Enzymes in clinical diagnosis.
- 2) HORMONES - Introduction, classification, chemistry and function.
- 3) HAEMOGLOBIN – Chemistry, properties and synthesis, metabolism of pigments Hb- derivatives – abnormal hemoglobin, Hb electrophoresis Porphyrins and disorders of porphyrins metabolism, chemistry of porphyrins metabolism, chemistry of porphyrines, primary disorders of haemsynthasis, secondary disorders, Analytical procedures
- 4) WATER AND MINERAL METABOLISM – General consideration, Regulation of water. Phenomenon of thirst, mineral Metabolism (Ca, Na, Cl K, P)
- 5) CARDIAC PROFILE TESTS – Introduction, Heart diseases, Laboratory tests for heart diseases. Troponin TM, qualitative and quantitative
- 6) VITAMINS – Introduction, classification, chemistry, clinical significance.
- 7) URINALYSIS – 24 hour urine sample collection and assays for proteins, Ca, P, urea, creatinine, uric acid.
- 8) Acid- Base balance.
- 9) Water and electrolyte balance, Osmolality.
- 10) Buffers of blood-Blood pH.Methods of determination of blood pH.
- 11) Quality control in clinical biochemistry laboratory.

CLINICAL BIOCHEMISTRY (PRACTICAL)

- Estimation of SGPT
- Estimation of SGOT
- Estimation of serum acid phosphatases
- Estimation of serum Amylase
- Estimation of serum inorganic phosphorous
- Estimation of serum sodium
- Estimation of serum Potassium
- Estimation of urinary calcium
- Estimation of pH of water
- Demonstration of equipment

Recommended text books/Reference books

1. Practical Clinical Biochemistry - H. Varley
2. Lynch's medical laboratory technology - Raphael
3. Micro analysis in Medical Biochemistry - Wootten
4. Outline of Biochemistry - Coon and stumpt
5. Biochemistry – Trehan Text Book of Biochemistry

Reference Books:

1. Clinical Chemistry – Principales and techniques – Henry
2. Clinical Laboratory Diagnosis - Gradwonl
3. Clinical Laboratory Diagonisis – Levansen
4. Clinical Chemistry- Bewell
5. Micromethods – Natelson
6. Chemical Methods in clinical medicine – G. A . Harrison
7. Text book of clinical chemistry –N.W. Tietz
8. Practical biochemistry - H.W.Cole.

BACTERIOLOGY AND SEROLOGY (THEORY)

Systematic study of morphologic, cultural biochemical and antigenic characters, epidemiology, pathogenesis, Laboratory diagnosis, treatment and prophylaxis of following bacterial pathogens.

1. Staphylococcus, Streptococcus, Pneumococci, Neisseria.
2. Haemophilus, Corynebacterium diphtheriae, Mycobacterium tuberculosis, Mycobacterium leprae, Atypical mycobacteria.
3. Enterobacteriaceae- Salmonella, Shigella, Escherichia coli, Klebsiella, Proteus, Vibrio, Pseudomonas.
4. Yersinia, Anthrax bacilli, Clostridia, Non sporing anaerobes.
5. Spirochetes- Treponema, Borrelia, Leptospira
6. Mycoplasma, Rickettsia, Chlamydia, Actinomycetes.
7. Bacteriology of air, water and milk
8. Laboratory diagnosis of bacterial infections.
9. Serological diagnosis of microbial diseases
10. TORCH profile
 - Widal test
 - V.D.R.L test
 - R.P.R TEST
 - Antistreptolysin'O test
 - C.R.P.
 - Rheumatoid factor test
 - Rose waaler test
 - Latex agglutination test
 - Fluorescent antibody test
 - Antinuclear antibody test

Fluorescent treponemal antibody absorption test

BACTERIOLOGY AND SEROLOGY (PRACTICAL)

Bacteriology

-Identification of unknown bacteria

Study cultural characteristics, Biochemical reactions and antibiotic sensitivity of the following bacteria

- Staphylococcus, Streptococcus
- E.coli, Salmonella, Shigella, Pseudomonas, Klebsiella, Proteus, Vibrio etc

Serology

- Widal test
- V.D.R.L test
- R.P.R TEST
- Antistreptolysin'O test
- C.R.P.
- Rheumatoid factor test

Books Recommended:

- Medical Microbiology-R. Cruickshank Vol.I&II
- Medical Bacteriology-C.H.Collins
- Diagnostic Microbiology-Baily and Scott
- Text book of Medical Microbiology-R.Ananthnarayanan&C.K. Jayaram Paniker.
- Topley and Wilson's principles of Bacteriology and Immunity-C.S.Wilson and A.A.Miles VolI&II
- Medical Laboratory Manual for Tropical countriesVol.II-Microbiology-Monica cheesbrough.

CYTOLOGY & CYTOTECHNOLOGY

- Cell morphology and physiology
- Cell structure and functions – lining membrane epithelia, stratified squamous epithelia, columnar epithelia, epithelia serving reproductive function and miscellaneous epithelia.
- Various cells seen in cytological preparations
- Body fluids: method of collection transport and macroscopic and microscopic of Ascitic fluid, pleural fluid, and synovial fluid with special reference to cytology.
- Genitourinary cytology (including normal and abnormal)

Histology and cytology of epithelia of female genital tract during the child bearing age. Cells originating from the normal squamous epithelium of cervix vagina. Squamocolumnar junction. Endocervical epithelium ciliary tuft. Cells originating from normal Endometrial. Endometrial smears in women wearing intra uterine devices, cells other than epithelia in normal smears, normal vaginal floras. Cyclic changes in vaginal smears. Basic cytologic pattern of menopause, early, crowded and Atrophic menopause. Importance of physiologic cytology of prepubertal females. Vaginal smear at ovulation time.

- Excretory system: Cytology in the absence of cancer, cytology of normal urine- voided urine and catheterized urine. Inflammatory process with in the lower urinary tract. Bacterial fungal (Monilia) and viral infections and associated changes. Cytologic changes in bladder epithelium due to therapy, cytology of urinary tract in inflammation and malignancy.
- Respiratory Tract: Cytology in the absence of cancer. The squamous epithelium and Respiratory epithelium and their cytology, Non – epithelial cells of respiratory tract. Foreign materials in sputum. Benign abnormalities of respiratory epithelium, squamous epithelium and Squamous metaplasia cytology in malignant condition,

- Cancer cells: Morphologic characters of cancer cells. Morphologic difference between normal cells and cancer cells.
- Fine Needle Aspiration Cytology (FNAC).
- Clinical procedures: Preparation and fixation of smears and fluid specimens. Collection, fixation and transport of cervical smears and vaginal smears for hormonal studies. Standards of adequacy of cytology examination of female genital tract.
- Collection of urine, bladder irrigation, urine collection after prostatic massage, screening of urinary sediment, GIT Brushing and lavage, Cytological sampling from oesophagus, stomach and duode-num. occult blood in stool. Collection of body fluids and anticoagulants used.

Practicals

- Collection of samples and processing.
- Cytological fixatives and fixation.
- Collection and preparation of fluid sediment for cytological examination.
- Preparation and fixation of sputum smears for cytology and preparation.
- Preparation and fixation of vaginal and cervical smears for cytology.
- Hormonal evaluation of vaginal smears.
- Papanicolaou staining-principles and staining procedures.
- Maygrunwald staining-principles and staining procedures.
- Identification of cells.
- Differentiation between malignant and benign cells.

Books recommended for reference:

- Diagnostic cytology and its Histopathological Basis-Vol-1-E.G.Koss

HEMATOLOGY-II

Theory

- Mechanism of blood coagulation – coagulation factors, laboratory methods used in investigation of coagulation disorders Bleeding time, whole blood coagulation time, one stage prothrombin time, partial thromboplastin time with kaolin, Thromboplastin generation test, Thrombin clotting time. platelet function test, clot retraction , tourniquet test, plasma recalcification time, prothrombin consumption index, Estimation of fibrinogen, clot lysis time, lysis of fibrin clots, assay of coagulation factors, Haemophilia and its laboratory parameters, measurement of life span of platelets.
- Cytochemistry – Peroxidase, Sudan block, and Esterases, Perl's staining and estimation of Iron content in bone marrow smears and its significance.
- Thalassemia and hamoglobinopathies (in brief)
- Definition, Classification, Laboratory diagnosis of various types of anemia, polycythaemia vera, leucocytosis, leucopenia, lymphopenia, monocytosis, neutropenia and Agranulocytosis, infectious mononucleosis.
- Definition and FAB classification of leukemia, Acute and Chronic leukemia blood and bone marrow findings in acute myeloid Leukemia (AML).acute lymphoid leukemia (ALL) chronic myeloid leukemia (CML),chronic lymphatic leukemia,(CLL), Erythroleukemia, Eosinophilic Leukemia, megakaryocytic leukemia, leukemoid blood reactions, FAB classification, Multiple Myeloma (in brief)
- Systemic methods of examination of blood film (blood Picture) and reporting
- LE cell phenomenon and demonstration of LE cells, principle, method and significance of osmotic fragility test, Acid haemolysis (ham's test), G6PD estimation and its significance.

- Automation and recent advances in hematological techniques.

Practicals

- Bleeding time
- Clotting time
- PT
- APTT
- Determination of fetal hemoglobin
- Osmotic fragility test
- LE cell phenomenon
- Heinz body preparation
- Determination of G-6-PD
- Demonstration of slides of various disorders of anemia and leukemia

Suggested books:

1. Practical Hematology -J.V.Docie, S.M.Lewis
2. Hematology -William J.Willams, Ernest Beutler
3. Clinical Hematology in Medical Practice-G.C.de Gruchy, David Penington etc
4. Atlas of Hematology-George A.Mc Donald, T.C.Dodds etc.
5. Lynch's Medical Laboratory Technology -Raphael
6. Clinical Hematology - Wintrobe
7. Blood and its diseases - Chanarin
8. Aids to clinical Hematology - Child
9. Medical Laboratory Hematology - Hall
- 10.Hematology for medical Technologists-Linch
- 11.Hematology for medical Technologists-Seivered
- 12.Hematology - Cawley
- 13.Clinical Hematology - Eastham
- 14.Short text book of Hematology - Thompson

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| 15. Blood atlas and source | - Book of Haematology - Kapff |
| 16. Hematology | - Reich |
| 17. Introduction to Hematology | - Rapaport |

VIROLOGY

- 1) Introduction to virology-Classification, Structure and General properties of viruses
- 2) Laboratory diagnosis of viral infections-Specimens collected, Processing of specimens, Different methods of diagnosis.
- 3) Bacteriophage
- 4) Biological characteristics of the following viruses with tests
 - Pox virus
 - Myxovirus
 - Arbovirus
 - Herpes virus
 - Enterovirus
 - Rabies virus
 - Rota virus
 - HIV virus
 - Oncogenic viruses (in brief)
 - Slow viral diseases (in brief)

Books recommended:

- Lelind-Clinical virology: Elsevier
- Text book of Medical Microbiology-R. Ananthnarayanan & C.K. Jayaram Paniker.

IMMUNOHAEMATLOGY AND BLOOD BANKING **(THEORY)**

- General Introduction to blood banking
- Antigen-Antibody Concept, precipitation, flocculation
- General management and essential components of blood bank.

- ABO blood group system – Inheritance, distribution antibodies in ABO system, Subgroups, ABO grouping methods and factors influencing
- RH Blood group system - Inheritance and distribution, antibodies, Hemolytic disease of newborn, RH typing methods.
- Other blood group systems -
 - M N S blood group
 - P Blood Group
 - Lutheran Blood group
 - Kell blood group
 - Lewis blood group
 - Duffy blood group
 - Kid blood group
 - Bombay blood group

- Blood transfusion – Donor screening, collection of blood.
- Screening of blood, Anticoagulants used in blood bank, storage of blood.
- Transfusion reaction – Principles and methods of investigating Transfusion reactions, diseases transmitted by blood transfusion

- Component therapy – preparation and transfusion of leucocytes poor blood, RBC concentrate platelet rich plasma, platelet concentrate factor VIII, Transfusion of plasma, components and preparation of cryoprecipitate, its use and advantages.
- Human Leukocyte Antigen (H L A) system.
- Automation and recent developments in blood banking techniques.

IMMUNOHAEMATLOGY AND BLOOD BANKING **(PRACTICAL)**

- ABO grouping-Cell and serum grouping
- Rh grouping
- Test for D^u antigen
- Compatibility test-Major and Minor cross matching & Coombs cross matching
- Coombs test-Direct and Indirect.
- Screening of blood for infectious agents-HIV test, HBV, HCV, V.D.R.L, malaria etc

Books recommended:

1. Grawhol's Clinical Laboratory methods and Diagnosis
2. Medical Laboratory Technology and clinical Patnology – Lynch, Raphel, Meller etc.
3. Lynch' s Medical Laboratory Technology – Rapel
4. Manual of clinical Laboratory methods - Capal E.Hopler
5. Medical Laboratory methods – Dr. Ramnik Sood
6. Clinical Laboratory methods – Bouer
7. Introduction to medical laboratory technology – Baker
8. clinical pathology and Bacetriology - Sachdev
9. Basic Essentials of Blood grouping and clinical applications – K.S. Ranganathann.

10. An introduction to blood group serology - Boorman and Dood
11. Essential of Blood grouping and clinical application -K.S. Ranganthan.
12. Blood Group serology - Boorman
13. Laboratory hand book of blood transfusion Techniques - Farr
14. Blood grouping Techniques – Schief and BYD
15. Technical methods and procedures of the American Association of Blood Banks –Revised 1956
16. Clinical Blood transfusion - Kay
17. Blood Transfusion _ Kelton’
18. Blood Transfusion in clinical medicine – PL Mollison
19. Manual of clinical blood transfusion – Brozovic
20. Clinical pathology – Betra
21. Hand book routine urinalysis – Graft.

CYTOGENETICS AND TISSUE CULTURE

1. Introduction to cytogenetics and tissue culture.
2. Terminology, classification and nomenclature of human chromosomes.
3. Barr body -origin, sampling, staining and its demonstration.
4. Karyotyping - methods of chromosome analysis.
 - a. Culture and direct preparation
 - b. Banding techniques.
 - c. Major chromosomal abnormalities.
5. Tissue culture : principle and brief outline, indications.

A. Equipments:

- (I) Laminar flow equipment.,
- (II) Carbon dioxide incubator.
- (III) Inverted microscope.

B. Procedure of preparation of glassware, media etc.

- (I) Dry heat sterilization.
- (II) Autoclaving
- (III) Chemical sterilization.

C. Derivation of culture from the tissue.

- (I) Enzymatic digestion of the tissue using collagenase, protease etc.
- (II) Plating of cells in tissue using collagenase, protease etc.
- (III) Observation of cells in Invertoscope
- (I V) Subculturing and derivation of cell lines.

D. Characterization of cell lines.

- (I) Determination of biochemical markers in cells.
- (II) Chromosomal and D.N.A.contents of cells.
- (III) Immunological properties of cells.

E. Preservation of immortalized cell lines.

-Storage in glycerol & in liquid nitrogen.

PARASITOLOGY (THEORY)

1. Introduction
2. Classification of parasite
3. Classification of host
- 4) Study of morphology, important developmental stages, Symptoms, Pathogenesis, epidemiology, diagnosis, treatment, prevention of the following parasites
 - Protozoa-Entamoeba, Trichomonas, Trypanosoma, Leishmania, Giardia, Plasmodium, Toxoplasma, Isospora, balantidium, Cryptosporidium, Pnemocystis carinii.
 - Platyhelminthes-Diphyllobothrium, Taenia, ccinococcus, Hymenolepsis, Schistosoma, Fasciola, Clonorchis, Paragonimus.
 - Nematelminthes-Ascaris, Ancylostoma, Necator, Strongyloides, Trichinella, Enterobious, Trichuris trichura, wuchereria, Brugia, Loa loa, Dracunculus.
- 6) Laboratory diagnosis of parasitic infections.
- 7) Demonstration of various stages of parasites
- 8) Direct and indirect means of demonstration of parasites in the body, nonspecific gamma globulins, specific antibody demonstration, complement fixation, malaria card antigen

PARASITOLOGY (PRACTICAL)

-Collection, preservation and processing of stool specimens

-Stool examination

- Direct wet mount for parasites and parasitic eggs.
- Concentration methods of stool.
- Egg counting technique

-Examination of parasites in blood.

Books Recommended:

- Text Book of Medical Parasitology-Paniker.
- Parasitology-K.D.Chatterjee
- Medical Parasitology-P.Chackraborty

SEMESTER-VI

IMMUNOLOGY

- 1) Immunity-definition, classification, mechanism-Innate immunity and Acquired immunity, Vaccines
- 2) Antigens-Definition properties and Types of antigens
- 3) Antibodies-definition, structure of immunoglobulin, immunoglobulin classes and its function
- 4) Complement system
- 5) Antigen -Antibody reaction
- 6) Immune responses-Humoral and Cell mediated immune responses, Lymphokines, basic knowledge of different kinds of immunocompetent cells.
- 7) Monoclonal antibodies
- 8) Immunodeficiency diseases including HIV/AIDS
- 9) Hypersensitivity reaction
- 10), Autoimmunity

- 11) Autoimmune disorders and Transplantation immunology, autoimmune disorders.

Books recommended:

- Immunology-Janis Kuby.
- Immunology and Serology-K.R.Joshi,N.O.Osamo

MYCOLOGY -(THEORY)

- 1) Introduction to mycology, classification of fungal infections, fungal infections in men.
- 2) Laboratory diagnosis of fungal infections-Specimens collection, transport of specimens, Different methods employed-direct microscopic examination, Slide culture technique, fungal culture, serology and animal inoculation.
- 3) Superficial cutaneous mycoses- Malassezia infections, Taenia nigra, Piedra, Dermatophytosis.
- 4) Subcutaneous mycosis-Mycetoma, Sporotrichosis, Chromoblastomycosis, Phaeohyphomycosis, Rhinosporidiosis, Lobomycosis
- 5) Systemic mycoses-Histoplasmosis, Blastomycosis, Coccidioidomycosis, Paracoccidioidomycosis.
- 6) Opportunistic mycoses- Candidiasis, cryptococcosis, Penicilliosis, Aspergillosis, Zygomycosis.
- 7) Occulomycosis
- 8) Otomycosis
- 9) Mycotic poisoning

MYCOLOGY- (PRACTICAL)

1. Collection, Transport and Processing of specimens & stains.
2. Morphologic study of fungi.
 - Lacto Phenol Cotton Blue Mount, KOH preparation
 - India ink preparation.
 - Germ tube test.
2. Fungal culture
 - Preparation of culture media
 - Methods of culture.
 - Study of colony characteristics.

Books Recommended:

- Morphology and taxonomy of fungi –Bassey E.A
- Genera of fungi – Clements F.E and shear C.L.
- Manual of clinical mycology – conant N.F, smith D.F.
- Medical mycology – Rippon
- Medical mycology – Jagadish Chander

BASIC TISSUE PATHOLOGY

- Introduction
- Cell, tissue
- General pathology
 - Injury and cell death.
 - Acute and chronic inflammation
 - Repair and healing
 - Neoplasia
- Environmental and nutritional pathology (occupational diseases)

- Blood vessels, (normal vasculature, artery, vein)
- Heart- Normal myocardium, discussion on diseases.
- Lungs pneumoconiosis
- GI tract – important diseases.
- Demonstration of various slides

Books recommended:

- Robbins Basic Pathology-Kumar, Cotran, Robbins
- Robbins and Cotran-Pathologic Basis of disease-Kumar, Abbas, Fausto.

HISTOPATHOLOGY & HISTOPATHOLOGICAL TECHNIQUES

(THEORY)

- General understanding of the terms –Histology, histopathology and histopathological techniques.
- General organization of histopathological laboratory and basic requirements of histopathology laboratory. (Glass wares, chemical and Reagent, Equipment and Instruments). Responsibilities of a histotechnologist.
- General introduction to processing of tissues. cell nucleus, cyto. Membrane, cytoplasm, cell division).
- Basic steps in tissue processing fixation, embedding, microtomy, staining, mounting.
- Fixation and fixatives- Aim of fixation, classification of fixation, classification of fixatives, Different fixatives used, its advantages and disadvantages.

- Decalcification- Aim of decalcification, selection of tissue, fixation, decalcifying agents used, Decalcification techniques.
- Tissue processing- Technique of dehydration, clearing (Aim of cleaning, different cleaning agents), Impregnation, techniques of casting Blocking, section cutting.
- Principles, operation, parts and use of automatic tissue processors.
- Different types of microtomes, microtone knives.
- Staining- Principles of staining Basic staining techniques, special stains in histopathological studies.
- Mounting- Different mounting media and mounting techniques.
- Museum techniques- General introduction, organization of museum, mounting of museum specimens.
- Frozen sections- Principles, methods used, freezing micro sections, staining of frozen sections and application of frozen sections.
- Immunohistochemistry

HISTOPATHOLOGY & HISTOPATHOLOGICAL TECHNIQUES **(PRACTICAL)**

- Basic steps of tissue processing.
- Preparation of fixatives and fixation.
- Embedding.
- Microtomy.

- Staining.
- Mounting.
- Various methods of preparation of tissue sections.
- Paraffin section, celloidin embedding, frozen section.
- Decalcification.
- Tissue processing (Manual / Automatic).
- Section cutting and sharpening of microtone knife.

Suggested books:

- Handbook of Histopathological and Histochemical techniques- CFA.Culling.
- Theory and practice of Histological techniques-John D.Bancroft

MARKETING OF HEALTH SERVICES

PROJECT

COMPREHENSIVE VIVA

SEMESTER-VII & VIII

1. Internship

2. Project