MLT – 101 Blood Banking, Hematology, Serology and Instrumentation

A: outline of course

Sr. No.	Title of Unit	Hours
1.	**Unit-A** Blood Banking	50
2.	**Unit-B** Hematology	60
3.	**Unit-C** Serology	60
4.	**Unit-D** Instrumentation	40

B. detailed syllabus

Sr. No.	Detailed syllabus	Total hrs. 210
	Unit-A	**Hours**
	ABO System, antigens, sub-groups of A, Bombay-O, Antibodies of ABO System. Nature of antibodies, Anti A, Anti B and Anti H, ABO testing, slide and tube test. Reverse grouping, Discrepancies between cell and serum result, sources of error, Rouleaux formation and methods of checking this. Rh system Nomenclature, D" system and its significance. Nature of Rh antibodies. Clinical significance, phenotype and genotype. Rh grouping tests. Slide or rapid tube test. False positive and false negative results. Cross matching of Blood, Principles, Reasons for Cross- match. Saline, albumin, coomb's serum in testing. Major and minor cross matching. Labelling of tubes, methodology, and legal implication incompatible cross match. Autoantibodies, plasma expanders, multiple myeloma etc. affecting a cross- match. Difficulties in cross-matching, and methods of investigation. Reception of donors, indirect questioning of eliciting medical history. Types of donors, Rejection of donors in certain diseases and test done on donor's blood for safe transfusion of blood. Technique and importance of sterile technique in drawing blood. Various donor reactions and their remedies. Facts of blood donation, precautions and care to be taken during and after blood donation. Need of giving refreshments to the donor, Emergency kit.	50

	Anticoagulants for blood preservation - ACD, ACD-A, CPD, Herparin Advantages and Disadvantages. Shelf life of Blood, changes taking place in blood on storage, Na, K etc. Demonstration of coombs test direct and indirect. Principle, explanation of procedure and sources of error, control, interpretation and clinical application. Different types of coomb's sera reactions. Transfusion of blood, handling of transfusion reactions in blood banks. Hemolytic disease of the new born (HDN) due to Rh or ABO incompatibility. Mechanism of the disease, blood for exchange transfusion and tests done on cord blood. Other blood group systems-Kell, Kidd, Lewis, Duffy, MNSs and its importance, H.L.A. system. Antibody titrations, reasons and methodology. Blood component therapy.	
	Unit-B	
	Hematopoietic system (Origin, formation and fate of Blood cells. theories of Blood cell formation, Bone Marrow sites). Maturation of Blood cells-myeloid series. Maturation of Blood cells-lymphocyte, monocytic series and megakaryocytic series. Maturation of Erythrocytic series-Neoblastic and megaloblastic maturation. Interpretation of **TCL** & **DLC,** Hemocytometer and RBCs, WBCs counting. Leukocytosis; Physiological and Pathological. Arneth and Schilling counts, Leukopenia, eosinophilia, Lymphocytosis. Principle, interpretations and demonstrations of **Reticulocyte** count and Eosinophil count various methods. **Hemoglobin**-structure in detail, Hemoglobin-formation, fate and functions; Normal range, physiological and pathological variations formation of normal and abnormal Hemoglobins, Estimation of Hb by various methods. Hb. electrophoresis test. Iron metabolism. The **Hematocrit**-macro and micro methods; Hematocrit ratio to Hb. Erythrocytic indices, Interpretation, Demonstration of micro hematocrit. **E.S.R.:** Principles-normal range and interpretation, various Methods, Demonstration. **Theory of Blood coagulation (Cascade Theory)**, Factors involved in Extrinsic and intrinsic pathway, Cascade theory. Various simple tests used in coagulation. a. Bleeding time -Duke and Ivy method b. Coagulation time -Lee and white, Capillary and slide method. c. Prothrombin time -1 stage and 2 stage. d. Clot Retraction e. Platelet Count f. Thrombin time g. Partial Thromboplastin time	60

	h. F.D.P. **Anemia,** Classification of anemias, Morphological(microcytic, normocytic, macrocytic) and patho physiological(due to blood loss, due to impaired red cell production, hemolytic anemia) of R.B.C., hypochromia, anisocytosis, polychromasia, Cabot rings, Basophilic Stippling, Reticulocyte, Poikilocytosis, myelofibrosis, Polycythemia, Iron Deficiency anemia, sickle cell anemia, enzyme deficiency anemia (G6PD, pyruvate kinase), Thalassemia, sideroblastic anemia, Aplastic anemia, pernicious anemia spherocytic anemia, eliptocytosis, megaloblastic anemia and laboratory findings **Hemolytic anemias** classification, Intra and extra corpuscular, Hereditary hemolytic anemia (Congenital anemias), Acquired hemolytic anemias (PNH, Drug induced, Haemoglobinopathies), **Leukemia**-acute and chronic. Gen lab findings, **Purpuras (**Non thrombopenic and thrombopenic) and Hemorrhagic disease, Hemophilia, osmotic fragility. Demonstration of **Bone marrow** pictures, Bone marrow aspiration, Staining and differential count and reporting.	
	Unit-c	
	Immunity: Definition of Immunity and the immune system of the body, immune responses, Basic structure, types and biological properties of **immunoglobulins**, complement. Basic aspects of the immune response, (a) Humoral division (b) Cellular division. Antigens and haptens, types of antigen. Types of immunization, heterophilic antigens, alloantigen. Methods of detection and measurement of antibody and antigen **(Precipitation, Agglutination).** **Precipitation:-** Types of precipitation reactions (**Precipitation in liquid**, (Ring test, Slide test, Tube test). **Precipitation in gel** Single diffusion in single dimension (oudin test), Single diffusion in double dimension (Immunodiffusion), double diffusion in single dimension (Oakley Fulthrope techniques), double diffusion in double dimension (Ouchterlony technique). **precipitation in agar in electric field** (Immuno electrophoresis, Counter electrophoresis. Rocket electrophoresis) **Agglutination: -** Active or Direct agglutination (Slide, tube, heterophillic, antiglobulin Coomb's agglutination) and Passive or indirect or using RBC as carriers (Coated RBC), Latex coated particles, Bentonite, agglutination (Latex, Hemeagglutination, and Coaggulation), Antigen-antibody titration, prozone reaction, febrile agglutinins.	60

	Complement fixation test and Wasserman reaction -principle; Immunofluorescence test. **Pregnancy** test (including the historical background and Bioassay), ASO, CRP, RF and autoimmune disorder, widal. Syphilitic serology-Kahn, VDRL,(Wassermann's test, TPI, TPHA, FTA, RPR) Immune fluorescence test. Fluorescent labelled antibody, anti-nuclear antibody or immunofluorescence tests for L.E. techniques, **EIISA and RIA-principle**; Auto-Immunity, auto-immune disease, LE cell. Organ transplantation.	
	Unit-D	
	Different microscopy, Centrifuge, Magnetic stirrer, Vortex mixer, Electrophoresis water Bath, Colorimeter and Spectrophotometer, Flame Photometer.	40

C. Reference Text Books:

Medical Laboratory Technology Vol 1, 2, 3: K. Mukherjee

Medical Laboratory Technology: Godkar

Pathology: Harsh Mohan

Practical Hematology: Dacie Louis, Elsevier

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MLT- 102 Clinical Biochemistry

A. Outline of course

Sr. No.	Title of the Unit	Hours
	Unit – A	Total 195 hrs.
	Revision of Basic concept in clinical Biochemistry, Bio-molecules and its analytical methods in clinical pathology	05
	(a) Carbohydrate	20
	(b) Protein	20
	(c) Enzymes	20
	(d) Lipid	15
	(e) Nucleic acid	05
	(f) Minerals	03
	(g) Function tests	10
(a)	**Unit-B**	
	Principal in brief of the various methodologies. Spectrophotometry, Chromatography, Electrophoresis, ELISA, RIA, GC, HPLC, POCT	57
(b)	Urine analysis, Function tests, Semen and CSF sample analysis	40

B. Detailed syllabus:

Sr.No.	Detailed syllabus	Hours
	Unit – A	
	Revision of Basic concept in clinical Biochemistry, atomic and molecular symbols and formulae various types of solutions, Molar, Normal definitions and calculations/various types of chemicals, Acid, Base, pH, Indicators, Buffers. Electrolyte. Primary and secondary standards.	05
(a)	Brief revision of biochemistry Carbohydrate, Classification, properties, biochemical importance, Brief revision of glycolysis, TCA, Regulation of blood sugar, GTT, and diabetes. Benedict's test, Fehling's test, Dipstick method, GOD, POD, Hexokinase method. GTT metabolism and ketosis, glycogen storage disorder,	20

	pentose urea, mucopolysaccharide and other carbohydrate metabolic disorders.	
(b)	Brief revision of biochemistry of Protein, Introduction and definition , importance, structure of protein primary, secondary, tertiary, quaternary. Types of proteins, albumin, globulin, immunoglobulin, lipoproteins, enzymes, acetophase protein, transport protein, coagulation factors. Role of protein in MLT testing Disorders: Amino acid, melanin, Indian PKU, Homogentisic acid. Demonstration of technique for Protein test and assay: Total protein, Albumin test, Globulin test, SGOT, SGPT, Protein Electrophoresis, ELISA. Protein free filtrate. Clinical significance in abnormalities and conclusions.	20
(c)	Brief revision of biochemistry of Lipid , metabolism and estimation, (a) cholesterol, (b) HDL-Cholesterol, (c) Triglycerides, (d) total Lipids. Various estimation, clinical significance of lipid. GPO method, CE/CO method, PTA method, Phosphoveniline method.	20
(d)	Brief revision of biochemistry of Enzyme, types of enzymes, factors affecting enzymes activity, Enzyme Unit of measurement, enzyme regulation, enzyme assay, Amylase caraway's method, ALKP/PNP method and Acid phosphatase method	15
(e)	Brief revision of biochemistry of nucleic acid, Molecular biological concept of DNA and RNA structure	05
(f)	Hormones : Brief Understanding of Thyroid function test T3, T4, TSH, CPK, VMA, Cortisol, Estrogen, Progesterone, other Hormones	03
(g)	Minerals ; Urine Ca+2, Phosphorus and its metabolism Arsenazo method for estimation	10

	Unit-B	
(a)	Urine Analysis: Bile pigments and urobilinogen in urine, principle and various methods, demonstration of Harrison's spot test, metabolism of bile pigments, interpretation. Watson's semiquatitative test and tests; for porphobilinogen, demonstration of techniques. Ketone bodies in urine-Principles and interpretation; demonstration of techniques. Porphyrin in urine-various tests, clinical significance, demonstration of techniques. Occult blood in urine-principles, various methods; sources of error; demonstration of technique. Principle of tests for glucose in urine-various methods. Urine calcium, reasons for formation; clinical significance; 24 hours tests for urinary Calcium (Sulkowitch) and chloride (Fantu's); demonstration of technique. Addis count-various preservatives for 24-hour samples of urine, volume of urine in 24 hours, changes in urine on standing. Physical and chemical examination of urine by strip. Appearance, color, Specific gravity, pH, Alb, sugar. Chemical examination of urine by Albumin-sulfosalicylic acid method, glucose-benedict's method and other methods. Principles of Albumin tests with interpretation. 24-hour semiquantitative test for albumin; Bence Jones proteins-methodology. Urinary sediments-method of obtaining sediment, organic and inorganic sediments; normal and abnormal sediments.	57
(b)	**Function Test:** Liver function test: (a) Malloy & Evelyn, (b) Jendrassik and groff method, Neonatal jaundice and direct spectrophotometric method of bilirubin estimation, advantages and disadvantages. Renal function tests: Principle of concentration and dilution tests, PSP dye test, Thyroid test. Semen analysis; reasons for it & interpretation. Creatinine and its estimation – Jaffe's method. Calcium.	40

	CSF, Physical, chemical and cytological examination, methods and procedures used and clinical interpretation.	

C. Reference Text Books:-

Principal of Biochemistry Lehninger (6E), Nelson & Cox

Harpers Collins Illustrated Biochemistry

Text Books of Medical Biochemistry ; Vasudevan

A Text Book of Medical Biochemistry: Chatterjee and Shinde

Clinical Biochemistry and Metabolic Medicine: Crook

In current Time or Digital Age Internet is the best medium for learning.

MLT- 103 Medical Microbiology and histopathology

A. Outline of course

Sr. No.	Title of the Unit	Hours
	Unit – A	
	Bacteriology	60
	Unit-B	
	Mycology and Virology	50
	Unit-C	
	Parasitology	60
	Unit-D	
	Histopathology and Instrumentation	40

Sr. No.	Title of the Unit	Hours
	Unit – A	**Total 210 hrs.**
	Bacteriology: - Morphology and Physiology of bacteria, Bacterial genetics In brief, Basic constituents of **culture media**, various types of culture media; liquid and solid media; semi solid media, differential, selective, enriched media. **Methods** of inoculation, cultivation, isolation; Cultivation on liquid, semisolid and plates; Aerobic and anaerobic methods of culture. Various **staining** procedures for staining and differentiating bacteria, hanging drop method for motility. **Sterilization** and **disinfection** by various methods. a. Physical, b. Chemical, c. Irradiation, etc. **Antimicrobial agents**, Antibiotic sensitivity. Normal Flora of various areas in the body. **Morphology, Culture Characteristic, Antigenic structure, Pathogenicity, Lab. diagnosis of following bacteria.** *Staphylococcus spp., streptococcus spp., Pneumococcus, Neisseria spp., Mycobacterium spp., Spirochetes, Clostridia, Salmonella spp., Shigella spp., Vibrio spp.*	60

	Enterobacteracae group. *E. coli, Klebsiella, Enterobactor, Edwardsiella, Serratia and Hafnia, Pseudomonas, Aeromonads, Alcaligenes. Proteus, Providencia. Citrobacter, Arizona.* Non-intestinal gram negative bacteria; *Haemophilus, Brucella, Pasteurella, Bordetella, Bacteroides,* Gram positive bacteria *Corynebacteria, Listeria coccidian, Bacillus species*	
	Unit-B	
	Mycology and Virology: - Morphological, classification of fungi, Lab. diagnosis of fungal disease. General properties of virus: Morphology, Replication and cultivation of virus. Disease caused, Lab. Diagnosis and prevention of *Adenovirus, Herpes* virus, *Pox* virus, *Hepatitis* virus, *Rabbis* virus, *Rubella* virus, *influenza* virus, and *mumps and measles* virus.	50
	Unit-C	
	Parasitology: - General information of about parasites, Classification of parasites. Protozoa, Nematodes, cestodes, trematodes. **Protozoa:- Amoeba** (*E. histolytica, E.coli, Endolimax nana*), **Flagellates**(*Giardia and Trichonads Spp.*), Hemo Flagellates(*Leishmania Spp., Trypanosoma Spp.*), **Ciliates** (*B. coli*), **Sporozoa** (*Toxoplasma*, Malarial Parasites) **Nematode: - Round warm (***A. lumbricoids***), Intestinal warm** (*Trichinella spiralis*) **Tissue warm** (*Onchocerca volvulus, Dracunculus medinensis, Wuchereria bancrofti, Brugia malayi; Loa loa*)**, Hook warm (***Ancyclostoma duodenal, Strongyloides stercoralis***), Thread warm(***Enterobius vermicularis***) Dog and cat round warm (** *Toxocara canis, Toxocara cati* **).** **Cestoda: - Dog tape warm (***Echinococcus granulosus***), Fish Tape Warm** (D. latum), **Pork Tape warm (***Taenia saginata***), Beef Tape Warm (***Taenia solium***), Intestinal tape warm (***Hemenolepsis nana***).** **Tremetoda: - Blood Fluke (***Schistosoma haemetobium* and other spp.**), Liver Fluke (***Fasciola hepatica***), Lung Fluke (***Paragonimus westermanii***), Whip warm (***Trichuries trichiura***). Intestinal Flukes (***Fasiolopsis buski***)** **Stool Examination (different methods)**	60
	Unit-D	
	Histopathology and Instrumentation: - Introduction to histopathology, Sources and types of histological specimens received; records, labelling and general rules	40

	when receiving a specimen. Processing of tissue: Grossing, Fixation and fixatives, Decalcification and its agents, Dehydration and its agents, Cleaning and its agents, Impregnation, Embedding with wax, Block making, horning, Storming, trimming, sectioning, knife angle, Errors in sectioning and their remedies. Separating and identifying sections. Staining and microscopically examination of histopathological samples. Types of stains, mordents and differentiations. H&E staining methods and principals involved in staining.Introduction to cytology; various fluids and methods of making smears for cytology.Papanicolaou staining. Microtomes, Autoclave, Hot air Oven, pH meter and other tool / accessories.	

C. Reference Text Books:-

Anathanarayana and Panikar - A Text Book of medical Microbiology

Essentials of Medical Microbiology by Apurba Sastry

Scott and Bailey's Diagnostic Microbiology

Text book of Medical Mycology by Jagdish Chander

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