

SYLLABUS & SCHEME OF EXAMINATION

for

**BACHELOR IN MEDICAL LAB
TECHNOLOGY (BMLT)**

मेडिकल लैब टेक्नोलॉजी स्नातक पाठ्यक्रम

Three Years Degree course

(Academic Session 2021-22)

**Institute of Paramedical Science and Research,
Jiwaji University, Gwalior (M.P.)-India**

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Institute of Paramedical Science and Research

About the Course:

Medical Laboratory Technology, also called Clinical laboratory science, is an Allied health/paramedical profession, which is concerned with the diagnosis, treatment and prevention of disease through the use of clinical laboratory tests. Doctors rely on laboratory technologies to detect, diagnose and treat diseases. The programme covers the basics of preclinical subjects such as Biochemistry, Pathology, Microbiology and Blood Banking. Medical Laboratory Technologists (MLT) do these tests by analyzing body fluids, tissues, blood typing, microorganism screening, chemical analyses, cell counts of human body etc.

Job Prospects

After the completion of three year programme BMLT, students will find a challenging career in a hospital, minor emergency centers, private laboratory, blood donor centers, doctor's office or clinics. A technician can become a technologist through further education and work experience. Common job profiles of students after completing BMLT include: Senior Technician in Blood Banks, Hospitals, Nursing Homes and Diagnostic Labs.

Duration:

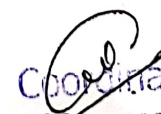
The Degree course is of three years.

Eligibility for admission in Para medical Degree course

- The candidate must have passed 10+2 with at least 40% marks in aggregate of Physics Chemistry and Biology (P C B) and for DMLT 10 + 2 (P C B) or 10 + 2 vocational (MLT) course with at least 40% marks will also be eligible.
- In case of SC/ST/OBC candidates, 5% marks relaxation will be given for the admission in above said courses (MP Domicile)
- Weightage will be given as per university rules.

Age limit for admission


The minimum age for admission shall be 17 years on 31 December of the Academic year of admission.


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SCHEME of EXAMINATION
BACHELOR IN MEDICAL LAB TECHNOLOGY (BMLT)
BMLT-1st Year

Course code	Subject	Theory	Internal assessment		Practical	Total	
			Theory	Practical			
MDLT 101	Basic Histology (Human Anatomy & Physiology-I)	100	50	50	100	300	
MDLT 102	Biochemistry-I	100	50	50	100	300	
MDLT 103	Hematology - I	100	50	50	100	300	
MDLT 104	Microbiology - I	100	50	50	100	300	
		TOTAL					1200


N.B.- Internal Assessment marks will be added in theory marks; candidate have to get min. 50% marks i.e.-100 marks in theory and internal assessment collectively for passing the examination and in practical he/she should get 50% marks i.e.-50 marks to get pass.


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SCHEME of EXAMINATION
BACHELOR IN MEDICAL LAB TECHNOLOGY (BMLT)
BMLT-2nd Year

Course code	Subject	Theory	Internal assessment		Practical	Total	
			Theory	Practical			
MDLT 201	Histology	100	50	50	100	300	
MDLT 202	Biochemistry-II	100	50	50	100	300	
MDLT 203	Hematology - II	100	50	50	100	300	
MDLT 204	Microbiology - II	100	50	50	100	300	
		TOTAL					1200


N.B.-Internal Assessment marks will be added in theory marks; candidate have to get min. 50% marks i.e.-100 marks in theory and internal assessment collectively for passing the examination and in practical he/she should get 50% marks i.e.-50 marks to get pass.


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SCHEME of EXAMINATION
BACHELOR IN MEDICAL LAB TECHNOLOGY (BMLT)
BMLT-3rd Year

Course code	Subject	Theory	Internal Assessment	Practical	Total
MDLT 301	Applied Histopathology	100	100	100	300
MDLT 302	Biochemistry-III	100	100	100	300
MDLT 303	Hematology - III	100	100	100	300
MDLT 304	Microbiology - III	100	100	100	300
MDLT 305	Instrumentation	-	50	-	50
	TOTAL	400	450	400	1250

N.B.-Internal Assessment marks will be added in theory marks; candidate have to get min. 50% marks i.e.-100 marks in theory and internal assessment collectively for passing the examination and in practical he/she should get 50% marks i.e.-50 marks to get pass.


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Pattern of Examination (Theory)

- All theory papers will of 100 max. Marks and 3 Hrs. time duration.
- Pattern of Examination(Theory) if Maximum Marks are 100 will be as under;-

No. and Type of Questions	Marks for each Question	Total Marks
10 very short answer Questions <i>Answer to be given in 50-60 words</i>	02	20
5 short answer Questions <i>Answer to be given in 250-300 words</i>	10	50
2 essay type Questions <i>Answer to be given in 450-500 words</i>	15	30
Total Marks		100


Instruction for the paper setter

Section-A: This will consist of 10 very short answer type questions with answer to each question upto five lines (Fifty to sixty words) in length. All questions will be compulsory to answer. Each question will carry two marks. Total weightage of the section shall be 20 marks.

Section-B: This will consist of short answer questions with answer to each question upto 2 pages (250-300 words) in length. Eight questions will be set by the examiner and five have to be answered by the candidate. Each question will carry 10 marks. Total weightage of the section shall be 50 marks.

Section-C: This will consist of essay type questions with answer to each question upto 5 pages(approx 500 words) in length. Four questions will be set by the examiner and two have to be answered by the candidate. Each question will carry 15 marks. Total weightage of the section shall be 30 marks.

Instructions for the candidates: Answer all questions only in required word.


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BACHELOR IN MEDICAL LAB TECHNOLOGY (BMLT): 1st Year Syllabus (2021-22)

MDLT 101: Basic Histology (Human Anatomy & Physiology-I)

Outcome of the Course:

The study of basic anatomy and physiology is essential because it will help in understanding the basic structure of the human body and normal function in health, during disease the normal function may be likely be affected, by various laboratory tests, the student will be able to know the abnormal functioning of the body and ultimately helps in diagnosis of the diseases.


Part A: Anatomy & Physiology of human body:

1. Introduction of living system and Human Body; General Anatomy.
2. The anatomic and physiological organization of human body and integrated physiology.
3. Cell structure, organization and function.
Normal anatomical structure, Histology & Functions (Physiology) of the following systems-
4. Anatomy of skin, types and its function; Applied aspects of skin-Albinism, Skin cancer etc
5. Skeletal system; bones, Joints - Definition, Classification of joints with examples, Synovial joint, Movements & mechanism of Joints, structure and range of movement; muscles.
6. The circulatory system; structure of the Heart & Blood Vessels; major arteries and veins of the body; Body fluids and their significance; Blood morphology, chemistry and function.
7. Lymphatic system: Circulation and function; lymphoid organ Spleen, lymph node and R.E. system.
8. Respiratory system; anatomy & physiology of lungs, mechanism of inspiration and expiration; cardio respiratory adjustment in health and disease.
9. Digestive system: mechanism and physiology of digestion and absorption of nutrients; Liver and pancreas structure and function. Gastrointestinal secretion & regulation; function of saliva, gastric juice, pancreatic juice & bile
10. Urinary system: kidney, ureter, bladder, urethra; regulation of Na, Cl, K excretion
11. Reproductive system – Male & Female; Spermatogenesis, Functions of Testosterone; Ovarian and Menstrual Cycle and their hormonal control
12. Nervous system; neurons, Brain and Spinal cord, structure and function
13. Endocrine System; different glands and their functions

Part B: Basic Histology & Histotechnology

Introduction:

1. Introduction to histopathology and laboratory organization.
2. Laboratory equipment, uses and maintenance.
3. Laboratory hazards and safety precautions.
4. Compound microscope - optical system, magnification and maintenance.


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Fundamentals of applied histology

1. Reception, recording and labeling of histology specimens.
2. Fixation and various fixatives.
3. Processing of histological tissues for paraffin bedding. Block making, Section cutting
4. Embedding and embedding media.
5. Decalcification various types.
6. Micro tomes various types, there working principle and maintenance.
7. Microtome knives and knife sharpening.
8. Practical section cutting, cutting faults and remedies.
9. Routine staining procedures, mounting and mounting media.
10. Dye chemistry, theory and practice of staining. Solvents, mordents, accelerators and accentuators.
11. Uses of controls in various staining procedures.

Cytology lectures:

1. Introduction to exfoliated cytology with special emphasis on female genital tract.
2. Collection processing and staining of the Cytology specimen.
3. FNAC technique

References

1. Chaurasia B D, Human Anatomy; Latest 3V, Regional and CBS, New Delhi
2. Snell, Richard S Clinical Anatomy for Medical Students; Little- Brown, Boston-L.
3. Tortora G.J. Tortora principles of Anatomy and Physiology with study guide; global edition; CBS, New Delhi
4. Graaff, Kent Van de and et al, Schaum's Outline of Human Anatomy and Physiology: Fourth Ed. , McGraw Hill Education
5. Khurana L, Textbook of anatomy and physiology for paramedical students, CBS, New Delhi
6. Singh B, Human Anatomy And Physiology For Health Science Students (In Hindi)
7. Vishwakarma Sadhana; Techniques in Histopathology & Cytopathology A Guide for Medical Laboratory Technology Students (2018); Jaypee Brothers, New Delhi.

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PRACTICAL

Lab-1 Basic Histology (Human Anatomy & Physiology-I)

M.M. 100 Marks

1) ANATOMY: -

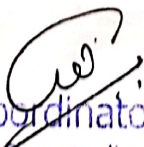
- Demonstration of parts of body and land marks on the surface.
- The skeletal system, Head & Neck. Thorax and Abdomen: -
- Demonstration of various organs within thorex & abdomen.
- Respiratory systems, pleurae, heart, liver, gall bladder, peritoneum stomach & intestine.
- Spleen, pancreas & parts of urinary system
- **General nervous system: -**
- Spinal level and site of lumber puncture.
- Surface anatomy of important organs & blood vessels.
- Identification of models like those of Brain, Heart, embryology, Kidney.
- **DEMONSTRATION: -**
- Fixing, labeling & storage of specimens.
- Drawing diagrams & labeling; Demonstration of models, specimens & skeleton.

2) PHYSIOLOGY: -

- The microscope, its usage, cleaning & maintenance.
- Identification of blood cells under Microscope. RBC, various types of WBC, pallets, Reticulocytes.
- Preparation of anti-coagulants.
- Collection of blood samples to obtain plasma & serum samples.
- Hemocytometry - Ruling area of the Neubauer's Chamber.
- Hemocytometry - The Diluting Pipettes.
- Usage of RBC & WBC pipettes (Westergren tube & Wintrobe tube).
- Estimation of Hb,
- Preparation of blood smears, staining.
- Demonstration of blood pressure recording and pulse.
- Determination of bleeding, clotting & prothrombin Time.

Note: - All theory topics scheduled followed by practical.

- Minimum 100 Hrs. of posting should be in Biochemistry Minimum 100 Hrs. of posting should be in pathology in 1st years to get accustomed with Pathology Dept.


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MDLT 102: Biochemistry-I

Outcome of the Course:

On completion of this course the students will be able to: 1. Define biochemistry and explain the major complex biomolecules of the cell. 2. Enumerate the chemical structure, classification and functions of proteins, lipids and carbohydrates. 3. Comprehend the classification & function of nucleic acids and enzymes. 4. Explain the biochemical structure of vitamins, its classification and the functions of vitamins and minerals. 5. List the various hormones, its action and function. 6. Describe acids and bases, the mechanism of homeostasis and acid base balance.

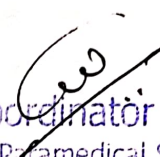
Course Outline:

1. Introduction to medical technology role of medical laboratory Technologists, ethics, responsibility, safety, measures First aid (accidents).
2. Introduction of inorganic chemistry; Structure of atom, atomic weight, molecular weight and equivalent weight; Acids, bases and salts; pH indicators; pH meter; pH measurement: different methods; Henderson – Hassel Balch equation.
3. Definition and preparation of reagents and solutions; Molar solutions; Normal solutions; Buffer solutions; Percent solution; Saturated solution; Standard solutions;
4. Elementary knowledge of organic chemistry (Organic compounds, aliphatic, aromatic, alcohol, ethers, phenols, Aldehydes, Ketones, Amines, Esters, acids etc.);
5. Elementary knowledge of Physical Chemistry; Osmosis (dialysis), osmotic pressure, diffusion, hypotonic; hypertonic and isotonic solutions; Definition and classification of some Colloids and crystalloids.
6. Elementary Knowledge of Analytical Chemistry: Principles, Instrumentation, working, uses, care, Maintenance; Balances - mono-pan, two-pan, top-pan; Centrifuges; pH meter; Colorimeter; Spectrophotometer; Fluorimeter; Flame-photometer; Ion selective electrodes; Urinometer; Chromatograph; Electrophoresis; Densitometer.
7. Units of measurement, S.I. Units, measurement of volumetric apparatus, (pipettes, flasks, cylinders) Calibration of volumetric apparatus.
8. Radioisotopes and their use in Biochemistry.
9. Structure Dietary Sources and basic metabolism of the following-
 - Carbohydrates- (blood glucose & its importance; glucose tolerance test; glycosylated H uric acid, creatinine;
 - Proteins- formation of urea, ammonia; formation of non-protein nitrogenous products e.g.;
 - Lipids- lipid profile (cholesterol, triglyceride, lipoproteins, phospholipids) and its significance in various disorders.
 - Nucleic acid- DNA and RNA Watson & Crick model of DNA
10. Enzymes: Classification; properties; Clinical enzymology - Therapeutic, diagnostic and analytical uses of enzymes with normal values of serum enzymes;
11. Vitamins, Minerals and Electrolytes: Fat soluble and water soluble vitamins; vitamin deficiency. Calorific value of foods – Basal metabolic rate (BMR) – respiratory quotient (RQ) Specific dynamic action (SDA) – Balanced diet – Marasmus – Kwashiorkor

12. Hormones - Chemical nature and biochemical functions.
13. Urine analysis (qualitative) for sugar, proteins bile pigments, ketone bodies, morpholinone, faecal of blood.
14. Collection and recording of biological specimens' separation of serum plasma, preservation and disposal of biological samples material. Basic statistics (mean, SD, CV, normal distribution, probability).

References

1. Albert S. Tarendash, Let's Review Chemistry, The Physical Setting; 5th edition (2014) Barron's Educational Series.
2. Mary Campbell, Biochemistry; 8th Edition, (2014); Cengage Learning.
3. Nelson D L, Cox Michael M., Principles of Biochemistry; 6th edition (2013) Freeman.
4. U Satyanarayana, Biochemistry; 4th edition, 2013; Elsevier.
5. Arya Bhushan and Arun Jyothi, Biochemistry for DMLT; 3rd edition (2022) DYNAMICS PUBLISHER, Hyderabad.
6. Vasudevan D. & Sree Kumari S., Text Book of Bio Chemistry for Medical Students, Jaypee Brothers, New Delhi.


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PRACTICAL

Lab-II: Biochemistry- I

M.M. 100 Marks

1. Introduction to pathology- Principles of Laboratory work, medical ethics, Para and cleanliness.
2. Principle, function, maintenance and use of various equipments like-centrifuge, electric stove, sterilizer, microscope and its component part, simple, Analytical, electronic balance, microtomes, Automatic knife and sharpeners, Automatic slide stainer, incubator, electronic cell counter, Automatic tissue procured beep, freeze, Preening, Macro tome, and cryostat.
3. Cleaning and care of general laboratory glassware and equipment.
4. Preparation of the stains and solution required in pathology
 - Preparation of Primary standard: 1N Sodium Carbonate.
 - Preparation of 2/3N Sulfuric acid.
 - Preparation of 10g/dl Sodium Tungstate.
 - Preparation of Normal Saline (Quantity 1Lt).
5. Collection of sample/blood.
6. Demonstration of Kidney function test. Gastric function test & liver function test.
7. Demonstration of Enzyme Analysis - Acid and Alkaline phosphates, SGOT/SGPT, Lactate dehydrogenase, CPK.
8. Lipid profile.
9. Estimation of Blood/ serum- Glucose, G.T.T. Urea, creatinine, uric Acid, Cholesterol. Bilirubin. protin & A/G Ratio, Glycosylated Hb.
10. Demonstration of semi-automated, fully automated Biochemical Analyzers.
11. Demonstration/ Exposure to Radio immunoassay laboratory.
12. Visit to Laboratory / pathology/ hospital of National Importance


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MDLT-103: Hematology-I

Outcome of the course

: The student will be able to know the basic components of blood and their significance in normal health, by examination of blood, various types of diseases can be diagnosed.

HAEMATOLOGY:

1. Introduction to Hematology; Laboratory Organization. Lab. Safety and instrumentation. Maintenance and Equipment of Hematology Lab Introduction to a microscope - Parts of microscope - Centrifuge - Automated Cell Counter - Urine Analyzer - Maintenance of equipments in the hematology lab - Coagulometer Responsibilities of a lab technologist.
2. Composition and function of blood.
3. Collection of blood; Various anticoagulants, their uses, mode of action and their merits and demerits. preservation of blood for various hematological investigations.
4. Physiological variations in Hb, PCV, TLC and platelet.
5. Normal and absolute values in hematology. 8. Quality assurance in hematology.
6. Hemoglobinometry, various methods of estimation of Hb, errors involved and standardization of instrument for adaptation for Hb estimation.
7. Hemocytometry, procedures for cell counts visual as well as electronic, red cell, leucocytes and platelet counts. An error involved and means to minimize such errors.
8. Romanowsky dyes, preparation and staining procedure of the blood smears.
9. Morphology of normal blood cells and their identification.
10. Erythrocyte sedimentation rate, factors influencing and various procedures for its estimation with their significance.
11. Haemocrit value by macro and micro methods their merit and demerits.
12. Routine examination of urine.
13. Examination of biological fluids such as CSF, etc.
14. Examination of semen
15. Development of WBCS (Leukopoiesis); TWBC & DWBC count – LEUKAEMIAS
16. Absolute values, ESR, PCV, Reticulocyte count; Platelet count BT & CT
17. LE cell preparation, sickling test; osmotic fragility
18. Bone marrow examination.
19. **BLOOD BANKING:**
 - a. Blood group – ABO system, Rh typing
 - b. Cross matching, Coomb's test,
 - c. Donor screening; Blood transfusion & transfusion reactions
20. **CLINICAL PATHOLOGY:**
 - a. Physical, chemical & microscopic examination of urine
 - b. Stool examination; Semen examination
 - c. CSF exam. & Other body fluids


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21. PARASITOLOGY:

a. Introduction; Parasites in Blood, stool & Urine

References:

1. Ramanic Sood, Laboratory Technology (Methods and interpretation) 4th Ed. Jatpee Bros, New Delhi
2. Satish Gupta Short text book of Medical Laboratory for technician J.P. Bros, New Delhi
3. Shirley Mitchell Lewis, Barbara J. Bain, Imelda Bates (2006) Dacie And Lewis Practical Haematology, 10th Ed, Churchill Livingstone/Elsevier.
4. Barbara A. Brown (2008) Hematology: principles and procedures 6th Ed Lea & Febiger.
5. Bernadette F. Rodak, George A. Fritsma, Kathryn Doig (2007) Hematology: Clinical Principles and Applications 3rd Ed, Elsevier Health Sciences.
6. Maheswari; clinical pathology, hematology and blood banking (for DMLT Students), Jaypee Publisher. New Delhi


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Practical
Lab-III- Hematology-I

M.M. 100 Marks

1. Laboratory management – Sample Collection, Labeling, Transport, Screening, Reporting and Dispatch of Reports. (Hospital/pathology visit)
2. Collection of Blood Samples and labelling
3. Blood Smear preparation
4. Staining Of Blood Smear
5. Obtaining Cell Counts –both manual and automated-
 - a. Red blood cell count.
 - b. Total white blood cell count.
 - c. Platelet count.
6. Absolute Eosinophils Count
7. Estimation of Hemoglobin, TRBC Counts
8. Packed Cell Volume, Erythrocyte Indices
9. Reticulocyte Count
10. Differential count of white blood cells.
11. Bleeding Time
12. Clotting Time
13. Paraffin section cutting.
14. Staining by Hematoxylin & Eosin and other special stains.
15. Calculation of red cell indices.
16. Disposal of infective material like samples and containers.


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MDLT -104: Microbiology- I

Outcome of the course:

A large number of diseases are caused by infections of organisms. The microbiology and parasitology give knowledge of various infectious agents and their role in different infectious diseases.

Course outline:

1. Introduction and brief history of microbiology; Safety measures in microbiology; Care and handling of laboratory animals. Laboratory organization, management, recording of results and quality control in microbiology.
2. Care and maintenance of laboratory equipments; Care and handling of various microscopes – binocular, DGI, phase – contrast, fluorescence and electron microscopes.
3. General characteristics, morphology and classification of bacteria and fungi; isolation and culture of bacteria; Aerobic and anaerobic culture methods.
4. Growth and nutrition of microbes; Preparation, uses and standardization of culture media.
5. Principles and methods of sterilization; Uses and mode of action of antiseptics and disinfectants; Handling and cleaning of glassware apparatus. Decontamination and disposal of contaminated material.
6. Principles of staining methods and preparation of reagents.
7. General characters and nature of antigens and antibodies; Principles of Antigen Antibody reactions.
8. Collection, transportation and processing of clinical samples for microbiology investigations.
9. Principles and mode of action of antibiotics and chemotherapeutic agents for bacteria and fungi.

Virology

1. Introduction to Medical Virology.
2. Nomenclature and classification of viruses.
3. General characteristics of viruses: physical, chemical and biological properties.
4. Collection, transport, processing and storage of sample for viral diagnosis.


Parasitology

1. Introduction to medical and safety.
2. General characters and classification of protozoa.
3. Laboratory procedure collections, preservation and processing of samples for parasites stool/blood/fluids/tissue/biopsy.
4. Morphology and life cycles of intestinal protozoa, Amoeba-Giardia.
5. Laboratory diagnosis of intestinal protozoa infection: -Amoeba-Giardia.
6. Morphology and diagnosis of oral of – trichomonas vaginal flagellates – E. Gingivalia.
7. Morphology and life cycle of Haemopro- malaria protozoa-parasite.
8. Laboratory diagnosis of malarial infection.

9. General characters and classification of medical helminthology.
10. Morphology and life cycles of Nematodes (Intestinal), - Ascaris, Enterobius, - Ancylostoma, - Strongyloides.
11. Laboratory diagnosis of intestinal Nematode infection.

References:

1. Fischbach, 2005. Manual of lab and diagnostic tests, Lippincott Williams Wilkins, New York.
2. Gradwohl, 2000. Clinical laboratory methods and diagnosis. (ed) Ales C. Sonnenwirth and Leonard Jarret, M.D.B.I., New Delhi.
3. J Ochei and Kolhatkar, 2002. Medical laboratory science theory and practice, Tata McGraw-Hill, New Delhi.
4. Kanai L. Mukherjee, 2007, Medical laboratory technology Vol.1. Tata McGraw Hill.
5. Nanda Maheshwari, Clinical Microbiology and Parasitology; 3rd ed (2016); Jaypee Brothers Medical Publishers, New Delhi.
6. Ranjan Kumar, Diagnostic Microbiology, 1st edition, (2009); Jaypee Brothers Medical Publishers; New Delhi.


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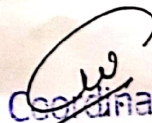
Practical

M.M. 100 Marks

Lab-IV: Microbiology -I

1. Introduction to use of different laboratory instruments and their safety precautions
2. Using of autoclave, hot air oven and other common laboratory equipment etc.
3. Use and care of microscopes
4. Disinfection practices in laboratory and wards; Assay for disinfection.
5. Measurement of microbes by micrometry
6. Simple staining methods and gram stains
7. Special staining methods – capsule, spore, acid fast, Metachromatic etc.
8. Tests for motility in bacteria.
9. Preparation of media.
10. Techniques of cultivation of bacteria.
11. Isolation of bacteria from clinical specimens
12. Biochemical testing – Catalase, oxidase, citrate, urease, TSI, Carbohydrate fermentation, MR VP, Indole Test.
13. Purification of microbial cultures.
14. Standard Plate Count.
15. Antibiotic sensitivity test
16. Isolation, Characterization and identification of pathogens from various clinical specimens.
17. Examination of stool for parasites.
18. Culture techniques for parasites
19. Mycology:
 - a. Lactophenol blue staining.
 - b. KOH Preparation.
 - c. Morphology of fungi/ Yeasts.
 - e. Culture demonstration of contaminants- Aspergillus, Penicillium, Mucor, Rhizopus
 - f. Dermatophytes.
 - g. Dimorphic fungi.
20. Serology:
 - a. Diagnosis of syphilis – VDRL test
 - b. Diagnosis of Typhoid – Widal test
 - c. RA test/ Elisa test

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