

# Patna Institute of Nursing & Paramedical Science

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## Syllabus for Two Years Diploma Course in Medical Laboratory Technician

### **SYLLABUS**

#### **MICROB 101 OGY**

1. The Microbial world and the structure of microbes.
2. Morphological variations and classification.
3. Physiology and growth requirements.
4. Principles of anaerobiosis and how to obtain anaerobiosis.
5. Sterilization Principles and different methods adopted.
6. Disposal of laboratory waste.
7. Preparation of culture media.
8. Methods of inoculation of culture media from different samples.
9. Morphological identification of bacteria by colony characters, staining and motility test.
10. Biochemical tests and its interpretation.
11. Laboratory diagnosis of staphylococcal infection.
12. Laboratory diagnosis of streptococcal infection.
13. Laboratory diagnosis of Diphtheria.
14. Laboratory diagnosis of Tuberculosis.
15. Laboratory diagnosis of Typhoid and Bacillary Dysentery
16. Laboratory diagnosis of Cholera.
17. Laboratory diagnosis of Meningitis.
18. Laboratory diagnosis of Septicemia.
19. Methods of colony count.
20. Bacteriology of water, milk and food.
21. Antibiotic Sensitivity Testing.

#### **CLINICAL PATHOLOGY**

1. The Microscope : It's different parts and uses.
2. Urine : Physiology of urine formation.  
Chemical examination of Urine for Protein, Sugar, Ketone bodies, Bile salts, Bile pigments and Blood.  
Microscopic examination of cells, casts, crystals and other deposits.
3. Stool : Physical examination of colour, consistency and appearance. Chemical examination for occult blood.  
: Microscopic examination for Protozoa, Parasites and Helminthic ova or cysts.  
: A short account of the common Protozoa and Helminthics infesting the Alimentary system e.g. amoeba, giardia, thread worm, hook worm, round worm.
4. Examination of Cerebrospinal fluid, Ascitic, Pleural fluid, Hydatid fluid.
5. Examination of Semen .Physical character, motility, count and sperm morphology.

#### **HAEMATOLOGY**

1. Composition of Blood and its function.
2. Origin and development of blood cells.
3. Common Anticoagulants used. Their composition, amount, mechanism of action and methods of preparation of blood vials.
4. Method of counting of Red blood cells, Leucocytes and Platelets.
5. Method of estimation of Hemoglobin.
6. Method of determination of Packed Cell Volume.
7. Calculation of different Red Cell Indices.
8. Drawing of Peripheral Blood Smear, Bone Marrow slides and their staining methods.
9. Differential Leucocytes Count.
10. Reticulocytes staining and counting.
11. Erythrocytes Sedimentation Rate (ESR).
12. Blood Group (A B O & Rh) methods of grouping and reverse typing.
13. Basic Blood Banking Procedures. collection of blood, anticoagulants used, storing of blood. Cross matching, Coombs Test for incomplete antibodies, different blood components in use and how to serve a requisition.
14. Basic tests for the Disorders of Coagulation. Bleeding Time, Clotting Time.
15. Prothrombin time. Some special test L. F. Cell phenomenon, Red Cell Fragility, Abnormal HB.

### HISTOLOGY

1. Basic tests Histological structure of mammalian tissues Different types of tissues and different organs of Human beings.
2. Receiving of tissue for Histopathology.
3. Fixation ion of tissue Different fixatives and their mode of action.
4. Methods of Decalcification.
5. Processing of Tissue. Protocol of Paraffin Embedding, Reagent used for manual and mechanical processing and embedding, different techniques and their application.
6. Use of Microtome. Selection and maintenance of knives, techniques and section cutting.
7. Staining of tissue sections. preparation of different stains, staining methods of Haemotioxiline and Eosin, P. A. S. reticuline, Mason's Van Gieson, Staining of Lipid, Mucin.
8. Preservation of Specimen and Mounting for Museum.

### SEROLOGY

1. Antigens and Antibodies. definition, different types preparation and preservation of antigens and antisera.
2. Types of Antigen. antibody reaction.
3. Diagnostic Serology. methods and interpretation of Widal, Brucella Agglutination Test, Well Belix, Kahn & Wassermann Reaction, Aldehyde Test, A. S. O. Titer, ELISA including demonstration of ELISA reader

### BIOCHEMISTRY

1. Principles of Analytic Biochemistry. Colorimetry, Spectrophotometry, Flame photometry, Fluorimetry, Semiautoanalyser, ELISA, RIA.
2. Physical Chemistry. pH and Buffers, Radioactivity Electrophoresis, Chromatography.
3. Clinical Biochemistry. Specimen Processing for Biochemical Analysis, Chemistry, Principles. procedures, calculation and preparation of Standard Curve and result of estimation of Blood Sugar, Urea. NPN, Cholesterol, Triglycerides, Creatinine, Total Protein, Albumin. Globulin ratio, Bilirubin, Alkaline Phosphatase, SGOT, & SGPT.

### ANIMAL CARE

1. Common Laboratory Animal .General knowledge about their food, housing, breeding. Handling etc.
2. For normal experimental animals .Cage sterilization, Disposal of infected materials.
3. .Postmortem and disposal.

## **COURSE CONTENTS.**

### **CLINICAL CHEMISTRY.**

#### **Outline & Guidance.**

1. Carbohydrates.
2. Lipids.
3. Proteins & amino acids.
4. Enzymes.
5. Non .Protein Nitrogen.
6. Electrolytes.
7. Acid base & blood gas studies.
8. Drug monitoring including toxicology.
9. Endocrinology.
10. Vitamins including provitamins and derivatives.
11. Haemo synthesis and degradation.
12. Body fluids other than blood serum and urine.
13. Instruments and technical specification.
14. Urine analysis.
15. Tests for glomerular filtration.
16. Tests of tubular function.
17. Tests for calculi.
18. Correlations with analytical results and disease states.
19. Quality Control.

The study areas outline should be considered as an expansion of knowledge following previous studies. Emphasis should be given to principles of laboratory practices.

Successful completion at the end of course examinations will enable students to study further concepts and the critical evaluation of different methodologies and their application to normal and diseased states.

#### **The *purpose and Scope of Clinical Investigations.***

The essential objectives and limitations of clinical chemistry investigation in relation to clinical diagnosis and the treatment of disease. The physical and chemical characteristics of body fluids, secretions and excretions and the physiological and biochemical functions of the principal constituents of these materials and the way they alter in disease.

#### **Analytical Procedures:**

The collection, identification, preservation and preparation of samples for analysis. Laboratory safety. The value and limitations of qualitative and quantitative analysis. Factors influencing analytical procedures. Sample size and complexity and ultra micro procedures. Principles and application of common analytical techniques. Sources of error, reference ranges and quality controls.

### **MICROBIOLOGY.**

#### **Outline & Guidance.**

#### **Bacteriology.**

1. General Microbiology.
2. Laboratory examination of specimens for bacteriology.
3. Procedures and techniques in diagnostic bacteriology.
4. Concepts of Infectious disease processes.
5. Clinically important bacterial agents.
6. Quality control.

#### Micro biology.

1. General Microbiology.
2. Laboratory examination of specimens for mycology.
3. Procedures and techniques in diagnostic mycology.
4. Clinically important fungal agents,
5. Quality control.

#### **Parasitology.**

1. General Parasitology.
2. Laboratory examination of specimens for parasites.
3. Specific procedures and techniques in parasitology.
4. Specific parasitic agents.
5. Quality control.

#### **Virology.**

1. General Virology.
2. Laboratory examination of specimens for viral agents.
3. Viral diseases/body site and agent.
4. Quality control.

#### **Antimicrobial Agent Studies.**

1. Properties of antimicrobial.
2. Laboratory tests.
3. Quality control.

#### **Infection Control and Environmental Studies.**

1. Epidemiology of infectious diseases.
2. Nosocomial infections.
3. Surveillance studies.
4. Handling and disposal of infectious materials.

#### Structure and Physiology of Micro -organism

The fine structure and function of the major structural components of the microbial cell Comparison of bacterial protoplast spheroplasts, L forms and mycoplasmas. Yeast and fungal cell walls and protoplasts. Structure and morphology of viruses. Critical comparisons of growth are replication measurements, kinetics. Factors affecting and replication e.g. pH. temperature. oxygen Microbial response to Environmental stress. Cell synchrony and its role in the study of cell Cycle.

#### Microbial Interactions.

Examples of mutualism, commensalisms, amensalism, predation and competition, interaction within microbial communities, i.e. gut flora, oral flora.

## Microbial and virological Taxonomy and nomenclature.

The basis and development of microbial taxonomy and nomenclature. The application charges in nomenclature. Working of the International committee of systematize.

## Products of Microbial Metabolism

Recognition, demonstration and composition of microbial toxins and products of metabolism. Principles and application of physical and chemical methods for the destructions of Micro organisms. Physical methods including thermal destruction, sanitation and irradiation. The chemistry and mode of action of antimicrobial compounds. The dynamics of disinfections, dilution coefficients. Principles employed in the Isolation and identification of micro organism. The use of contemporary methods and the influence of automation and mechanization.

## **HEMATOLOGY.**

### **Outline & Guidance**

1. Origin, development and function of formal elements of blood.
2. Morphology and maturation.
3. Laboratory procedures general.
4. Tests to characterize anemias.
5. Cytochemical stains.
- 6. Other** tests to characterize leukocyte disorders.
7. Quality control.
- 8. Disorder** / correlation.
9. Instrumentation.
10. Hemostasis.
11. Quality control
12. Theory.
13. Screening tests.
14. Platelet function tests.
15. Factor identification.
16. Fibrinolysis.
17. Diseases / correlations.
18. Instrumentation.

### **Reticuloendothelial System and Blood.**

Structure and function of blood cell forming tissue in the embryo, child and adult. Haemopoiesis, Haem and globin chain synthesis. Structure and function of the cellular and sub-cellular elements of the blood. Blood cell survival and destruction.

### **Anatomy and Microanatomy.**

Morphology, structure and ultrastructure of blood cells and their precursors. Structure of cell membrane. Study of cell components and their Metabolism. Cell outline Light and electron microscopy. Autoradiography and microdensitometry

### **Principles of Haematology Practice.**

To include cell counting, immunological aspects kinetics, biological and radio assay system. **electrophoresis, Chromatographic** and spectrophotometric analysis, cytochemistry and theology.

## **HISTOPATHO / CELLULAR PATHOLOGY.**

Outline & Guidance.

Human anatomy and histology. Normal cells and tissues: Structure and ultra structure. Physiological variation, immune response.

### **Methodology : General Principles**

Fixation and the use of fixatives. Preparatory techniques for dissociated cells and tissues. Embedding procedures. Iysochromes and metallic salts. Vital staining with dyes. The use of stains and histochemical methods to demonstrate cells, tissues and their constituents Methods of obtaining and handling biopsies, large surgical specimens and post mortem tissue. Special fixatives and their applications. Decalcification and the preparation of sections.

Freeze drying and freeze substitution. Cryopreservation. Artifacts Histochemistry of carbohydrates, lipids amyloids, nucleic acids, enzymes, biogenetic animes and inorganic constituents.

The application of stains and histochemical methods to diagnostic problems and the significance of he results obtained. Co-operative evaluation of methods.

Organization and management of the laboratory. Safety procedures, quality assurance. Relevant legal and entical requirements Use and maintenance of microtome and other associated instruments.

## **IMMUNOLOGY**

### **Outline & Guidance**

1. Cellular and humoral immunity.
2. Immunoglobulins : Complements.
- 3 Basic immunological methods.
4. Syphilis and infectious mononucleosis serologies.
6. Other infections serologies, CRP Cold agglutinins.
6. Auto immunes serologies.
7. Testing for fungi and parasites,
- 8.** Pregnancy testing.
9. Testing Involving leukocytes.

### **Immunoglobulin: Structure. Chemistry1 Synthesis, Clarification and Function.**

Detection of Antigen and Antibodies: Structure of antigens and antibodies. Their separation isolation and quantitation. Antigen antibody reaction. Identification of substances of immunologic importance including the role of complement.

### **Fundamental1 Concets of Adoptive Immunity**

The concept of self and non self The nature and fate of antigens Examination of Coloma distribution and the generation of diversity. The basis of immunological memory and tolerance.

## **BLOOD GROUP SEROLOGY & TRANSFUSION MEDICINE**

### **Outline & Guidance**

1. ABO System.
2. Rh System.
3. Other blood group systems,
4. Antiglobuline testing.
5. Antibody studies (Red Cell).
6. Compatibility testing.

7. Transfusion therapy.
8. Transfusion reactions.
9. Haemolytic disease of the New Born.
10. Immune haenolytic anemia.
11. Blood and blood components / storage/ Shipment.
12. Donor selection / blood collection / testing of recipient blood.
13. Quality Control.

Genetics, Serology and clinical Significance of red blood groups systems, particularly and ABO and Rhesus systems. The major histocompatibility at the A, B, C and DR loci, mixed lymphocyte culture for detection of antigens at the b locus: significance of HLA system, other leucocytes and platelet systems. The serum immunoglobulin and red enzyme blood groups.

### **Investigation of Blood Transfusion Reaction.**

Cause of Transfusion reaction, samples required for their investigation. Test for pigments in serum and urine. Repeat compatibility test with Pre and Post transfusion sera. Direct anti globulin test. Red cell survival studies.

The hemolytic Anaemias (**H**emolytic Disease of the Newborn and Autoimmune Hemolytic anemia).

Blood banking: Care, selection and organization of blood donors.

Quality control of blood donations. Blood inventories, blood issues and stock control. Strong in liquid and *frozen* states physical and chemical changes. Effect of various anticoagulants. Additives and blood containers. Collection, fractionation quality control and use of blood products. Transfusion hazards. Plasmapheresis of donor and patients. Principle and use of cell separation machine.

### **BIOMEDICAL SCIENCES.**

#### **Outline & Guidance.**

##### **Group A.**

1. Professional conduct, Health & safety: Code of behavior staff health and immunization Disposal of specimens and cultures First aid.
2. Different glass apparatus their use. accuracy, cleaning, disinfection, syringes and needles plastic wares and SI units.
3. General equipments, Balances, Centrifuge, water baths, Hot air ovens Incubators, Colorimeters Gas cylinders, and other Laboratory equipments.
4. Autoclave, filters Sterilisation.
5. The Microscope .Construction, care and maintenance, parts of microscope, Illuminations .lenses Specimen stage .Focusing- setting up the microscope.
6. Principles and use of colorimeter, spectro photometer and flame photometer, electrophoresis
7. Pure water and solutions and storage of chemicals.
8. Laboratory hazards and safety.
9. Quality control in laboratory works.
10. Examination of Gastric juice & F.I.M.:  
 Test for albumin, sugar, acetone, bile salt & pigment, phosphates urobilinogen, occult blood and chyle. Examination urine deposits .organic and inorganic including crystals. cells casts & parasites.
11. Health administration.
12. Laboratory Management.
13. Good laboratory Practices.
14. Quality Control.

## GROUP-B

1. Reception and labeling of samples. record keeping and cleaning of glass wares.
2. Preparation of stains and reagents, different anticoagulants.
3. Urine Examination: Physical and Chemical Examination, Specific gravity.
4. Stool Examination: Physical, Chemical and Microscopical Examination for protozoa and helminthes including concentration methods.
5. Short discussion of the parasite commonly found in the alimentary tract (E. histolytica, Giardia lamblia, A. lumbricoides, E. vermiculars, Hookworm Protozoa & Helminths & other)
6. Short discussion about the haemoparasite Malaria. I.D. Body, Microfilaria.
7. Sputum Examination: Physical, Chemical, Microscopical Examination (including acid fast and Gram starting).
8. Examination of C. S. Fluid, ascetic and pleural fluids, hydatid fluid (complete analysis).
- 9 Examination of Seminal Fluid.

## CLINICAL PATHOLOGY.

### outline & Guidance

1. Reception and labeling of samples, record keeping and cleaning of glass wares.
2. Preparation of stains and reagents, principles of microscope and other instruments.
3. Urine Examination: Physical and chemical Examination, Specific gravity. Test for Albumin Sugar. Acetone, Bile salt and pigment. Phosphates, Urobilinogen, Occult blood and Chyle Examination of Urine deposits .organic and inorganic including crystals. cells. casts & Parasites.
4. Stool Examination: Physical, Chemical and Microscopical Examinations for protozoa and helminthes including concentration methods.
5. Short discussion of parasites commonly found in The alimentary tract (**E. Histolytic**. Giard Hookworm and other Protozoa & Helminths).
6. Short Discussion about the Haemoparasites: Malaria, L.D. Body, Microfilaria.
7. Sputum Examination: Physical, Chemical and Microscopical Examinations (including Acid to and Gram staining). Also methods of concentration.
8. Examination of C.S. fluid. ascitic and pleural fluids, Hydatid fluid (Complete analysis).
9. Examination of Seminal fluid.
10. Examination of Gastric juice & F. T. M.

## HEALTH CARE & LABORATORY ADMINISTRATION.

### Outline & Guidance.

1. Indian Health Care System: Policy and Programs.
2. Health Care laws.
3. Epidemiological concepts for Health Administration.
4. Management of Health Service Organization.
5. Financial Management of Health Care Services.
9. Health Planning and Marketing.
10. Inter-organizational relationship and Multi Health Care system.
11. Strategic Management of Human Resources in Health Care Organization.

## LABORATORY MANAGEMENT

1. Theories and activities of management & management style of diagnostic test.
2. Clinical Laboratory Acts in the State Govt. and Central Govt.
3. Introduction to clinical chemistry.
4. Quality improvement in the Laboratory: Management the Quality of laboratory tests results.
5. Financial Management in the Laboratory.
6. Work load recording system: Introduction to cost accounting.

7. Managing yourself and your Career: MTs and patients liaisons effective decision making leader. & leadership.
8. Health Care Organizations: National & International their objectives and activities.
- 9 Clinical Laboratory utilization the role of Clinical Laboratory Technologists/Scientists.

## **LABORATORY SERVICES IN THE HEALTH DELIVERY SYSTEMS IN INDIA.**

1. Laboratory Services in India.
2. The Health administration system in India: National level, state level. District level, Village level.
3. Voluntary Health Organization in India.
4. Health Program in India.

## **LABORATORY PLANNING.**



1. General Principles, Laboratory goals.
2. Operational data: Market potential, Hospital/Laboratory relation, competition. laboratory trend.
3. Planning at different levels.
4. Guiding principles for planning hospital laboratory services:

Factors

Guiding principles for planning

- ❖ Functional criteria
- ❖ Operational demand
- ❖ Section of a hospital laboratory
- ❖ Common areas
- ❖ Design aspect
- ❖ Space requirement.

## **LABORATORY ORGANIZATION.**

**General Principles.**

Components and function of a laboratory,

Staffing the laboratory.

Job description

Job specification

Work schedule.

Personnel arrangement and work load assessment.

Care of Laboratory, Glassware, Equipments and Chemicals.

Specimen handling: Collection, entry, Transport, distribution reassignment, disposal and preservation.

Laboratory Safety: Laboratory hazards, safety programme, first aid, safety measures.

Quality Control; Requisite specification, specimen specification distribution of test, Analytical method, equipments, reagents & materials, controls, proficiency testing.

## **MATERIALS MANAGEMENT**

Procurement.

Identification & Correspondence of material with sources. Inventory, control and analysis.

Inspection and storage.

Records and reports.

Purchase and utilization of supplies.

## **COMMUNICATION: PERSONAL DEVELOPMENT & RELATIONS.**

General principles.  
Inter department communication.  
Public Relations: Patients, Physicians, Nursing Staff (Sates Representatives & other personal.  
Request/report forms.  
Continuing Education.  
Method of evaluation and selection.

**LABORATORY ETHICS**

General Principles. Special Considerations

**STATISTICAL METHOD OF ANALYSIS.**

Basic Principles of statistics.  
Relation of laboratory medicine and statistics.  
Role of Statistics in preventive social medicine.  
Collection and presentation of statistics, problems of sampling.  
Frequency distribution frequency diagrams.  
The average, calculation of averages .Mean Median and Mode the weighted average variation, Norms distribution.  
Co efficient of variation, normal distribution.  
Standard deviation and standard error significant test and null hypothesis.  
Correlation co-efficient.  
Application of statistics of clinical and preventive medicine, health and immunity.