PMF-NATIONAL COUNCIL OF PARAMEDICAL,DELHI

Syllabus & Curriculum
Of
Medical Laboratory Technology Course (One Year)

INDEX

OBJECTIVES OF THE COURSE:

To prepare a **Lab technician** who –

- Can perform all types of pathological tests.
- Can perform all types of Biochemistry tests.
- CanCan perform all types of Microbiology tests.
- Can help in processing of Histo-cytopathology.
- Can perform blood bank techniques.

Out line of Curriculum
Of
Medical Laboratory Technology Course
(One year)

Theory Classes: (9AM to 12 Noon)

First Paper: ANATOMY & PHYSIOLOGY

Detailed Topic-Wise Syllabus

1. Introduction to Human Body – 10 Hours

* Definition of anatomy and physiology
* Levels of structural organization
* Anatomical terms and body planes
* Body cavities and membranes

2. **Cell Structure and Function** – 10 Hours

* Components of a typical human cell
* Cell membrane, cytoplasm, nucleus
* Cell cycle, mitosis and meiosis
* Types of tissues (epithelial, connective, muscular, nervous)

3. **Skeletal System** – 15 Hours

* Classification and function of bones
* Structure of a long bone
* Axial and appendicular skeleton
* Joints: classification and types
* Common disorders (fractures, arthritis)

4. **Muscular System** – 15 Hours

* Types of muscle tissue (skeletal, cardiac, smooth)

* Structure of skeletal muscle

* Mechanism of muscle contraction

* Muscle tone, fatigue

5. Circulatory System – 15 Hours

* Structure and function of heart

* Blood vessels: arteries, veins, capillaries

* Cardiac cycle and conduction system

* Blood pressure and pulse

* Lymphatic system and immunity

6. Blood and Lymphatic System – 15 Hours

* Composition and functions of blood

* Blood groups and coagulation

* White blood cells and immunity

* Lymphoid organs and lymph circulation

7. Respiratory System – 15 Hours

* Anatomy of respiratory tract

* Physiology of respiration

* Exchange of gases

* Regulation of respiration

* Common respiratory diseases (asthma, TB)

8. **Digestive System** – 15 Hours

* Organs of the GI tract

* Functions of liver, pancreas, gallbladder

* Digestion and absorption

* Enzymes and hormones in digestion

9. Excretory System (Urinary System) – 15 Hours

* Structure of kidney and nephron

* Formation of urine

* Fluid and electrolyte balance

* Hormonal control (ADH, aldosterone)

* Common disorders (UTI, kidney stones)

10. Nervous System – 15 Hours

* Organization: CNS, PNS, ANS

* Structure and function of brain and spinal cord

* Reflex arc

* Nerve impulse conduction

* Cranial and spinal nerves

11. Special Sense Organs – 10 Hours

* Eye: structure and visual pathway

* Ear: structure and auditory pathway

* Nose, tongue, and skin: sensory receptors

12. Endocrine System – 15 Hours

* Major endocrine glands and hormones (pituitary, thyroid, adrenal, pancreas)

* Mechanism of hormone action

* Feedback regulation

* Common disorders (diabetes, goitre)

13. Reproductive System – 10 Hours

* Male and female reproductive organs

* Menstrual cycle

* Fertilization, pregnancy, and parturition

* Secondary sexual characteristics

14. Metabolism – 25 Hours

* Basic concepts of metabolism

* Carbohydrate, fat, and protein metabolism

* Basal metabolic rate (BMR)

* Role of vitamins and minerals

* Water and electrolyte balance

Suggested Breakdown of Study Hours

Unit	**Hours**
Introduction	10
Cells & Tissues	10
Skeletal System	15
Muscular System	15
Circulatory & Lymphatic System	30
Respiratory System	15
Digestive System	15
Excretory System	15
Nervous System	15
Special Senses	10
Endocrine System	15
Reproductive System	10
Metabolism	25
Total	**195 Hours**

Recommended Books

* **Ross & Wilson –** ***Anatomy and Physiology in Health and Illness***

* **Tortora & Derrickson –** ***Principles of Anatomy and Physiology***

*** Guyton & Hall – *Textbook of Medical Physiology***

Second Paper: CLINICAL BIO-CHEMISTRY

Unit-Wise cum Topic-wise Syllabus Breakdown

Unit 1: Introduction to Clinical Biochemistry (15 Theory hrs/5 Practical hrs)

* Definition and scope
* Role of biochemistry in health and disease
* Laboratory safety and ethics
* Biomedical waste management

Unit 2: Laboratory Glassware and Equipment (15 Theory hrs / 15 Practical hrs)

* Types and use of lab glassware
* Care, calibration and cleaning procedures
* Introduction to equipment:
    * Centrifuge
    * Water bath
    * Colorimeter
    * Spectrophotometer
    * Incubator, Autoclave
    * pH meter, Balance

Unit 3: Units and Solutions (15 Theory hrs / 15 Practical hrs)

* SI units and conversions
* Preparation of molar, normal, % solutions
* Concept of dilution and serial dilution
* Use of buffers and indicators
* pH and titration principles

Unit 4: Carbohydrate Metabolism & Blood Sugar Estimation (20 Theory hrs / 25 Practical hrs)

* Digestion, absorption, metabolism of carbohydrates
* Blood glucose regulation
* Laboratory estimation:
    * Glucose (FBS, RBS, PPBS)
    * Glucose Tolerance Test (GTT)
    * HbA1c (Glycosylated hemoglobin)
    * Methods: Folin-Wu, O-Toluidine, GOD/POD

Unit 5: Protein Metabolism & Serum Protein Estimation (20 Theory hrs / 20 Practical hrs)

* Protein digestion and metabolism
* Plasma proteins and their clinical significance
* Laboratory estimation:
    * Total protein, albumin, globulin
    * A/G ratio
    * Methods: Biuret, Lowry, Bromocresol green

Unit 6: Lipid Profile (15 Theory hrs / 15 Practical hrs)

* Fat digestion and metabolism
* Lipoproteins: HDL, LDL, VLDL
* Clinical importance of cholesterol and triglycerides
* Laboratory estimation:
    * Total cholesterol, HDL, LDL, Triglycerides

Unit 7: Liver Function Tests (LFTs) (15 Theory hrs / 20 Practical hrs)

* Bilirubin (direct, indirect)

* SGOT (AST), SGPT (ALT)

* Alkaline phosphatase, GGT, Serum albumin

* Interpretation of LFT results

Unit 8: Renal Function Tests (RFTs) (15 Theory hrs / 20 Practical hrs)

* Urea, creatinine, uric acid

* Electrolytes: Sodium, potassium, chloride

* Creatinine clearance

* Clinical significance in kidney diseases

Unit 9: Enzymes in Diagnosis (15 Theory hrs / 10 Practical hrs)

* Definition, classification, factors affecting enzymes

* Diagnostic enzymes: Amylase, lipase, CK, LDH

* Isoenzymes and clinical relevance

Unit 10: Endocrinology & Hormone Assays (15 Theory hrs / 10 Practical hrs)

* Introduction to hormones and endocrine glands

* Diabetes, thyroid disorders

* Hormonal assays (ELISA basics)

Unit 11: Acid-Base Balance & Blood Gases (10 Theory hrs / 10 Practical hrs)

* pH, buffer systems

* Acidosis and alkalosis

* Blood gas analysis (overview)

Unit 12: Automation and Quality Control (15 Theory hrs / 20 Practical hrs)

* Semi-auto and fully automated analyzers

* Batch and random access analysis

* Calibration and control samples

* Internal and external quality control

Practicals Summary (195 Hours)

* Preparation and standardization of solutions

* Estimation of glucose, urea, creatinine, proteins, enzymes

* Liver and kidney function tests

* Electrolyte analysis

* Use of auto-analyzer, colorimeter, spectrophotometer

* Quality control procedures

* Maintenance of lab records and result interpretation

Recommended Books:

* *Textbook of Biochemistry for Medical Students* – Vasudevan & Sreekumari

* *Practical Clinical Biochemistry* – Varley

* *Biochemistry* – Satyanarayana & Chakrapani

* *Clinical Chemistry* – Bishop et al.

Third Paper: Mircobiology & Parasitology

Detailed Unit-wise cum Topic-wise Syllabus:

Unit 1: Introduction to Microbiology

(10 Theory hrs / 10 Practical hrs)

* History and scope of microbiology
* Types of microorganisms: bacteria, viruses, fungi, protozoa
* Differences between prokaryotes and eukaryotes
* Relevance of microbiology in diagnostics

Unit 2: Microscope and Microscopy

(10 Theory hrs / 10 Practical hrs)

* Parts and working of light microscope
* Principles of magnification, resolution, and illumination
* Maintenance and calibration of microscope
* Introduction to dark field and phase contrast microscopy

Unit 3: Sterilization and Disinfection

(20 Theory hrs / 20 Practical hrs)

* Principles and types of sterilization: moist heat, dry heat, filtration, radiation
* Disinfection methods and agents
* Aseptic techniques and biosafety
* Preparation of sterilization loads and indicators

Unit 4: Classification & Structure of Microorganisms

(15 Theory hrs / 10 Practical hrs)

* Morphology and classification of bacteria
* Bacterial anatomy: capsule, flagella, pili, spores

* Fungi: classification and basic morphology

* Viruses: structure and general properties

Unit 5: Bacterial Growth and Culture Techniques

(15 Theory hrs / 20 Practical hrs)

* Growth curve and phases

* Factors affecting microbial growth

* Culture media: types (selective, differential, enriched)

* Methods of inoculation and cultivation

Unit 6: Staining Techniques

(20 Theory hrs / 30 Practical hrs)

* Principles and types of staining

* Simple, negative, and differential staining

* Gram staining, Ziehl-Neelsen (AFB), Albert, Leishman, Romanowsky

* Special stains: spore, capsule, flagella staining

Unit 7: Culture Media & Identification

(25 Theory hrs / 30 Practical hrs)

* Preparation and sterilization of media

* Inoculation methods: streak, pour, spread plate

* Colony morphology and growth characteristics

* Identification based on biochemical tests

Unit 8: Laboratory Diagnosis of Infections

(15 Theory hrs / 10 Practical hrs)

* Specimen collection, storage, and transport

* Sample types: urine, sputum, blood, pus, throat swab

* Interpretation of culture and sensitivity reports

* Antibiotic susceptibility testing (Kirby-Bauer method)

Unit 9: Parasitology - Introduction & Stool Examination

(15 Theory hrs / 20 Practical hrs)

* Introduction to medical parasitology

* Classification of parasites (protozoa, helminths)

* Stool collection and preservation

* Direct microscopy and concentration methods

Unit 10: Intestinal Parasites

(20 Theory hrs / 25 Practical hrs)

* Morphology and life cycle:

    * *Entamoeba histolytica*

    * *Giardia lamblia*

    * *Ascaris lumbricoides*

    * *Ancylostoma duodenale*

    * *Trichuris trichiura*

* Clinical symptoms and lab diagnosis

Unit 11: Blood Parasites

(20 Theory hrs / 20 Practical hrs)

* Morphology and life cycle of:

    * *Plasmodium* spp. (malaria)

    * *Wuchereria bancrofti* (filaria)

    * Blood collection and preparation of smears

    * Identification using thick and thin films

Unit 12: Quality Control & Automation in Microbiology

(10 Theory hrs / 10 Practical hrs)

* Quality assurance and control in microbiology

* Record keeping, validation

* Introduction to automated microbial identification systems

Practical Exercises (Summary)

* Use and care of microscope

* Preparation and sterilization of media

* Staining methods (Gram, AFB, Leishman, etc.)

* Culture techniques and sensitivity testing

* Identification of parasites from stool and blood

* Drug sensitivity testing

* Aseptic and biohazard handling

Hour Allocation Summary

Unit	Theory (hrs)	Practical (hrs)
Unit 1: Introduction	10	10
Unit 2: Microscope	10	10
Unit 3: Sterilization	20	20
Unit 4: Microorganisms	15	10
Unit 5: Growth & Culture	15	20
Unit 6: Staining	20	30
Unit 7: Media & ID	25	30

Recommended Textbooks

* *Textbook of Microbiology* – C.P. Baveja

* *Medical Parasitology* – K.D. Chatterjee

* *Textbook of Microbiology* – Ananthanarayan & Paniker

* *Essentials of Parasitology* – Gerald D. Schmidt

Fourth Paper

Clinical Pathology, Hematology & Blood Banking

Detailed Unit-wise cum Topic-wise Syllabus

Unit 1: Introduction to Clinical Pathology

(10 Theory hrs / 10 Practical hrs)

* Definition and scope of clinical pathology
* Laboratory setup and safety measures
* Duties and ethics of a lab technician
* Biomedical waste disposal

Unit 2: Collection and Handling of Specimens

(15 Theory hrs / 15 Practical hrs)

* Blood collection: venipuncture and capillary
* Types of anticoagulants and their uses
* Urine collection (routine & 24 hours)
* Preservation and transportation of biological samples

Unit 3: Physical, Chemical & Microscopic Examination of Urine

(20 Theory hrs / 25 Practical hrs)

* Physical characteristics: color, clarity, specific gravity
* Chemical tests: protein, glucose, ketones, bile salts, blood
* Microscopy: epithelial cells, casts, crystals, RBCs/WBCs
* Interpretation of abnormal findings

Unit 4: Examination of Other Body Fluids

(15 Theory hrs / 20 Practical hrs)

* CSF: collection, physical, chemical, cytological analysis
* Semen analysis: parameters and interpretation

* Sputum, ascitic, pleural, synovial fluids

Unit 5: Basics of Hematology

(15 Theory hrs / 15 Practical hrs)

* Composition and function of blood
* Hematopoiesis and blood cell morphology
* Types of anemia and leukemias (brief overview)
* Normal blood values

Unit 6: Hemoglobin Estimation

(10 Theory hrs / 15 Practical hrs)

* Principles and methods:
    * Sahli's method
    * Cyanmethemoglobin method
* Clinical significance of hemoglobin levels

Unit 7: Blood Cell Counts

(20 Theory hrs / 25 Practical hrs)

* RBC count: method and calculation
* WBC count: total and differential
* Platelet count
* Reticulocyte count
* Absolute eosinophil count

Unit 8: ESR, PCV & Blood Indices

(15 Theory hrs / 20 Practical hrs)

* ESR: Westergren and Wintrobe methods
* Packed Cell Volume (PCV)
* Indices:

* MCV (Mean Corpuscular Volume)

* MCH (Mean Corpuscular Hemoglobin)

* MCHC (Mean Corpuscular Hemoglobin Concentration)

Unit 9: Blood Smears and Differential Count

(20 Theory hrs / 25 Practical hrs)

* Preparation of peripheral blood smear

* Staining: Leishman, Giemsa, Romanowsky

* Identification of normal and abnormal cells

* DLC (Differential Leukocyte Count)

Unit 10: Coagulation Studies

(15 Theory hrs / 15 Practical hrs)

* Bleeding time, clotting time

* Prothrombin time (PT), Partial thromboplastin time (PTT)

* INR (International Normalized Ratio)

* Factors affecting coagulation

Unit 11: Special Hematological Tests

(10 Theory hrs / 10 Practical hrs)

* LE cell phenomenon

* Coombs test (Direct & Indirect)

* Osmotic fragility test

* Bone marrow aspiration (overview)

Unit 12: Blood Banking and Transfusion Services

(20 Theory hrs / 25 Practical hrs)

* Blood group systems (ABO, Rh)

* Blood grouping and cross-matching techniques

* Donor selection and blood collection

* Component preparation and storage

* Screening of transfusion-transmitted infections (TTIs)

* Hazards of blood transfusion

Unit 13: Automation & Quality Control in Hematology

(10 Theory hrs / 10 Practical hrs)

* Hematology analyzers (3-part & 5-part)

* Calibration and quality assurance

* Internal & external QC

* Digital record maintenance

Practical Training Highlights

* Use of microscope and hemocytometer

* Estimation of Hb, PCV, ESR

* Total and differential leukocyte count

* Blood grouping and cross-matching

* Coagulation profile tests

* Body fluid analysis (urine, CSF, semen, etc.)

* Use of hematology analyzers

Hour Allocation Summary

Unit	Theory (hrs)	Practical (hrs)
Unit 1	10	10
Unit 2	15	15
Unit 3	20	25
Unit 4	15	20
Unit 5	15	15
Unit 6	10	15
Unit 7	20	25

Unit	Theory (hrs)	Practical (hrs)
Unit 8	15	20
Unit 9	20	25
Unit 10	15	15
Unit 11	10	10
Unit 12	20	25
Unit 13	10	10
Total	**195**	**195**

Recommended Books

* *Clinical Hematology* – Todd & Sanford

* *Textbook of Medical Laboratory Technology* – Ramnik Sood

* *Practical Hematology* – Dacie & Lewis

* *Textbook of Blood Banking and Immunohematology* – P. Choudhary

Eligibility criteria & duration of the course.

ELIGIBILITY:-

Candidate must have Xth Or XIIth Passed from any recognised Board.

DURATION OF THE COURSE:

* It is 1 year, **full time**Course.

Scheme of Examination.

One Year Course :

Paper	Subject	Total Marks	Min Pass Marks	Duration
First	**Anatomy & Physiology**	**100**	**35**	**3 Hours**
Second	**Clinical Bio-Chemistry**	**100**	**35**	**3 Hours**
Third	**Microbiology & Parasitology**	**100**	**35**	**3 Hours**
Fourth	**Clinical Pathology, Heamatology & Blood Banking**	**100**	**35**	**3 Hours**

Practical & Viva-Voce : Total Marks : 50, Pass Marks: 17

Internal Assessment : Total Marks : 50, Pass Marks: 20

Schedule of the course

(List of Holidays, Total Hours, Subject-wise allotment of Hours)

List of Holidays:-

Sundays - 52 days
Summer vacation - 10 days
Winter vacation - 10 days
Gazetted holidays - 23 days
Preparatory holidays - 10 days

Total Holidays - 105 days

Total Hours :-

Theory classes per day - 3 Hours

Practical classes per day - 3 Hours

Total hours per day - 6 Hours

Total days & hours in One year-
260 days (after holidays) Or
- 1560 Hours
Theory : 780 Hours.
Practical: 780 Hours.