

Syllabus for Medical Lab Assistant

Course Name	Medical Lab Assistant
Course Code	STC - HLC /2023/1615
Sector	Healthcare (Paramedical)
Course Level	3
Occupation	Medical Lab Assistant
Job Description	The Medical Lab Assistant is responsible for supporting the medical laboratory team by collecting, processing, and preparing patient samples for testing, ensuring accurate labeling and documentation. They assist in routine laboratory tasks, maintain cleanliness and organization of the lab environment, and provide essential administrative support to ensure efficient workflow and quality patient
Course Duration	720 hrs (Th. 150Hrs, Prac. 330Hrs, ES 60Hrs, OJT. 180 Hrs at Medium Laboratory / at 30 or more bedded hospital with facility of relevant training. OJT will be for a period of not less than 3 months.
Trainees' Entry Qualification	Class X Pass Out
Trainers Qualification	Trainers already registered with West Bengal Allied & Paramedical Council in relevant training module. OR Postgraduate from relevant allied Healthcare / MLT wherever applicable with relevant experience OR Doctors with MD/MBBS/BHMS/BAMS or person holding GNM/B.SC Nursing Certificate wherever applicable with relevant experience. <i>In all cases Postgraduate of relevant Allied Healthcare Community will be preferred.</i>

Structure of Course:

Module No.	Module name	Outcome	Theory (Hrs)	Practical (Hrs)	Total (Hrs) (in multiple of 30 each)
1	Fundamentals in Physiology & Laboratory Techniques	Explain basics of human anatomy and physiology, as well as essential laboratory techniques, including the preparation of various solutions, maintenance of laboratory equipment, centrifugation, titration, and measurement of hydrogen ion concentration.	30	90	120
2	Fundamentals in Biochemistry	Demonstrate expertise in laboratory techniques, qualitative analyses, and the utilization of analytical instruments for biochemical investigations	30	60	90
3	Hematology & Clinical Pathology	Assist to conduct comprehensive clinical pathology examinations, essential hematological techniques and diagnose hematological disorders.	30	90	120
4	Microbiology	Acquire microbiology knowledge and assist in sterilization, culture media, staining, specimen	50	70	120

		handling, and waste management.			
5	Medical Ethics	Apply ethical principles, legal guidelines, and professional values to ensure patient rights, uphold ethical standards, and maintain professionalism.	10	20	30
6	Employability Skill		60		60
7	OJT	OJT At Medium Laboratory / at 30 or more bedded hospital with facility of relevant training. OJT will be for a period of not less than 3 months.		180	180
TOTAL:			210	510	720

SYLLABUS:**Module No. 1: Fundamentals in Physiology & Laboratory Techniques**

Course Outcome: Explain basics of human anatomy and physiology, as well as essential laboratory techniques, including the preparation of various solutions, maintenance of laboratory equipment, centrifugation, titration, and measurement of hydrogen ion concentration.

Theory Content:

1. Introduction to Human Anatomy and Physiology
 - 1.1. Overview of the Human Body
 - 1.2. Importance of Studying Anatomy and Physiology
2. The Cell: Basic Building Block of Life
 - 2.1. Cell Structure and Components
 - 2.2. Functions of Cells
3. Tissues: Building Blocks of Organs
 - 3.1. Introduction to Tissues
 - 3.2. Types of Tissues: Epithelium, Connective, Muscle, Nervous
4. The Blood: Life-Giving Fluid
 - 4.1. Blood Composition: Cells and Plasma
 - 4.2. Hemoglobin and Oxygen Transport
 - 4.3. Understanding Blood Groups
 - 4.4. Blood Clotting and Coagulation Factors
 - 4.5. Anemia and Immunoglobulins
5. Cardiovascular System: The Pumping Heart
 - 5.1. Heart Anatomy and Function
 - 5.2. Cardiac Cycle and Heart Rate
 - 5.3. Blood Pressure: Basics and Measurement
 - 5.4. Hypertension: Causes and Risks
 - 5.5. Pulse: Measurement and Interpretation
 - 5.6. Listening to the Heart: Auscultation and Heart Sounds

6. Respiratory System: Breathing and Oxygen Exchange

- 6.1. Overview of the Respiratory System
- 6.2. Mechanics of Breathing
- 6.3. Functions of the Lungs
- 6.4. Lung Volumes and Capacities

7. Digestive System: Processing Food

- 7.1. Overview of Digestion
- 7.2. The Digestive Tract and Its Parts
- 7.3. Nutrient Absorption and Processing

8. Endocrine System: Hormonal Regulation

- 8.1. Introduction to Hormones
- 8.2. Endocrine Glands and Their Functions

9. Excretory System: Filtering and Eliminating Waste

- 9.1. Structure of the Nephron
- 9.2. Urine Formation and Its Role

10. Central Nervous System: The Brain and Nerves

- 10.1. Parts of the Central Nervous System
- 10.2. Basics of Nerve Function
- 10.3. Motor and Sensory Nervous Systems

11. Reproductive System: Creating New Life

- 11.1. Male and Female Reproductive Systems

12. The Skin: Our Protective Barrier

- 12.1. Skin Structure and Functions

13. Muscular System: Moving Our Bodies

- 13.1. Classification of Muscles and Their Functions

14. Special Senses: Sight and Hearing

- 14.1. Introduction to the Eye and Ear Structures

Practical Content:

1. Laboratory Basics

- 1.1. Introduction to Laboratory Safety
- 1.2. Lab Apparatus: Identification and Usage
- 1.3. Handling Chemicals Safely
- 1.4. Proper Laboratory Attire and Personal Protective Equipment (PPE)

2. Weighing and Measuring

- 2.1. Proper Use of a Chemical Balance
- 2.2. Measurement Units: Grams, Milligrams, and Micrograms
- 2.3. Precision and Accuracy in Weighing

3. Solution Preparation

- 3.1. Basics of Solution Preparation
- 3.2. Calculation of Molecular Weights
- 3.3. Calculation of Equivalent Weights
- 3.4. Preparing Normal Solutions
- 3.5. Making Molar Solutions
- 3.6. Preparing Percent Solutions
- 3.7. Handling and Storage of Reagents

4. Dilution Techniques

- 4.1. Understanding Dilution Ratios
- 4.2. Stepwise Dilution Procedure
- 4.3. Dilution Calculations

5. Laboratory Glassware and Apparatus Maintenance

- 5.1. Cleaning and Sterilization Techniques
- 5.2. Inspection and Maintenance of Glassware and Equipment
- 5.3. Proper Storage of Glassware and Equipment

6. Centrifugation

- 6.1. Principles of Centrifugation
- 6.2. Types of Centrifuges
- 6.3. Applications in Laboratory Settings
- 6.4. Safe Operation and Handling of Centrifuges

7. Acid-Base Titration

- 7.1. Introduction to Acid-Base Reactions
- 7.2. Titration as a Quantitative Analysis Technique
- 7.3. Preparation of Standard Solutions
- 7.4. Conducting a Titration Experiment
- 7.5. Calculating Normality and Concentrations

8 Measurement of Hydrogen Ion Concentration

- 8.1. Understanding pH and Its Significance
- 8.2. pH Measurement Techniques
- 8.3. Calibration and Proper Use of pH Meters
- 8.4. Troubleshooting pH Measurement

Module No. 2: Fundamentals in Biochemistry

Course Outcome: Demonstrate expertise in laboratory techniques, qualitative analyses, and the utilization of analytical instruments for biochemical investigations.

Theory Content:

1: Laboratory Basics

- 1.1. Introduction to Laboratory Equipment and Chemical Balance Types

1.2. Principles and Hands-On Practice of Laboratory Apparatus

2: Fundamentals of Chemistry

2.1. Understanding Molecular Weight, Atomic Weight, and Their Significance

2.2. Grasping Concepts of Normality, Molarity, and Standards

3: Atomic Structure and Chemical Basics

3.1. Atomic Structure, Valence, and Their Role in Chemical Reactions

3.2. Understanding Acids, Bases, Salts, and the Use of Indicators

4: Carbohydrates and Metabolism

4.1. Chemistry of Carbohydrates: Introduction, Classification, and Properties

4.2. Exploring Biomedical Importance and Functions of Carbohydrates

5: Metabolic Pathways

5.1. Overview of Metabolism- Carbohydrates, protein, lipid

6: Amino Acids and Protein Chemistry

6.1. Amino Acids: Definition, Classification, and Importance

6.2. Chemistry of Proteins: Structure, Classification, and Biomedical Significance

7: Metabolism of Amino Acids

8: Lipids

8.1. Lipids: Introduction, Classification, and Biomedical Importance

8.2. Essential Fatty Acids and Their Role in Health

9: Nucleic Acids and Genetic Information

9.1. Understanding DNA Structure and RNA Structure and function

10: Vitamins and Their Role in Nutrition

10.1. Fat-Soluble and Water-Soluble Vitamins

10.2. Sources, Requirements, Deficiency Disorders, and Biochemical Functions

11: Enzymes and Biochemical Catalysts

11.1. Introduction to Enzymes: Definition, Classification, and Roles

11.2. Coenzymes, Isoenzymes, and Factors Affecting Enzyme Activity

11.3. Enzyme Inhibition and Diagnostic Use of Serum Enzymes

Practical Content:

1. Qualitative Analysis

1.1. Identification of Carbohydrates

1.2. Identification of Proteins

1.3. Identification of Substances of Biochemical Importance

2. Urine Analysis

2.1. Examination of Normal Urine Constituents

2.2. Identification of Abnormal Urine Constituents

3. Instrumentation Demonstration

3.1. Colorimeter: Introduction and Operation

3.2. Spectrophotometer: Introduction and Operation

3.3. pH Meter: Introduction and Operation

3.4. Single Pan Balance: Introduction and Operation

4. Chromatography

4.1. Principles of Chromatography

4.2. Types of Chromatography Techniques

4.3. Calculation and Interpretation of RF (Retention Factor) Values

4.4. Description and Applications of Paper Chromatography

Module No. 3: Hematology & Clinical Pathology

Course Outcome: Assist to conduct comprehensive clinical pathology examinations, essential hematological techniques and diagnose hematological disorders.

Theory Content:

1: Hematological Disorders

1.1. Classification of Anemia (Morphological & Etiological)

1.2. Definition, Causes, and Classification of Anemia

1.3. Laboratory Findings of Iron Deficiency Anemia, Megaloblastic Anemia, and Hemolytic Anemia

2: Basic Hematological Techniques

2.1. Blood Collection

2.2. Anticoagulants Used in Hematology

2.3. Normal Values in Hematology

2.4. Basic Hematological Techniques:

2.4.1. RBC Count

2.4.2. Hemoglobin Estimation

2.4.3. Packed Cell Volume

2.5. Calculation of Absolute Indices:

2.5.1. WBC Counts (Total and Differential)

2.5.2. Absolute Eosinophil Count

2.5.3. Platelet Count

2.5.4. Erythrocyte Sedimentation Rate

2.5.5. Reticulocyte Count

2.6. Preparation of Blood Films

- 2.7. Stains Used in Hematology
- 2.8. Morphology of Red Blood Cells
- 2.9. Morphology of Leukocytes and Platelets
- 2.10. Bone Marrow:
 - 2.10.1. Techniques of Aspiration
 - 2.10.2. Preparation and Staining of Films
 - 2.10.3. Bone Marrow Biopsy
- 2.11. Laboratory Methods Used in the Investigation of Anemia

3: Clinical Pathology

- 3.1. Urine Examination:
 - 3.1.1. Physical
 - 3.1.2. Chemical
 - 3.1.3. Microscopic
- 3.2. Examination of Body Fluids and Cell Counts
- 3.3. Semen Analysis
- 3.4. CSF (Cerebrospinal Fluid) Analysis
- 3.5. Stool Examination

Practical Content:

Hematology

- 1. Study of Microscope and Its Application in Hematology
- 2. Familiarization with Glassware Used in Hematology
- 3. Handling and Operating Various Hematology Instruments
- 4. Preparation of Anticoagulant Vials for Blood Samples
- 5. Determination of Blood Group
- 6. Performing Complete Blood Counts
- 7. Estimating Hemoglobin Levels
- 8. RBC Count Using Hemocytometers
- TLC (Total Leukocyte Count) Estimation Using Hemocytometer
- 9. Conducting Differential Leukocyte Count
- 10. Determining Platelet Count
- 11. Measuring Erythrocyte Sedimentation Rate (ESR) by Wintrobe's Method
- 12. Measuring ESR by Westergreen's Method
- 13. Determining Packed Cell Volume (PCV) by Wintrobe's Method
- 14. Calculating Erythrocyte Indices: MCV (Mean Corpuscular Volume), MCH (Mean Corpuscular Hemoglobin), MCHC (Mean Corpuscular Hemoglobin Concentration)
- 15. Counting Reticulocytes
- 16. Estimating Absolute Eosinophil Count
- 17. Analyzing the Morphology of Red Blood Cells

Clinical Pathology

- 1. Comprehensive Urine Examination:
 - 1.1. Physical Examination
 - 1.2. Chemical Analysis

1.3 Microscopic Evaluation

Module No. 4: Microbiology

Course Outcome: Acquire microbiology knowledge and assist in sterilization, culture media, staining, specimen handling, and waste management.

Theory Content:

1: Introduction & History of Microbiology

- 1.1. Development of microbiology as a discipline.
- 1.2. Contributions of Anton von Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister, Alexander Fleming, Edward Jenner.

2: Microscopy

- 2.1. Study of compound microscope-magnification, numerical aperture, resolution, and components of microscope.
- 2.2. Different types of microscopy: Bright field microscope, Dark field microscope, Phase contrast microscope, Electron Microscope-Transmission & Scanning Electron Microscope.
- 2.3. Precautions and care of microscope.

3: Bacteria

- 3.1. General characters and classification.
- 3.2. Morphology: Shape, Capsule, Flagella, Inclusion, Granule, Spore.

4: Growth and Maintenance of Microbes

- 4.1. Bacterial division, Batch Culture, Continuous culture, bacterial growth- total count, Viable count, bacterial nutrition, oxygen requirement, CO₂ requirement, temperature, pH, light.

5: Sterilization and Disinfection

- 5.1. Physical agents- Sunlight, Temperature less than 100°C, Temperature at 100°C, steam at atmospheric pressure and steam under pressure, irradiation, filtration.
- 5.2. Chemical Agents- Alcohol, aldehyde, Dyes, Halogens, Phenols, Ethylene oxide.

6: Culture Media

- 6.1. Definition, uses, basic requirements, classification, Agar, Peptone, Transport Media.
- 6.2. Media, Sugar Media, Anaerobic Media, Containers of Media, Forms of Media.

7: Staining Methods

- 7.1. Simple, Gram's staining, Ziehl-Nelsen staining or AFB staining, Negative Impregnation.

8: Collection and Transportation of Specimen

- 8.1. General Principles, Containers, Rejection, Samples- Urine, Feces, Sputum, Pus, body fluids, Swab, Blood.

9: Disposal of Laboratory/Hospital Waste

- 9.1. Non-infectious waste, infected sharp waste disposal, infected non-sharp waste disposal.

10: Nosocomial Infections/ Hospital Acquired Infections (HAI)

- 10.1. Causative methods, transmission methods, investigation, prevention and control of Hospital Infection.

Practical Content:

1. Preparation of swabs/sterile tubes & bottles.
2. Demonstration of glassware used in microbiology.
3. Preparation of media.

4. Identification of Culture media & uses.
5. Demonstration of Autoclave & sterilization of media.
6. Preparation of culture plates.
7. Preparation of smear.
8. Staining: Gram & Ziehl-Nelson staining.
9. Identification of common microbes.
10. Identification of instruments.
11. Operation of microscope and handling of equipment's and instruments required for routine lab work.
12. Visit to the hospital for a demonstration of Biomedical Waste Management

Module No 5: Medical Ethics

Course Outcome:

Apply ethical principles, legal guidelines, and professional values to ensure patient rights, uphold ethical standards, and maintain professionalism.

Theory:

1: Introduction to Medical Ethics

Differentiating between medical ethics and medical law, defining their goals and scope.

Understanding the healthcare Code of Conduct.

Exploring basic medical ethics principles, with an emphasis on confidentiality.

Providing an overview of malpractice and negligence, including rational and irrational drug therapy.

2: Ethics and Practice

Upholding patients' rights by understanding and implementing autonomy and informed consent.

Ethical considerations in caring for terminally ill patients.

Distinguishing medical diagnosis from physiotherapy diagnosis.

Exploring the medico-legal aspects of medical records, including types of medico-legal cases, record-keeping, ownership, confidentiality, release of information, unauthorized disclosure, and retention.

3: Protocol & Principles

Understanding professional indemnity through insurance policies.

Developing standardized protocols to prevent near misses or sentinel events.

The process of obtaining informed consent.

Exploring biomedical ethical principles.

Discussing the code of ethics for para-medical staff.

4: Professionalism & Values

Understanding and actively applying professional values such as integrity, objectivity, competence, due care, and confidentiality.

Embracing core values in healthcare, including accountability, altruism, compassion, excellence, integrity, professional duties, and social responsibility.

Recognizing the ethical significance of personal values.

Demonstrating appropriate attitudes and behaviors in healthcare, including professionalism and treating all individuals equally.

Examining the code of conduct, professional accountability, responsibility, and addressing misconduct.

Recognizing the differences between professions and emphasizing the importance of teamwork in healthcare.

Considering cultural factors in the healthcare environment.

Understanding the role of entry-level healthcare practitioners, their autonomy, and their commitment to evidence-based practice.

Practical Syllabus:

1. Practical activities related to each topic, including case studies, role-playing, and discussions to apply ethical principles and legal guidelines in real-world healthcare scenarios.
2. Hands-on exercises in developing protocols, obtaining informed consent, and addressing ethical dilemmas.
3. Interactive sessions to explore biomedical ethical principles and their application in healthcare practice.
4. Ethical decision-making simulations and discussions on code of conduct.
5. Collaborative exercises emphasizing teamwork and cultural sensitivity in healthcare settings.
6. Practical demonstrations of handling medical records, ensuring confidentiality, and addressing medico-legal aspects.
7. Visits to healthcare facilities to observe and discuss real-world applications of medical ethics and professionalism.
8. Role-playing and case studies focused on patient interactions, informed consent, and ethical dilemmas.
9. Group discussions and activities to foster a deeper understanding of personal and professional values and their impact on healthcare practice.

Module No 6: Employability Skill (60 Hrs)

Key Learning Outcomes

Introduction to Employability Skills

Duration: 1.5 Hours

After completing this programme, participants will be able to:

1. Discuss the Employability Skills required for jobs in various industries
2. List different learning and employability related GOI and private portals and their usage

Constitutional values - Citizenship

Duration: 1.5 Hours

3. Explain the constitutional values, including civic rights and duties, citizenship, responsibility towards society and personal values and ethics such as honesty, integrity, caring and respecting others that are required to become a responsible citizen
4. Show how to practice different environmentally sustainable practices.

Becoming a Professional in the 21st Century

Duration: 2.5 Hours

5. Discuss importance of relevant 21st century skills.
6. Exhibit 21st century skills like Self-Awareness, Behavior Skills, time management, critical and adaptive thinking, problem-solving, creative thinking, social and cultural awareness, emotional awareness, learning to learn etc. in personal or professional life.
7. Describe the benefits of continuous learning.

Basic English Skills

Duration: 10 Hours

8. Show how to use basic English sentences for everyday conversation in different contexts, in person and over the telephone
9. Read and interpret text written in basic English
10. Write a short note/paragraph / letter/e -mail using basic English

Career Development & Goal Setting

Duration: 2 Hours

11. Create a career development plan with well-defined short- and long-term goals

Communication Skills

Duration: 5 Hours

12. Demonstrate how to communicate effectively using verbal and nonverbal communication etiquette.
13. Explain the importance of active listening for effective communication
14. Discuss the significance of working collaboratively with others in a team

Diversity & Inclusion

Duration: 2.5 Hours

15. Demonstrate how to behave, communicate, and conduct oneself appropriately with all genders and PwD
16. Discuss the significance of escalating sexual harassment issues as per POSH act.

Financial and Legal Literacy

Duration: 5 Hours

17. Outline the importance of selecting the right financial institution, product, and service
18. Demonstrate how to carry out offline and online financial transactions, safely and securely
19. List the common components of salary and compute income, expenditure, taxes, investments etc.
20. Discuss the legal rights, laws, and aids

Essential Digital Skills

Duration: 10 Hours

21. Describe the role of digital technology in today's life
22. Demonstrate how to operate digital devices and use the associated applications and features, safely and securely
23. Discuss the significance of displaying responsible online behavior while browsing, using various social media platforms, e-mails, etc., safely and securely
24. Create sample word documents, excel sheets and presentations using basic features
25. utilize virtual collaboration tools to work effectively

Entrepreneurship

Duration: 7 Hours

26. Explain the types of entrepreneurship and enterprises
27. Discuss how to identify opportunities for potential business, sources of funding and associated financial and legal risks with its mitigation plan
28. Describe the 4Ps of Marketing-Product, Price, Place and Promotion and apply them as per

requirement

29. Create a sample business plan, for the selected business opportunity

Customer Service

Duration: 5 Hours

30. Describe the significance of analyzing different types and needs of customers
 31. Explain the significance of identifying customer needs and responding to them in a professional manner.
 32. Discuss the significance of maintaining hygiene and dressing appropriately

Getting Ready for apprenticeship & Jobs

Duration: 8 Hours

33. Create a professional Curriculum Vitae (CV)
 34. Use various offline and online job search sources such as employment exchanges, recruitment agencies, and job portals respectively
 35. Discuss the significance of maintaining hygiene and confidence during an interview
 36. Perform a mock interview
 37. List the steps for searching and registering for apprenticeship opportunities

Module No. 7: OJT

Outcome: Work in real job situation with special emphasis on basic safety and hazards in this domain

Practical Content:

Assessor will check report prepared for this component of Practical training of the course and assess whether competency has been developed to work in the real job situation with special emphasis on basic safety and hazards in this domain.

(OJT to be completed at Medium Laboratory / at 30 or more bedded hospital with facility of relevant training. OJT will be for a period of not less than 3 months.)

List of Tools, Equipment & materials needed for 30 Trainees (Practical)

Name of Equipment	Quantity
Pathology	
Microscope (Monocular)	2 nos
Microscope (Binocular)	2 nos
Centrifuge	3 nos
Water bath	1 no

Hemocytometer, haemoglobinometer, Counting Chamber, Haematocrit tube, Westergren Pipette	1 no
Photoelectric Calorimeter	1 no
Blood Cell Counter (Semi/automated)	2 nos
Refrigerator	5 nos
Stop Watch	1 no
Glass equipment	2 nos
Charts showing microscopic findings of stool & urine examinations	1 no

OJT to be done at a Medium Laboratory / at 30 or more bedded hospital with facility of relevant training.
OJT will be for a period of not less than 3 months.

Marks Distribution

Outcome	Outcome Code	Total Th Marks	Total Pr Marks
Explain basics of human anatomy and physiology, as well as essential laboratory techniques, including the preparation of various solutions, maintenance of laboratory equipment, centrifugation, titration, and measurement of hydrogen ion concentration.	HCL/1615/OC1	30	130
Demonstrate expertise in laboratory techniques, qualitative analyses, and the utilization of analytical instruments for biochemical investigations	HCL/1615/OC2	30	90
Assist to conduct comprehensive clinical pathology examinations, essential hematological techniques and diagnose hematological disorders.	HCL/1615/OC3	30	130
Acquire microbiology knowledge and assist in sterilization, culture media, staining, specimen handling, and waste management.	HCL/1615/OC4	50	100
Apply ethical principles, legal guidelines, and professional values to ensure patient rights, uphold ethical standards, and maintain professionalism.	HCL/1615/OC5	10	50
OJT	HCL/1615/OC6	0	300
Employability Skill-60 Hrs	DGT/VSQ/N0102	50	0