



REPUBLIC OF KENYA
MINISTRY OF HEALTH



KENYA MEDICAL LABORATORY TECHNICIANS AND TECHNOLOGISTS BOARD

KMLTTB DESIGN AND OPERATION REQUIREMENTS OF A MODERN MEDICAL LABORATORY IN KENYA.

Pursuant to the Medical Laboratory Technicians and Technologists Act CAP 253 A Laws of Kenya.

KMLTTBQUALITY ASSURANCE SERVICES.

	<i>KMLTTB DESIGN AND OPERATION REQUIREMENTS OF A MODERN MEDICAL LABORATORY IN KENYA.</i>		DOCUMENT CONTROL
	OWNER OF THE FORM	REGISTRAR	Serial: KMLTTB/MED/LAB/STD/01 Version 001 Date: 2 ND , JANUARY, 2026

KMLTTB DESIGN AND OPERATION REQUIREMENTS OF A MODERN MEDICAL LABORATORY IN KENYA

The scientific design of a modern medical laboratory follows a multi-phase protocol that integrates **architectural intelligence**, **biosafety compliance**, and **technological adaptability**. Modern standards, such as ISO 15189:2022, shift from traditional equipment-centric planning to a holistic ecosystem approach centered on safety and workflow.

The design of a modern medical laboratory is a highly specialized, multidisciplinary process that integrates advanced automation, safety regulations, and ergonomic principles to ensure accurate, timely, and safe diagnostic services. Modern laboratories are shifting away from static, traditional designs towards flexible, modular, and digital-enabled environments.

This protocol outlines the essential phases of designing a modern, ISO 15189-compliant medical laboratory.

CONCEPTUAL PHASE: NEEDS ASSESSMENT ARCHITECTURAL , SPATIAL PLANNING AND ZONING

Before physical design, the laboratory's scope must be defined to determine spatial and technical requirements

The physical structure must support safety, durability, and cleanliness.

- a. **Flooring:** Non-pervious, seamless, chemical-resistant, and coved (curved) at wall-floor junctions for easy disinfection.
 - b. **Walls & Ceilings:** Smooth, non-porous finish with anti-microbial paint, free of sharp corners.
 - c. **Space Requirements:** Minimum aisle clearances of 24–36 inches for safety and emergency egress.
 - d. **Doors:** Self-closing and secure; doors in high-risk zones should open outward.
- **Modular Architecture:** Use reconfigurable casework, mobile medical laboratory benches, and overhead service carriers (utilities delivered from the ceiling) to allow for rapid reconfiguration as technology evolves.
 - **Define Scope & Workload:** Determine test volume, types of testing (Hematology, Blood transfusion, Clinical chemistry, Microbiology (Bacteriology, Virology, and Mycology)



Mycology, Histopathology, cytopathology, Parasitology and PCR), and future growth capacity.

- **Define Zoning (The "Clean-Dirty" Split):** Divide the facility into three primary areas to prevent cross-contamination.
 - a. **Administrative Zone:** Offices, staff break rooms, and reception (separated from biohazard areas).
 - b. **Clinical/Work Zone:** Main testing area (Blood, Urine, Chemistry).
 - c. **Specialized/Support Zone:** Microbiology, Molecular Biology (PCR), and Cold Storage (high security).
- **Linear Workflow Mapping:** Design a "one-way" workflow from Sample Reception.

The layout to follow a strict sequence: **Specimen Receiving** → **processing** → **Analysis** → **Waste Disposal**.

- **Clean Zone:** Administrative offices, staff break rooms, and study areas.

PRE-ANALYTICAL SORTING:

❖ Phlebotomy Area (Specimen Collection)

KMLTTB requires that this area must be separated from active, high-risk laboratory testing, ideally located near the entrance to minimize traffic in the main medical laboratory.

- **Dimensions/Area:**
 - a. **Minimum Cubicle:** Approx. 4–6 m² per station (approx. 2m x 2.5m minimum) to allow for a chair, phlebotomist stool, and equipment trolley.
 - b. **Accessibility:** Must accommodate wheelchairs (36-inch minimum clearance).
- **Key Components & Layout:**
 - a. **Patient Chair:** Comfortable chair with armrest (preferably a reclining chair for fainting).
 - b. **Workstation:** Clean, non-porous counter (solid surface) for supplies.



- c. **Hand Hygiene:** Dedicated sink for handwashing with foot-operated or electronic faucets.
- d. **Equipment:** Dedicated storage cabinets for consumables (gauze, tubes, PPE).
- e. **Emergency Care:** Space for an emergency tray or trolley
- f. **Buffer/Support Zone:** Specimen receiving, reagent storage, and supply areas.

❖ **ANALYSIS**

- a. **Pollution/Clinical Zone:** Analysis workstations, washing areas, and biohazardous waste storage.

❖ **RESULT REPORTING**

The reporting area must be a "clean" zone, physically separated from the laboratory testing benches to protect staff from aerosols, odors, and potential exposure.

- **Location and Layout:**
 - a. **Distance from Hazards:** Located away from high-risk, high-pollution areas.
 - b. **Workflow:** Ideally positioned near the sample accessioning area for ease of data entry.
 - c. **Design:** Ergonomic, with sufficient space for computers, printers, and document storage.
- **Space Requirements:**
 - a. **Desk Space:** Minimum 1.5–2 meters of workspace per staff member to accommodate LIS (Laboratory Information System) hardware.
 - b. **Document Storage:** Locked filing cabinets for hard copies of reports and Quality Control (QC) records.
- **Environmental Controls:**
 - a. **Positive Pressure:** The administrative/reporting room should have higher air pressure than the lab to prevent contaminated air from entering.
 - b. **Lighting:** Adequate, glare-free lighting to reduce eye strain.



❖ WASTE MANAGEMENT

Waste management must follow a "source-to-disposal" strategy, ensuring proper segregation, storage, and handling to avoid infection, according to ISO 15189 standards and local regulations.

- **At-Source Segregation (In-medical Laboratory):**
 - a. **Distance:** Waste containers must be located within 5 meters of the point of generation.
 - b. **Bin Requirements:** Three-container system: General waste (black), infectious/pathological waste (yellow), and sharps (yellow, rigid, puncture-proof).
 - c. **Biohazard Symbol:** All infectious waste containers must bear the biohazard symbol.

- **Intermediate Waste Storage Room (On-Site):**
 - a. **Location:** Secure, separate, well-ventilated, and away from patient access or food preparation areas.
 - b. **Accessibility:** Accessible to waste collection vehicles and staff.
 - c. **Storage Time:** Max 48 hours in warm climates (24 hours if high temperature) before final treatment.
 - d. **Design Standards:**
 - i. **Flooring:** Non-porous, slip-resistant, and coved (rounded edges) for easy cleaning and disinfection.
 - ii. **Ventilation:** Active, dedicated exhaust system.
 - iii. **Security:** Locked to prevent unauthorized access.
 - iv. **Capacity:** Sufficient space to store multiple, clearly labeled containers, with a "first-in, first-out" system.

- **Specialized Areas:**



- a. **Autoclave/Decontamination Room:** If on-site sterilization is performed, a dedicated, negative-pressure room for the autoclave is necessary.
- b. **Sharps/Placenta Pit:** If in rural areas, these should be securely fenced, located at least 30m away from water sources.

SUMMARY OF KEY DESIGN ELEMENTS

Feature	Reporting Area	Waste Management Area
Zone	Clean / Administrative	Contaminated / Service
Air Pressure	Positive	Negative (to isolate fumes)
Flooring	Standard, durable	Impervious, non-slip, coved
Security	Access-controlled	Locked, secure storage
Proximity	Quiet, accessible to admin	Near exit/service, away from medical laboratory

III. SPECIALIZED FACILITY INFRASTRUCTURE

Modern medical laboratory infrastructure requires high-performance environmental controls.

❖ HVAC & Pressure Control:

- **Negative Pressure:** Used in high-risk areas (microbiology, grossing) to prevent airborne contamination from escaping.
- **Positive Pressure:** Used in clean rooms (reagent storage) to prevent contaminants from entering.
- **Air Changes:** 12–15 air changes per hour (ACH) are typically required.

2. Utilities & Service Delivery:



- **Overhead Service Carriers:** Deliver power, data, and gases from above to allow mobile, reconfigurable benches.
- **Electrical:** GFI protection for outlets near sinks and 20–40% additional capacity for future equipment.
- 3. **Lighting:** A mix of natural and artificial (fluorescent or LED) light (typically 600 lux), designed to eliminate shadows at the bench.

IV. SAFETY ENGINEERING AND CONTROL SYSTEMS

- **Ventilation & HVAC:**
 - Maintain **negative air pressure** in clinical zones relative to non-medical laboratory areas to contain contaminants.
 - Ensure 8–10 air changes per hour for occupied spaces.
 - Incorporate specialized exhaust systems (Fume Hoods/Biosafety Cabinets) with dedicated HEPA filtration for high-containment areas.
- **Environmental Stability:** Install redundant HVAC systems to maintain tight tolerances ($\pm 1^{\circ}\text{C}$ and $\pm 5\%$ relative humidity) for sensitive diagnostic equipment.
- **Utility Resilience:** Provide high-density power with **Emergency Backup Power** (UPS/Generators) specifically for continuous-monitoring blood culture incubators and STAT testing platforms.

III. SAFETY & BIOSAFETY STANDARDS.

- **Facility Enclosure:** The medical laboratory must be completely separated from public areas by four walls with **self-closing, lockable doors**.
- **Containment Equipment:**
 - **Biosafety Cabinets (BSC):** Mandatory for aerosol-generating procedures.
 - **Emergency Stations:** Plumbed eyewash stations and safety showers must be within **10 seconds (approx. 100 feet)** of hazardous chemical use areas.
- **Surface Selection:**



- **Flooring:** Use non-pervious, seamless materials (e.g., epoxy or heat-welded vinyl) with **covings** that extend up the wall to contain spills.
- **Benchtops:** Must be chemical-resistant, non-porous, and seamless (e.g., stainless steel or phenolic resin).

IV. KMLTTB PROTOCOL FOR WASTE MANAGEMENT IN A MEDICAL LABORATORY.

Waste management in a medical laboratory is critical for safety, regulatory compliance, and environmental protection. It involves systematic segregation, handling, storage, and disposal of various waste streams to prevent infection and hazardous exposure. Safety is embedded, not added, in modern medical laboratory design.

- a. **Biosafety Cabinets (BSCs):** Class II BSCs must be installed in areas handling potentially infectious materials.
- b. **Emergency Equipment:** Emergency eye wash stations and safety showers must be within 10 seconds of travel distance and easily accessible.
- c. **Waste Management:** Dedicated zones for biohazardous waste, including autoclaves for sterilization.

❖ WASTE CLASSIFICATION AND SEGREGATION AT SOURCE

Waste must be segregated at the point of generation to reduce cross-contamination.

- **Regulated Medical Waste (RMW) / Biohazardous Waste:** Items contaminated with blood, body fluids, or cultures (gloves, plastic pipettes and culture plates).
 - **Container:** Red or Yellow biohazard bags or rigid, sealable containers.
- **Sharps Waste:** Needles, syringes, scalpels, blades, broken glass and slides.
 - **Container:** Puncture-resistant, leak-proof, rigid plastic containers, clearly labeled with the biohazard symbol.
- **Chemical Waste:** Solvents, reagents, hazardous solutions.
 - **Container:** Compatible containers (glass or specialized plastic), kept closed except when adding waste, and stored with secondary containment.



- **Radioactive Waste:** Materials contaminated with radioisotopes (common in nuclear medicine).
 - **Container:** Shielded, lead-lined containers with appropriate warning labels.
- **General Waste:** Non-contaminated, non-hazardous office-type waste.
 - **Container:** Standard black or clear plastic bags.

❖ HANDLING AND PACKAGING PROCEDURES.

- **Sharps Handling:** Never recap, bend, or break needles by hand. Dispose of sharps immediately into the container.
- **Biohazard Bags:** When bags are 3/4 full, seal them by gathering the top, twisting, and using a single overhand knot (or ziplock/twist-tie).
- **Labeling:** All containers must be labeled with the type of waste, hazard symbols (biohazard, corrosive, etc.), and the date of accumulation.
- **Liquid Waste:** Collect liquid biohazardous waste in leak-proof, non-breakable containers. Pre-treat with disinfectant (e.g., 10% bleach for 30 minutes) if necessary.

❖ STORAGE AND INTERNAL TRANSPORT.

- **Storage Time:** Minimize storage time in the lab to avoid accumulation; dispose of waste regularly.
- **Location:** Store hazardous waste in a designated, secure area that is properly ventilated, inaccessible to the public, and protected from pests.
- **Transport:** Use leak-proof, sturdy trolleys to move waste to central storage areas. Do not transport waste through public hallways.

❖ TREATMENT AND DISPOSAL METHODS

- **Autoclaving (Sterilization):** Use for biohazardous waste (30–60 minutes at 121°C, 15 psi). Autoclaves must be validated regularly using biological indicators (e.g., *Geobacillus stearothermophilus*).
- **Incineration:** Mandatory for pathological waste, animal carcasses, and many chemical wastes. Requires high-temperature combustion (850°C–1100°C).



- **Chemical Disinfection:** Used for liquid waste, followed by disposal in the sanitary sewer.
- **Licensed Vendor Disposal:** Chemical, radioactive, and large volumes of biohazardous waste must be collected by licensed hazardous waste disposal companies.

❖ SAFETY, TRAINING, AND DOCUMENTATION

- **PPE:** Personnel must wear appropriate personal protective equipment (gloves, lab coats, goggles) when handling waste.
- **Spill Response:** Maintain spill kits in the laboratory. Chemical spills should be cleaned by trained personnel and disposed of as hazardous waste.
- **Documentation:** Maintain strict records of waste generated, including waste type, quantity, date of removal, and the final disposal method (e.g., waste transfer notes).
- **Training:** Provide annual training for staff on waste classification, segregation, and emergency response.

❖ EMERGENCY & SPECIAL CONSIDERATIONS

- **Broken Glass:** Contaminated broken glass goes into sharps containers. Non-contaminated broken glass goes into a separate, rigid, labeled box.
- **Mixed Waste:** If waste contains both hazardous chemicals and radioisotopes, it must be managed as the most hazardous component.
- **Empty Chemical Containers:** Triple-rinse containers, deface labels, and dispose of in regular trash

V. INTERIOR DESIGN: FURNITURE, ERGONOMICS AND HUMAN FACTORS.

- **Spatial Clearance:** Maintain a minimum aisle width of **36 inches** for emergency egress and at least **5 feet** between adjacent workstations.



- **Acoustic & Visual Comfort:** Use noise-absorbing materials for ceilings and walls in open-plan layouts to reduce distraction. Ensure task-specific lighting reaches **600 lux** at working surfaces.
 - a. **Adjustability:** Implement height-adjustable workstations and ergonomic seating to reduce musculoskeletal strain on medical laboratory professionals during long shifts.
 - b. Modern medical laboratories prioritize staff well-being to reduce error rates.
 - c. **Modular Casework:** Movable, reconfigurable bench systems that allow the medical laboratory to adapt without reconstruction.
 - d. **Surfaces:** Non-porous, chemically resistant materials (e.g., stainless steel, epoxy resin).
 - e. **Ergonomics:** Height-adjustable workstations for both sitting and standing tasks.

VI. TECHNOLOGY AND AUTOMATION INTEGRATION.

- **Digital Infrastructure and Smart Building Systems:** KMLTTB recommends medical laboratories strive to use IoT-linked sensors for real-time monitoring of temperature, humidity, and equipment performance. KMLTTB also recommends medical Laboratories to integrate Information Management System (LIMS) to automate specimen tracking from registration to result validation. Digital infrastructure should be integrated during the planning phase for data flow, sample tracking, and automated reporting.
 - a. **IoT Environmental Monitoring:** Real-time, remote tracking of temperature and humidity in freezers and refrigerators.
 - b. **Automation Readiness:** Floor plan must accommodate high-throughput, automated robotic systems.

VII. REGULATORY COMPLIANCE AND FINALIZATION.



- a. **Regulatory Standards:** KMLTTB requires that design should meet Kenyan regulations on OSHA, and accreditation standards (e.g., KMLTTB standards, ISO 15189).
- b. **Validation:** Before operational usage, all systems (HVAC, BSCs) must be validated (e.g., ASHRAE 110 for fume hoods).

VIII. SUMMARY TABLE OF KEY MODERN MEDICAL LABORATORY FEATURES.

Feature	Prescribed Standard	Goal/ Objective
Flexibility	Modular Furniture & Overhead Services	Rapid adaptation, long life cycle
Workflow	Linear/Unidirectional Flow	Reduced cross-contamination
Airflow	Negative Pressure & HEPA Filters	Containment of pathogens
Digital	Integrated LIMS & IoT Sensors	Real-time monitoring, accuracy
Safety	Touchless Fixtures, Ergonomic Benches	Staff well-being, hazard reduction

IX. ESSENTIAL COMPONENTS OF A MEDICAL LABORATORY REPORT

According to ISO 15189 and KMLTTB regulations, a final medical laboratory report must contain specific, identifiable information:

- **Patient Identification:** Name, unique identifier (e.g., medical record number), and date of birth.
- **Medical laboratory Identification:** Name and address of the laboratory performing the test.
- **Requestor Information:** Name and contact details of the ordering physician or authorized person.
- **Sample Information:** Type of primary sample (e.g., serum, EDTA blood), date and time of collection, and, if relevant, time of receipt.



- **Test Results:** Clearly reported results with applicable, standardized units of measurement (e.g., SI units).
- **Reference Intervals:** Appropriate biological reference intervals or clinical decision values (e.g., therapeutic ranges), adjusted for age and sex if applicable.
- **Interpretative Comments:** Comments that add value to the results or are necessary for correct interpretation (e.g., flagging interference like hemolysis).
- **Report Metadata:** Date and time of report release, page number/total pages (e.g., Page 1 of 2).
- **Authentication:** Identification of the person who reviewed and authorized the release of results.
- **Accreditation Status:** A mark specifying whether measurements are accredited or not.

X. CRITICAL RESULT REPORTING (PANIC VALUES)

Each medical laboratory must establish a procedure for the immediate notification of "critical" or "alarming" results that indicate an immediate risk to patient life or health.

- **Definition:** The medical laboratory superintendent/ director must approve a list of critical values, which should be agreed upon with clinicians.
- **Communication:** Results must be communicated immediately to the requesting physician, clinician, and patient/client or authorized staff.
- **Documentation:** A record must be maintained, including:
 - The date and time the result was authorized.
 - The person who communicated the result (lab staff).
 - The person who received the result (clinician/nurse).
 - The exact results communicated.
- **Alternative Procedure:** If the requesting physician cannot be reached, a documented, pre-agreed alternative procedure must be followed.



XI. REPORTING PROCESS AND WORKFLOW

- **Authorization:** Results must be reviewed and authorized by qualified medical laboratory professional personnel before release.
- **Confidentiality:** The report must reach only authorized personnel, guaranteeing patient data confidentiality.
- **Amendments:** If a report is modified after issuance, it must be clearly identified as "Amended" or "Corrected," indicating the change, the reason for the change, and the date/time of modification.
- **External medical Laboratories:** Results from external (referral) laboratories must be clearly identified as such to ensure traceability.

XII. ELECTRONIC AND AUTOMATED REPORTING

- **LIMS Validation:** Medical laboratory Information Management Systems (LIMS) must be validated for accuracy in transmitting results.
- **Automated Review:** Automated systems (middleware) can be used for auto-validation if predefined criteria (e.g. delta checks, reference intervals) are met. Any flags or unexpected results must trigger a manual review.
- **Data Protection:** Electronic transmission (e-mail/web portal) must comply with data protection act, 2019 and Digital health act, 2023 and KMLTTB regulations.

XIII. RECORD RETENTION

Medical laboratories must maintain records of test reports, including raw data, quality control (QC) results, and calibration, for at least two years (or longer e.g., 5 years for immunohematology).

XIV. KMLTTB REGULATORY FRAMEWORK SUMMARY

- **ISO 15189:2022:** KMLTTB recognises role of ISO 15189:2022 which sets international standards for quality and competence, emphasizing patient safety and technical requirements for reporting.
- **KMLTTB regulations under mltt ACT, Cap 253A Laws of Kenya:** Mandates specific, uniform quality standards for all clinical/ medical laboratories testing human specimens.



- **GCLP (Good Clinical Laboratory Practice):** Standards may be adopted specifically for clinical trials, focusing on data management and traceability.

❖ KMLTTB REGULATORY REQUIREMENTS & FORMS

For a specific kit to be used by medical laboratory professionals in Kenya, it must be validated by the KMLTTB or an agent appointed by them.

- **Application Process:** Manufacturers or local distributors must submit a dossier for the Medical Laboratory Reagent/Equipment before it can be used.
- **REGISTRATION FORMS:**
 - a. **Application for Validation of In-Vitro Diagnostic Products:** Required by KMLTTB FOR used to get specific reagents and equipment approved.
 - b. **Application for Registration of Vendors/Suppliers/Distributors of IVDs:** Required for the suppliers of in vitro diagnostics (medical laboratory reagents and equipment).
- **Process:** KMLTTB evaluates the dossier and, if necessary, contracts accredited agencies to validate the reagent.

❖ KMLTTB-APPROVED VENDORS & PRODUCTS

KMLTTB maintains a list of validated reagents and equipment.

NOTE: It is essential to check the official, updated KMLTTB Validated Reagents list for the current approved in vitro diagnostics / medical laboratory reagent and equipment.

❖ IMPORTANT REQUIREMENT FOR MEDICAL LABORATORY PROFESSIONALS.

- **Validation Requirement:** Every medical laboratory in Kenya must maintain records of certificates of validation for reagents and equipment used.
- **Quality Control:** All in vitro diagnostics / medical laboratory reagents and equipment must be validated against positive and negative controls regularly.



Disclaimer: Regulatory requirements and approved vendor lists are subject to change. Always refer to the KMLTTB website for the most current information

❖ SMALL MEDICAL LABORATORIES KMLTTB LAYOUT REQUIREMENTS

A small medical laboratory layout must prioritize **unidirectional workflow** and **biosafety segregation** to prevent cross-contamination while maximizing limited square footage. For a typical medical/clinical laboratory, KMLTTB recommends a space allocation of **15–20 square metres per person** to accommodate specialized equipment and safe movement.

➤ FUNCTIONAL ZONING AND LAYOUT PRINCIPLES

To ensure safety and efficiency, the lab should be divided into distinct functional zones that follow a logical sample path.

- **Clean Area:** Includes administrative offices, staff lounges, and clerical workstations. KMLTTB recommends that these must be physically separated from testing areas.
- **Buffer/Transition Zone:** A lobby or anteroom at the entrance for donning and doffing Personal Protective Equipment (PPE). KMLTTB requires that this area should include hooks for lab coats and storage for safety eyewear.
- **Contaminated/Analytical Area:** The core testing space divided by discipline (e.g., Hematology, Biochemistry, Microbiology etc.), must include dedicated sections for sample processing and hazardous waste.
- **Workflow Logic:** KMLTTB requires that a design for a "workflow triangle" (Sample Collection → Analysis → Storage) to minimize travel distance. KMLTTB also recommends the use a linear fashion for sensitive processes like PCR to avoid specimens passing back through unamplified areas.

➤ ARCHITECTURAL AND PHYSICAL REQUIREMENTS

Standardized dimensions and materials are critical for regulatory compliance (e.g., ISO 15189).



- **Flooring:** KMLTTB requires that there must be monolithic (seamless), non-pervious, and coved at least 100mm up the wall to prevent liquids from seeping under cabinets. Epoxy-coated concrete or heat-welded vinyl are ideal.
- **Workbenches:** Use chemical-resistant, non-porous materials (e.g., phenolic resin). Standard height is **720 mm** for seated work and **900 mm** for standing. Bench depth should be **600–750 mm**.
- **Aisle Width:** KMLTTB requires that medical laboratory maintain a minimum aisle width of **1.2–1.5 metres (4–5 ft)** to allow for safe movement and equipment transport.
- **Doors:** Small medical laboratory doors should be at least **1 metre (3.3 ft)** wide, self-closing, and equipped with a vision panel. For large equipment access, **1.2 metre (4 ft)** double doors are preferred.

➤ **ESSENTIAL INFRASTRUCTURE AND SAFETY SYSTEMS**

Small medical laboratories must integrate utility and safety features into their footprint early in the planning stage.

- **Ventilation (HVAC):** Small medical laboratories must provide **6–12 air changes per hour**. Fume hoods and Biosafety Cabinets (BSCs) should be placed away from doors and high-traffic routes to prevent air turbulence.
- **Plumbing:** Every medical laboratory room must contain at least one dedicated **hands-free sink** for hand washing. Emergency eyewash stations must be reachable within 10 seconds (approx. 15 metres) of hazardous areas.
- **Storage:** Use vertical storage and modular shelving to save floor space. Chemicals must be stored in specialized ventilated cabinets, never above sinks.
- **Power:** Medical laboratories must provide a dedicated UPS (Uninterruptible Power Supply) for sensitive analyzers and refrigerators to prevent data loss or reagent spoilage during power outages.

➤ **SPACE EFFICIENCY METRICS**

Feature	Requirement / Recommendation
---------	------------------------------

Area per Technician	15–20
---------------------	-------



Ceiling Height	Minimum 3000 mm (approx. 10 ft)
Aisle Clearance	1.2–1.8 m (4–6 ft)
Corridor Width	Minimum 2550 mm for main internal routes
Lab/Office Ratio	Typically 70% Lab to 30% Office for small models

KMLTTB TEACHING MEDICAL LABORATORY REQUIREMENTS

A modern teaching medical laboratory requires a design that balances safety, regulatory compliance (ISO 15189, BSL-2 standards), and educational functionality. The layout should follow a linear, one-way workflow to prevent cross-contamination, moving from clean areas to contaminated zones.

1. CONCEPTUAL SKETCH PLAN (LAYOUT)

Imagine a rectangular, partitioned space with a clear "dirty-to-clean" workflow:

[ENTRANCE]

[Reception/Check-in]

[Student Locker Area]

[Instructors Office/Control Area]



[Main Teaching medical Laboratory - Open Plan] (Central workbenches, 6ft spacing)

[Specialized Rooms] (PCR, Microbiology, Sample Processing - Enclosed)

[Waste Disposal & Decontamination Zone] (Autoclave, Sink)

[Exit]

2. FUNCTIONAL ZONING AND KEY COMPONENTS.

- **Clean Area (Non-Hazardous):** Located away from the lab benches. Includes offices, a student break room, and a locker area for personal belongings.
- **Main Teaching Lab (Analytical Area):**
 - a. **Layout:** Open-plan with modular benches to allow for flexibility and reconfiguring.
 - b. **Bench Spacing:** 6 feet (approx. 1.8m) between benches for safety.
 - c. **Stations:** Equipped with microscopes, centrifuges, and computers for Laboratory Information Management Systems (LIMS).
- **Specialized Areas (Contained):**
 - a. **Molecular/PCR Lab:** Dedicated, separated room to prevent DNA cross-contamination (positive/negative pressure).
 - b. **Microbiology/Pathology:** Biosafety Cabinets (Class II) for handling infectious samples.
- **Sample Processing/Receiving:** A distinct, initial station where specimens are logged and sorted.



- **Decontamination Zone:** Adjacent to the exit, featuring an autoclave for sterilization, biohazard waste storage, and emergency showers/eyewash stations (within 10 seconds of hazardous areas).

3. REGULATORY COMPLIANCE REQUIREMENTS.

- **Biosafety Level 2 (BSL-2):** Required for general medical laboratories. Includes hand-washing sinks near the exit, restricted access, and proper PPE storage.
- **Flooring & Surfaces:** Non-pervious, seamless, chemical-resistant flooring (e.g., epoxy or welded vinyl) with coving to the wall to prevent fluid accumulation.
- **Ventilation (HVAC):** Negative pressure relative to non-laboratory areas, with 8-10 air changes per hour (ACH) to contain contaminants.
- **Furniture & Ergonomics:** Adjustable-height workbenches and seating to reduce strain. No carpeting.
- **Safety Equipment:** Clearly marked, unobstructed access to fire extinguishers, spill kits, and eyewash stations.
- **Storage:** Secure, lockable cabinets for reagents and chemicals. No storage of hazardous materials above eye level.

4. SPECIAL FEATURES FOR A TEACHING MEDICAL LABORATORY

- **Instructor Station:** Elevated or centrally located for maximum visibility of all students.
- **Demonstration Station:** A separate, equipped bench for instructor demonstrations, often paired with an overhead camera and screen.
- **Shared Infrastructure:** Modular, "plug-and-play" utilities (power/gas/data) from overhead service panels to keep worktops clear.

.....THE END.....

