THE REPUBLIC OF KENYA

LAWS OF KENYA

MEDICAL LABORATORY TECHNICIANS AND TECHNOLOGISTS ACT

CHAPTER 253A

Revised Edition 2012 [1999]

Published by the National Council for Law Reporting
with the Authority of the Attorney-General

www.kenyalaw.org

CHAPTER 253A

MEDICAL LABORATORY TECHNICIANS AND TECHNOLOGISTS ACT

ARRANGEMENT OF SECTIONS

PART I – PRELIMINARY

Section

CHAPTER 253A

MEDICAL LABORATORY TECHNICIANS AND TECHNOLOGISTS ACT

[*Date of assent: 6th January, 2000*.]

[*Date of commencement: 22nd December, 2000*.]

An Act of Parliament to provide for the training, registration and licensing of medical laboratory technicians and technologists, to provide for the establishment, powers and functions of the Kenya Medical Laboratory Technicians and Technologists Board, and for connected purposes

[L.N. 147/2000.]

PART I – PRELIMINARY

1. Short title

This Act may be cited as the Medical Laboratory Technicians and Technologists Act, 1999.

2. Interpretation

In this Act, unless the context otherwise requires—

"approved training institution" means the Kenya Medical Training College or such other training institution as the Board may approve for the purposes of this Act;

"Association" means the Association of Kenya Medical Laboratory Scientific Officers;

"Board" means the Kenya Medical Laboratory Technicians and Technologists Board established by section 3;

"College" means the Kenya Medical Training College established by the Kenya Medical Training College Act, 1990 (No. 14 of 1990);

"Committee" means the Disciplinary Committee of the Board established by section 28;

"health institution" means a hospital, nursing home, convalescent home, maternity home, health centre, dispensary or other institution where health or medical services are rendered;

"hospital laboratory" means a facility in a health institution in which medical laboratory analysis and investigations are carried out;

"laboratory technician" and **"laboratory technologist"** mean a "medical laboratory technician" and a "medical laboratory technologist" respectively;

"medical laboratory" includes any facility where medical laboratory analysis and investigations are carried out and includes a hospital laboratory;

"medical laboratory technician" means a person holding a certificate in medical laboratory technology issued by the Kenya Medical Training College or other similar institution recognised by the Board;

"medical laboratory technologist" means a person holding a diploma, higher diploma or degree in medical laboratory technology issued by the Kenya Medical College or other similar institution approved by the Board;

"Minister" means the Minister for the time being responsible for matters relating to health and **"Ministry"** shall be construed accordingly;

"register" means the register of medical laboratory technicians and technologists required to be maintained under section 16;

"Registrar" means the Registrar of medical laboratory technicians and technologists provided for under section 14.

PART II – THE KENYA MEDICAL LABORATORY TECHNICIANS AND TECHNOLOGISTS BOARD

3. Establishment and incorporation of the Board

(1) There is established a Board to be known as the Kenya Medical Laboratory Technicians and Technologists Board.

(2) The Board shall be a body corporate with perpetual succession and a common seal and shall, in its corporate name, be capable of—

(a) suing and being sued;

(b) taking, purchasing or otherwise acquiring, holding, charging or disposing of movable and immovable property;

(c) borrowing or lending money; and

(d) doing or performing all such other acts necessary for the proper performance of its functions under this Act which may lawfully be done or performed by a body corporate.

4. Headquarters

The Headquarters of the Board shall be in Nairobi.

5. Objects and functions of the Board

(1) The object and purpose for which the Board is established shall be to exercise general supervision and control over the training, business, practice and employment of laboratory technicians and technologists in Kenya and to advise the Government in relations to all aspects thereof.

(2) Without prejudice to the generality of the foregoing, the Board shall—

(a) prescribe, in consultation with the College and such approved training institutions as the Board may deem appropriate, the courses of instruction for laboratory technicians and technologists;

(b) consider and approve the qualifications of laboratory technicians and technologists for the purposes of registration under this Act;

(c) approve institutions for the training of laboratory technicians and technologists;

(d) licence and regulate the business and practice of registered laboratory technicians and technologists; and

(e) regulate the professional conduct of registered laboratory technicians and technologists and take such disciplinary measures as may be appropriate to maintain proper professional standards.

6. Membership of the Board

(1) The Board shall consist of—

(a) the Director of Medical Services;

(b) the head of the National Public Health Laboratories of the Ministry;

(c) the Registrar;

(d) the Director of technical training in the Ministry for the time being responsible for Education;

(e) the medical laboratory technologist in charge of the Division of Vector-borne Diseases;

(f) three registered laboratory technicians, two of whom shall be in private practice, to be elected by the Association;

(g) three registered laboratory technologists, two of whom shall be in private practice, elected by the Association;

(h) the executive chairman of the Association;

(i) not less than three but not more than five laboratory technicians and technologists appointed by the Minister; and

(j) not more than two other member co-opted by the Board from time to time whose knowledge and experience is deemed necessary for the better performance of its functions.

(2) The Minister shall appoint a chairman from among the members of the Board.

(3) The Board shall elect a vice-chairman from amongst its members, who shall be a laboratory technician or technologist in private practice.

7. Powers of the Board

The Board shall have all powers necessary for the proper performance of its functions under this Act and in particular, but without prejudice to the generality of the foregoing, the Board shall have power to—

(a) control, supervise and administer the assets of the Board in such manner and for such purpose as best promotes the purpose for which the Board is established;

(b) determine the provisions to be made for capital and recurrent expenditure and for the reserves of the Board;

(c) receive any grants, gifts, donations or endowments and make legitimate disbursements therefrom;

(d) enter into association with other bodies or organisations within or outside Kenya as the Board may consider desirable for appropriate and in furtherance of the purpose for which the Board is established;

(e) open a banking account or banking accounts for the funds of the Board; and

(f) invest any funds of the Board not immediately required for its purposes in the manner provided in section 38.

8. Conduct of business and affairs of the Board

(1) The conduct and regulation of the business and affairs of the Board shall be as provided in the Schedule.

(2) Except as provided in the Schedule, the Board may regulate its own procedure.

9. Delegation by the Board

Subject to this Act, the Board may, either generally or in any particular case, delegate to any committee of the Board or to any member, officer, employee or agent of the Board, the exercise of any of the powers or the performance of any of the functions or duties of the Board under this Act.

10. Remuneration of Board members

The Board shall pay its members such remuneration, fees or allowances for expenses it may determine.

11. Staff of the Board

The Board may appoint such officers and other staff as are necessary for the proper discharge of its functions under this Act, upon such terms and conditions of service as the Board may determine.

12. Protection from personal liability

No matter or thing done by a member of the Board or by any officer, employee or agent thereof shall if the matter or thing is done *bona fide* for executing the functions, powers or duties of the Board, render the member, officer, employee or agent personally liable to any action, claim or demand whatsoever.

13. Liability of Board for damages

The provisions of section 12 shall not relieve the Board of the liability to pay compensation to any person for any injury to him, his property or to any of his interests caused by the exercise of any power conferred by this Act or by the failure, whether wholly or partially, of any works.

PART III – REGISTRATION OF LABORATORY TECHNICIANS AND TECHNOLOGISTS

14. The Registrar

The Chief Medical Laboratory Technologist in the Ministry shall be the Registrar of the Board and shall perform such duties as are prescribed by this Act.

15. Registration

(1) A person who—

(a) has successfully attended a course of instruction for laboratory technicians or technologists prescribed by the Board pursuant to subsection (2) of section 5, at any approved training institution in Kenya; or

(b) has attended a course of instruction for laboratory technicians or technologists recognised by the Board as equivalent to the course prescribed under subsection (2) of section 5, at any training institution outside Kenya approved by the Board; or

(c) holds such other qualifications as the Board may prescribe; and

(d) has completed such approved period of probation as may be prescribed by the Board,

may apply to the Board for registration under this Act.

(2) Every application under subsection (1) shall be in the prescribed form and shall be accompanied by such fee as may be prescribed.

(3) The Board shall consider every application made under this section and shall register the applicant if satisfied that the applicant is—

(a) duly qualified in terms of this section; and

(b) a fit and proper person to be so registered.

(4) The Board shall register every qualified person by entering his name, address, professional qualifications and such other particulars as the Board may prescribe, in the appropriate register kept for that purpose pursuant to section 16.

(5) The Board shall, on payment of the prescribed fee, issue to every person registered under this Act, a certificate of registration in the prescribed form.

16. Registers to be kept

(1) The Registrar shall maintain—

(a) a register of medical laboratory technicians; and

(b) a register of medical laboratory technologists,

in such form as the Board may prescribe.

(2) The Registrar shall, not later than the 31st March in every year, cause to be published in the *Gazette*, the names and addresses of all laboratory technicians and technologists registered in the previous year.

17. Removal of names from the register

(1) The Registrar shall remove from the register—

(a) the names of all deceased persons;

(b) the names of all persons struck off the register under section 32;

(c) any entries fraudulently or erroneously made.

(2) The Registrar shall cause the name and address of every person whose name is removed from the Register under this section, to be published in the *Gazette* within one month from the date of such removal.

18. Training institutions to be approved

(1) No person shall, being in charge of a training institution in Kenya—

(a) admit persons for training with a view to qualifying for registration under this Act; or

(b) conduct a course of training or administer the examinations prescribed for the purposes of registration under this Act; or

(c) issue any document or statement implying that the holder thereof has undergone a course of training or passed the examinations prescribed by the Board for purposes of registration,

unless such institution is approved by the Board for that purpose in accordance with this Act.

(2) A person who contravenes any of the provisions of subsection (1) commits an offence and is liable on conviction to a fine not exceeding one million shillings, or to imprisonment for a term not exceeding five years, or to both.

(3) The Board shall, in regulations, prescribe the procedure for approving training institutions for the purposes of this section.

19. Offences relating to registration

(1) No person shall act as a laboratory technician or technologist in any health institution in Kenya unless such person is registered under this Act.

(2) A person who contravenes the provisions of subsection (1) commits an office and shall be liable on conviction to a fine not exceeding one hundred thousand shillings.

(3) No person shall, while in charge of a health institution or any medical laboratory in Kenya, employ any person as a laboratory technician or technologist who is not registered under this Act.

(4) A person who contravenes the provisions of subsection (3) commits an offence and shall be liable on conviction to a fine not exceeding one millions shillings or imprisonment for a term not exceeding five years or to both.

(5) Any person who in an application for registration, wilfully makes a false or misleading statement or utters a false certificate, commits an offence and shall be liable on conviction to a fine not exceeding one million shillings, or to imprisonment for a term not exceeding five years, or to both.

PART IV – PROVISIONS RELATING TO PRIVATE PRACTICE

20. Qualification for a private practice

(1) Subject to this Act, no person shall be qualified to engage in private practice as a laboratory technician or technologist unless such person—

(a) is a Kenya citizen;

(b) is registered under this Act;

(c) holds a valid practising certificate and annual licence issued under this Act;

(d) has served as a medical laboratory technician or technologist under supervision for a period of not less than five years in a medical laboratory; and

(e) holds such other qualification as the Board may prescribe.

(2) For the purposes of this Act, a person shall be deemed to engage in private practice if he practices as a laboratory technician or technologist—

(a) on his own account and is entitled to receive the entire amount of all fees and charges earned for his own financial benefit; or

(b) in partnership with others and is entitled to receive a share of the profits earned by such partnership for his own financial benefit and is liable to bear a share of any losses incurred by such partnership,

but no person shall be deemed to engage in private practice where he is employed—

(i) by the Government or any other public body; or

(ii) by a State corporation as defined by the State Corporations Act (Cap. 446); or

(iii) by any person or partnership engaged in his profession where all fees and charges earned by him enure to the benefit of his employer, notwithstanding that he is engaged in his professional capacity as a laboratory technician or technologist.

(3) A person who engages in private practice as a laboratory technician or technologist contrary to the provisions of this section commits an offence and shall be liable on conviction to a fine not exceeding one million shillings, or to imprisonment for a term not exceeding five years, or to both.

21. Board to issue practising certificates and annual licences

The Board shall issue in accordance with, but subject to, this Part and any rules made under this Act, certificates and annual licences authorising the medical laboratory technicians and technologists named therein to engage in private practice.

22. Application for practising certificate

(1) An application for a practising certificate shall be made to the Registrar in duplicate, signed by the applicant, specifying his name and place of business, his registration number and the date of his registration as a medical laboratory technician or technologist.

(2) Every application under this section shall be accompanied by the prescribed fee.

(3) The Board shall, where the laboratory technician or technologist is duly registered under this Act and is not for the time being suspended from practice, within sixty days of receipt by the Board of the application, issue to the applicant a practising certificate in the prescribed form.

(4) The Registrar shall keep one copy of every application delivered to him under this section and any person may inspect the register during office hours.

23. Duration of practising certificate

(1) Every practising certificate shall bear the date of the day on which it is issued and shall have effect from that day:

Provided that a practising certificate issued the first month of any practising year shall have effect for all purposes from the beginning of that month.

(2) The practising year shall be from 1st January to 31st December:

Provided that the Board with the approval of the Minister may, by order in the *Gazette*, alter the practising year and the order may make such transitional provisions in regard to incidental matters as may be expedient.

(3) Every practising certificate shall expire at the end of the practising year in which it was issued:

Provided that, where the name of the laboratory technician or technologist is removed or struck off the register, the practising certificate, if any, shall expire forthwith.

(4) The Registrar shall enter upon the register a note of the date of issue of every practising certificate.

24. Renewal, cancellation, suspension, etc., of practising certificate

(1) A laboratory technician or technologist issued with a practising certificate may apply for the renewal of the certificate in the prescribed form at least thirty days before the date of expiry thereof.

(2) Any laboratory technician or technologist who fails to renew his practising certificate within the prescribed period shall, when applying for a renewal, be required to pay such late application fee as shall be prescribed by the Board.

(3) The Board shall have the power to renew any practising certificate and may refuse to renew, cancel, withdraw or suspend any certificate if satisfied that the laboratory technician or technologist is guilty of professional misconduct or is in breach of any provisions of this Act or any regulations made thereunder, for a period of twelve months.

(4) Any laboratory technician or technologist aggrieved by the decision of the Board in the exercise of its powers under subsection (3) may appeal to the Minister within thirty days of the receipt of the decision and in every such case, the decision of the Minister shall be final.

25. Terms and conditions of private practice

(1) The Board shall, in regulations, prescribe the terms and conditions of the business and practice of laboratory technicians and technologists engaged in private practice.

(2) Regulations under subsection (1) shall in particular provide for—

(a) the equipment and reagents to be provided in private medical laboratories;

(b) the services to be rendered by laboratory technicians and technologists in private practice; and

(c) the employment of laboratory technicians and technologists in private medical laboratories.

(3) A person who breaches any term or condition prescribed by the Board under this section commits an offence and shall be liable on conviction to a fine not exceeding one hundred thousand shillings, or imprisonment for a term not exceeding twelve months, or to both.

PART V – DISCIPLINE

26. Disciplinary Committee

(1) There is established a Disciplinary Committee of the Board which shall consist of—

(a) the chairman of the Association who shall be the chairman of the Committee;

(b) one representative of the Minister who shall not be a member of the Board;

(c) one representative of the Attorney-General;

(d) the Registrar who shall be the secretary; and

(e) one technician from private practice nominated by the Board, who shall not be a member of the Board.

(2) The quorum of the Committee shall be all five members.

27. Reference of matters to the Committee

(1) If the Board has reason to believe in respect of any registered person that such person, either before or after he became registered—

(a) has been convicted of an offence punishable by imprisonment, the commission of which in the opinion of the Board, has dishonoured him in the public estimation; or

(b) has been guilty of negligence or professional misconduct in respect of his calling; or

(c) has been guilty of impropriety or misconduct in respect of his calling,

it may refer the matter to the Disciplinary Committee.

28. Functions of the Committee

The functions of the Committee shall be to inquire into any matter referred to it by the Board under section 29 and to make its recommendations thereon to the Board.

29. Procedure of the Committee

(1) Upon an inquiry under section 30, the laboratory technician or technologist subject to the inquiry shall be afforded an opportunity of being heard either in person or by an advocate.

(2) For the purpose of proceedings at any inquiry by the committee, the committee may administer oaths or affirmation and may, subject to any regulations made under section 42, enforce the attendance of persons as witnesses and the production of books and documents.

(3) The Committee shall, subject to any regulations made under this Act, have powers to regulate its own procedure in any disciplinary proceedings.

30. Disciplinary measures

(1) Where on the recommendations of the Committee the Board is satisfied that a laboratory technician or technologist is in breach of any of the terms or conditions prescribed by the Board under section 27, the Board may—

(a) issue the laboratory technician or technologist with a letter of admonishment; or

(b) suspend the registration certificate of the laboratory technician or technologist for a specified period not exceeding twelve months; or

(c) withdraw or cancel the practising certificate, or suspend the practising certificate of the laboratory technician or technologist for a period not exceeding three months; or

(d) impose a fine which the Board deems appropriate in the circumstance; or

(e) remove the name of the laboratory technician or technologist from the register.

(2) The Board may be reimbursed by the medical laboratory technician or technologist costs and witness expenses incurred in connection with the disciplinary hearing and such costs shall be civil debt recoverable summarily by the Board.

(3) Where after the hearing in disciplinary proceedings under this Act, the Committee recommends to the Board that a registered laboratory technician or technologist is unfit to practice his profession as a result of ill-health, the Board may, if satisfied with the Committee's recommendations, withdraw the technologist's or technician's certificate of registration or practising certificate until such a time as the Board is satisfied that the laboratory technician or technologist is fully recovered to resume his duties.

(4) A laboratory technician or technologist who has been suspended from practice or whose licence to practice has been withdrawn or cancelled shall from the date of such suspension, withdrawal or cancellation, surrender to the Registrar his registration and practising certificates and annual licence.

(5) Any person being a registered medical laboratory technician or technologist who refuses or fails to surrender his badges, licences or certificates, to the Registrar on request shall be guilty of professional misconduct and liable to be fined by the Board a fine of not less than twenty thousand shillings.

(6) Any medical laboratory technician or technologist who is aggrieved by the decision of the Board in the exercise of its powers under this section may within sixty days from the date of the decision of the Board appeal to the High Court and in any such appeal, the High Court may annul or vary the decision as it thinks fit.

31. Lifting of suspension

(1) Where a medical laboratory technician or technologist has been suspended from practising, he may appeal to the Board for the lifting of the suspension at any time before the expiry thereof.

(2) Where the Board is satisfied in respect of any medical laboratory technician or technologist that he should have his suspension lifted, the Board shall, upon the receipt of the prescribed fee, lift the suspension and restore to the laboratory technician or technologist, his registration and practising certificates and his annual licence.

32. Restoration of the name in the register

(1) A laboratory technician or technologist whose name has been removed from the register may after the expiry of a period of three years from the date of such removal, appeal to the Board for restoration of his name in the register.

(2) The Board may after considering the appeal made under subsection (1), cause the name of the person appealing to be restored in the appropriate register, upon payment of the prescribed fee.

PART VI – FINANCIAL PROVISIONS

33. Funds of the Board

The funds of the Board shall comprise of—

(a) such monies as may accrue to or vest in the Board in the course of the exercise of its powers or the performance of its functions under this Act;

(b) all monies from any other source provided for or donated or lent to the Board.

34. Financial year

The financial year of the Board shall be the period of twelve months ending on the 30th June in every year.

35. Annual estimates

(1) Before the commencement of each financial year, the Board shall cause to be prepared estimates of revenue and expenditure of the Board for that year.

(2) The annual estimates shall make provisions for all the estimated expenditure of the Board for the financial year concerned and in particular shall provide for—

(a) the payment of salaries, allowances and other charges in respect of the staff of the Board;

(b) the payment of pensions, gratuities and other charges in respect of retirement benefits which are payable out of the funds of the Board;

(c) the proper maintenance of buildings and grounds of the Board;

(d) the acquisition, maintenance, repair and replacement of the equipment and other movable property of the Board;

(e) the creation of such reserve funds to meet future or contingent liabilities in respect of retirement benefits, insurance or replacement of buildings or equipment, or in respect of such other matter as the Board may deem appropriate.

(3) The annual estimates shall be approved by the Board before the commencement of the financial year to which they relate and shall be submitted to the Minister for approval, and after the Minister has given his approval, the Board shall not increase any sum provided in the estimates without the consent of the Minister.

36. Investment of funds

The Board may invest any of the funds of the Board in securities in which for the time being trustees may by law invest funds or in any other securities which the Treasury may from time to time approve for that purpose.

37. Accounts and audit

(1) The Board shall cause to be kept all proper books and records of accounts of the income, expenditure, assets and liabilities of the Board.

(2) Within a period of three months from the end of each financial year, the Board shall submit to the Auditor-General (Corporations) or an auditor appointed under subsection (3), the accounts of the Board together with—

(a) a statement of income and expenditure during the year; and

(b) a statement of the assets and liabilities of the Board on the last day of that year.

(3) The accounts of the Board shall be audited by the Auditor-General (Corporations) or by an auditor appointed by the Board under the authority of the Auditor-General (Corporations) given in accordance with subsection (2)(b) of the Exchequer and Audit Act (Cap. 412).

(4) The Auditor-General (Corporations) may give general or special directions to an auditor appointed under subsection (3) and the auditor shall comply with such directions.

(5) An auditor appointed under subsection (3) shall report directly to the Auditor-General (Corporations) on any matter relating to the directions given under subsection (4).

(6) Within a period of two months after the end of the financial year, the Auditor-General (Corporations) shall report on the examination and audit of the accounts of the Board to the Minister and where an auditor has been appointed under subsection (3) he shall transmit a copy of the report to the Auditor-General (Corporations).

(7) The fee payable to an auditor appointed under subsection (3), shall be fixed and paid by the Board.

PART VII – MISCELLANEOUS PROVISIONS

38. Certificates

(1) A certificate under the seal of the Board to the effect that a person is or was at any date registered under this Act shall be conclusive evidence of the facts so stated.

(2) All certificates under the seal of the Board shall remain the property of the Board.

(3) A person whose name is removed from the register under section 32, or in the case of a deceased person, his legal representative, shall, within thirty days of the publication of such removal, surrender the certificate of registration of that person to the Board.

(4) A person who—

(a) destroys or defaces a certificate of registration; or

(b) fails to surrender certificate of registration under subsection (3),

commits an offence and is liable on conviction to imprisonment for a term not exceeding three months.

(5) A person who, without reasonable excuse, is in possession of a certificate of registration not issued to him, or fails to surrender such certificate under subsection (3), commits an offence and is liable to a fine not exceeding one million shillings, or to imprisonment for a term not exceeding five years, or to both.

39. General penalty

Any person convicted of an offence under this Act for which no penalty is provided shall be liable to a fine not exceeding thirty thousand shillings.

40. Regulations

The Board may, with the approval of the Minister, make regulations generally for the better carrying out of the provisions of this Act, and, without prejudice to the generality of the foregoing, such regulations may provide for—

(a) the form and method of keeping the registers and other records under this Act;

(b) the conditions under which the training institutions for persons desirous of obtaining registration under this Act may be approved and the courses of instruction to be undergone by persons seeking such registration;

(c) the course content and examinations for laboratory technicians and technologists for purpose of registration under this Act;

(d) the standards and conditions of professional practice of registered laboratory technicians and technologists;

(e) forms and fees;

(f) the procedure for election of the members of the Board required to be elected; and

(g) the inspection of medical laboratories.

SCHEDULE

[Section 8.]

PROVISIONS AS TO THE CONDUCT OF BUSINESS AND AFFAIRS OF THE BOARD

1. Tenure of office

A member of the Board other than an *ex officio* member shall, subject to the provisions of this Schedule, hold office for a period of three years, on such terms and conditions as may be specified in the instrument of appointment, but shall be eligible for re-appointment or re-election, as the case may be.

2. Vacation of office

A member other than the chairman or an *ex officio* member may—

(a) at anytime resign from office by notice in writing to the Board through the Registrar;

(b) be removed from office by the Minister if the member—

(i) has been absent from three consecutive meetings of the Board without permission from the Board;

(ii) is convicted of a criminal offence and sentenced to imprisonment for a term exceeding six months or to a fine exceeding ten thousand shillings;

(iii) is incapacitated by prolonged physical or mental illness; or

(iv) is otherwise unable or unfit to discharge his functions.

3. Meetings

(1) The Board shall meet not less than four times in every financial year and not more than four months shall elapse between the date of one meeting and the date of the next meeting.

(2) Notwithstanding paragraph (1), the chairman may, and upon requisition in writing by at least five members shall, convene a special meeting of the Board at any time for the transaction of the business of the Board.

(3) Unless three-quarters of the total members of the Board otherwise agree, at least fourteen days' written notice of every meeting of the Board shall be given to every member of the Board.

(4) The quorum for the conduct of the business of the Board shall be eleven members.

(5) The chairman shall preside at every meeting of the Board at which he is present but in his absence, the vice-chairman shall preside and shall, with respect to that meeting and the business transacted thereat, have all the powers of the chairman.

(6) In the event of the absence of both the chairman and the vice-chairman, the members present shall elect one of their number to preside, who shall, with respect to that meeting and the business transacted thereat, have all the powers of the chairman.

(7) Unless a unanimous decision is reached, a decision on any matter before the Board shall be by a majority of the votes of the members present and voting and in the case of an equality of votes, the chairman or the vice-chairman or the person presiding shall have a casting vote.

(8) Subject to paragraph (4), no proceedings of the Board shall be invalid by reason only of a vacancy among the members thereof.

(9) Subject to the provisions of this Schedule, the Board may determine its own procedure and the procedure for any committee of the Board and for the attendance of other persons at its meetings and may make standing orders in respect thereof.

4. Disclosure of interest

(1) If a member is directly or indirectly interested in any contract, proposed contract or other matter before the Board and is present at a meeting of the Board at which the contract, proposed contract or other matter is the subject of consideration, he shall, at the meeting and as soon as reasonably practicable after the commencement thereof, disclose the fact and shall not take part in the consideration or discussion of, or vote on, any questions with respect to the contract or other matter, or be counted in the quorum of the meeting during consideration of the matter.

(2) A disclosure of interest made under this paragraph shall be recorded in the minutes of the meeting at which it is made.

5. The common seal

The affixing of the common seal of the Board shall be authenticated by the signature of he chairman and the Registrar and any document not required by law to be made under seal and all decisions of the Board may be authenticated by the signatures of the chairman and the Registrar:

Provided that the Board shall, in the absence of either the chairman or the Registrar in any particular matter, nominate one member to authenticate the seal of the Board on behalf of either the chairman or the Registrar.

6. Contracts and instruments

Any contract or instrument which, if entered into or executed by a person not being a body corporate, would not require to be under seal, may be entered into or executed on behalf of the Board by any person generally or specially authorised by the Board for that purpose.

CHAPTER 253A

MEDICAL LABORATORY TECHNICIANS AND TECHNOLOGISTS ACT

SUBSIDIARY LEGISLATION

List of Subsidiary Legislation

MEDICAL LABORATORY TECHNICIANS AND TECHNOLOGISTS (CURRICULUM AND COURSE CONTENT) REGULATIONS, 2006

[L.N. 13/2006.]

1. The Regulations may be cited as the Medical Laboratory Technicians and Technologists (Curriculum and Course Content) Regulations, 2006.

2. For the purpose of registration as a laboratory technician and technologist under the Act, the curriculum and course content set out in the Schedules shall apply and in particular, the curriculum and course content set out in the First Schedule shall apply to Certificate courses while the curriculum and course content set out in the Second Schedule shall apply to Diploma courses and the curriculum and course content set out in the Third Schedule shall apply to the Higher Diploma courses.

3. The Board may, in consultation with the College and with the approval of the Minister, amend the Schedules from time to time.

REPUBLIC OF KENYA

MINISTRY OF HEALTH

FIRST SCHEDULE

r. 2

REPUBLIC OF KENYA

MINISTRY OF HEALTH

THE KENYA MEDICAL LABORATORY TECHNICIANS AND TECHNOLOGISTS BOARD

CURRICULUM FOR CERTIFICATE IN MEDICAL LABORATORY SCIENCES

TABLE OF CONTENTS

FIRST SCHEDULE—*continued*

1.0 COURSE TITLE

INTRODUCTION

This course is intended to equip the trainee with knowledge, skills and attitudes to enable them to work as medical laboratory technicians.

2.0 RATIONALE

The public has become more aware of their health needs hence increasing the demand for laboratory services, which also includes use of technology and techniques that were not available previously.

Therefore the course aims at providing healthcare professionals who will serve at primary health care level (health centre/dispensaries) in both the public and private sectors.

3.0 ROLES AND FUNCTIONS

(i) Carry out basic laboratory tests.

(i) Report on laboratory results.

(i) Maintain laboratory equipment.

(i) Manage a laboratory.

4.0 PROGRAMME AIM

The course is intended to provide trainees with knowledge, skills and attitudes that will enable them to provide basic medical laboratory services.

5.0 PROGRAMME OBJECTIVES

At the end of the course, the trainee should be able to do the following in a basic medical laboratory—

5.0.1 understand the basic techniques applied in the medical laboratory;

5.0.2 practice safety precautions in a medical laboratory;

5.0.3 select, set up and operate laboratory equipment;

5.0.4 apply standard operating procedures to obtain quality results;

5.0.5 acquire attitude that enhances the delivery of quality service;

5.0.6 use the appropriate knowledge and skills in problem solving in the work environment;

5.0.7 contribute to the development of science and technology through creativity and application of acquired knowledge, skills and attitudes;

5.0.8 observe the professional code of conduct.

6.0 ADMISSION REQUIREMENTS

Trainees entering this course should have the following minimum requirements obtained at one sitting—

Kenya Certificate of Secondary Education (K.C.S.E.) with a mean grade of C– (minus) or equivalent, and in addition a minimum grade of C– (minus) in the following—

Biology/biological sciences.

FIRST SCHEDULE—*continued*

Chemistry/physical sciences.

English or Kiswahili.

They should also have a minimum grade of D+ in the following—

Mathematics or Physics.

7.0 COURSE DURATION

The course is designed to have duration of two (2) years of 1 980 contact hours where 1 320 hours are spent on campus and 660 hours are spent outside campus on clinical placement.

8.0 ATTENDANCE PATTERN

8.0.1 TERM SYSTEM

Each academic year will be three (3) terms which will be covered as follows in each term:

Year		*On Campus*	*Clinical Attachment Hours*
1.	TERM ONE	440	–
	TERM TWO	440	–
	TERM THREE	440	–
2.	TERM FOUR	–	440
	TERM FIVE	–	440
	TERM SIX	440	–
TOTAL		1760	880

9.0 AWARD OF CERTIFICATE

K.M.L.T.T.B. or its agent shall award the certificates.

10.0 TEACHING METHODS

For trainees to attain the basic competencies, the following teaching methods shall be applied—

- discussion;
- lectures;
- role play;
- simulation;
- demonstration;
- class practicals;
- project;
- tutorials;
- attachment;
- field visits.

10.0.1 TEACHING AIDS AND RESOURCES

The following teaching aids and resources shall be applied in the teaching methods employed during the course—

FIRST SCHEDULE—*continued*

10.0.2 AIDS

- Chalkboard/whiteboard.
- Charts.
- Slide projector.
- Models.
- Specimen.
- Realia.
- Overhead projector.
- Radio.
- Video/film.
- Computer Interactive learning.
- Computer-aided/assisted learning.

10.0.3 RESOURCES

- Recommended textbooks.
- Library.
- Laboratory.
- Health institution.

10.0.4 FORMAT OF STUDENTS ASSESSMENT AND EVALUATION

10.0.4.1 Each trainee shall be expected to attend at least 90% of the possible attendance in each subject and complete satisfactorily the coursework to qualify for the summative examination.

10.0.4.2 Each trainee shall be expected to have passed each subject at 50% as the pass mark to qualify for the next level.

10.0.4.3 Course work will be given a weighting of 40% as the final examination weight age of 60% will apply in the determination of examination results.

10.0.4.4 Assessment and evaluation shall be categorised as follows—

12.1.1 Continuous Assessment

(Conducted instructions)

(a) Timed tests.

(a) Carry away tests.

(a) Practicals and orals.

(a) Assignments.

(a) Projects.

(a) Oral examinations (*viva voce*).

10.0.4.5 Summative Examinations.

Shall be conducted by a K.M.L.T.T.B. authorised examination body.

10.0.4.6 Format of the subjects for examination in the final examination shall be—

(a) Project.

(a) Practicals and orals.

(a) Six (6) theory papers.

(i) Microbiology.

FIRST SCHEDULE—*continued*

(i) Virology.
(i) Clinical Chemistry.
(i) Histopathology.
(i) Haematology.
(i) Blood Transfusion Science.
(i) Parasitology.

10.0.4.7 Length of papers.

Time for each paper shall be allocated as follows—

(a)	Project	60 hours
(b)	Practicals and orals	4 hours
(c)	Theory	2 hours each.

10.0.4.8 The following grading system shall be used—

Grade	*Score%*
A	75–100
B	65–74
C	50–64
D	40–49
E	0–39

11.0 CHEMISTRY

This course is intended to provide trainees with the pre-requisite knowledge in the application of knowledge and skills in the professional subjects.

11.0.1 GENERAL OBJECTIVES

At the end of the course, the trainee should be able to—

- state physical and chemical changes;
- describe the atomic structure;
- describe the periodic table, relative to the first twenty elements;
- explain various types of bonds;
- balance chemical equations;
- explain use of ph scale;
- explain the terms used in chromatography as a qualitative method.
- explain the application of different types of chromatography;
- explain titrimetric analysis as a quantitative technique;
- explain concentration terms;
- prepare solutions;
- define the term organic chemistry;
- identify functional groups of hydrocarbons;
- state common uses of hydrocarbons.

11.0.2 CONTENT

Quantitative Analysis	• Definition of qualitative analysis. • Concentration terms. • Preparation of solutions. • Acid/base indicators. • Glassware used in quantitative measurements.
Organic chemistry	• Terms used. • Difference between saturated and unsaturated compounds. • Homologous series. • Common uses. Alkanes Alcohol. Aldehydes. Ketones. Carboxylic acids.
Physical and chemical changes	• Physical changes. • Chemical changes.
Atom, elements, compound and mixtures	• Structure of an atom properties of an atom. • Dalton's Atomic Theory. • Mixtures and compounds. • The Periodic Table. • Relationship of physical and chemical properties and their position in the Periodic Table. • Relationship of physical and chemical properties of elements in the Periodic Table.
Chemical combinations	• Types of bonds. • Chemical equations. • Properties of bonds.
Acid, bases and salts	• Definitions. • Properties. • Differences between weak and strong acids and bases. • pH scale. • Neutralization. • Salts.

12.0 COMPUTERS

12.0.1 This unit prepares the student to understand the role of computers in managing a laboratory and to keep in line with the trends all over the world.

12.0.2 GENERAL OBJECTIVES

At the end of this unit, the students should be able to—

(i) Describe the basic components of computers.
(i) State the principles of computer operating systems and information processing.
(i) Apply common computer software packages for data management.
(i) Understand the use of computers in health care services and research.

FIRST SCHEDULE—*continued*

12.0.3 CONTENTS

a) Computers:
- Personal computers.
- Micro computers.

Components of a computer:
- Hardware and software.
- Hardware: CPU, input and output devices, files storage devices.

Software operating systems: Application programmes.

2) Principles of computer operating system:

- OS
- Application programmes:
  - Major applications.
- Data management: Person's role to assure correct data.
  - Computer environment – Assuring power supply.
  - Introduction to windows – Word processing.

  Setting up files.

  Modifying, storing and laboratory management.

4) Use of computers in healthcare laboratory delivery and laboratory management.

13.0 ENTREPRENEURSHIP EDUCATION

13.0.1 AIM: This subject is intended to equip the trainee with knowledge, skills and attitudes that may enable the trainee to start and manage a business enterprise.

13.0.2 OBJECTIVES

At the end of this unit, the trainee should—

(a) acquire positive attitude toward self-employment;

(a) understand the factors that affect the success of an enterprise;

(a) apply entrepreneurial competency in business situations;

(a) manage an enterprise successfully.

13.0.3 SUBJECT SUMMARY

Topic	*Sub-topic*	*Time*
ENTREPRENEURSHIP AND SELF-EMPLOYMENT	• Importance of self-employment. • Entrepreneurship contribution to national development. • Requirements for entry into self-employment.	
ENTREPRENEURIAL OPPORTUNITIES	• Business opportunities. • Assessing product demand. • Matching skills and resources to changing technology.	
ENTREPRENEURIAL AWARENESS	• Evaluating business environment. • Type of business finance. • Contractual agreements. • Government policy on small-scale enterprises. • Problems of starting a business enterprise.	
ENTREPRENEURIAL MOTIVATION	• Internal motivating factors. • Techniques of self-assessment. • External motivating factors.	

FIRST SCHEDULE—*continued*

Topic	*Sub-topic*	*Time*
ENTREPRENEURIAL COMPETENCE	• Decision-making in business. • Institute change. • Coping with competition. • Risk-taking. • Techniques of time management. • Leadership qualities.	
ENTERPRISE MANAGEMENT	• Evaluating business goals. • Efficiency of resources utilisation. • Finance planning. • Production management. • Management of human resources. • Work study. • Marketing and public relations. • Information management. • Project planning.	

14.0 HUMAN ANATOMY AND PHYSIOLOGY

14.0.1 AIM: This subject is intended to equip the trainee with the knowledge, skills and attitudes to understand the various parts and functions of the body in relation to the medical laboratory profession.

14.0.2 OBJECTIVES

(i) Define anatomy and physiology.

(ii) Outline the anatomy and physiology of the circulatory (blood), urinary, digestive, respiratory and reproductive systems.

(iii) Identify various cells, tissues, organs and systems.

Topic	*Sub-topic*	*Time*
(i) Introduction to anatomy and physiology	Definition Importance Cells: Structure Functions. Epithelial cells: Definition, Types, Structure and Sites. Tissue: Types. Organs: Structures. Systems: Functions.	
(ii) Circulatory system	Blood, the heart, blood vessels and sketch of these structures.	
(iii) Urino-genital-system	The kidney and urino-genital tract, the reproductive organs, sketch of their structures.	
(iv) Digestive system	The stomach, the liver, intestines, pancreas and their sketches.	

FIRST SCHEDULE—*continued*

Topic	*Sub-topic*	*Time*
(v) Respiratory system	The nose, trachea, and lungs and their sketches.	
(vi) Practical	Identification of various cells, tissues, organs and systems.	

15.0 INSTRUMENTATION

15.0.1 AIM: This course unit is intended to equip the trainee with knowledge, skills and attitudes to be able to maintain, handle and operate laboratory instruments and apparatus.

15.0.2 General objectives

At the end of this course unit, the trainee should be able to—

(i) identify the types of laboratory instruments and apparatus;

(ii) install instruments and organise benches;

(iii) understand principles of functional units and instrument operation;

(iv) maintain daily checks, services and decontamination.

15.0.3 CONTENT

Topic		*Sub-topic*
1.	Laboratory instruments	Colorimeter, flame, photometer, oven, incubators, microscopes urinometers, centrifuge, ISE, deepfreezers, refrigerators, glucometer, stills, balances.
	Apparatus	Dilutors, dispensers, laboratory, ware, integral syringe.
2.	Instrument installation	Size of instrument weight, voltage, ventilation.
3.	Bench organization	Water, volatile chemicals, fumes, fire outbreak, biowaste.
4.	Principles of functional units	• Photometry: colorimeter flame photometer glucometer, ELISA. • Heating elements: water bath, incubators, hot air, autoclave, stills, incinerators. • Microscopy: miscropes: light-inverted. • Photoelectric.
		• Centrifugal forces: centrifuges. • Refrigeration: deep freezers, refrigerators, cold room. • Density: urinometer. • Measurement: weight-balance, volume-dilutors, dispensers, integral syringes and reagent bottles. • Electrochemistry: Ion selective electrodes De-ionizers pH meter.
5.	Daily maintenance • Instruments • apparatus • decontamination	• Dusting, covering, cleaning of instruments, daily checks, and servicing visits, trouble-shooting. • Cleaning, drying. • Disinfectant, anti-septic, sterilisation.

FIRST SCHEDULE—*continued*

16.0 MANAGEMENT/LABORATORY PRACTICE

16.0.1 AIM: This course unit is intended to equip students with knowledge, attitudes and skills that will enhance efficient delivery and interaction with staff and patients.

16.0.2 GENERAL OBJECTIVES

(1) Design a standard laboratory layout.

(2) Practice general safety procedures in the laboratory.

(3) Carry out specific cleaning procedures of apparatus and the general laboratory.

(4) Maintain a laboratory inventory.

(5) Prepare purchase documents.

(6) Administer basic first-aid.

(7) Demonstrate the procedures to handle a victim.

(8) Identify tools and equipment in first-aid.

(9) Describe the principles and practice of laboratory management.

(10) Demonstrate skills of effective communication.

(11) Identify methods of storing and retrieval of information.

16.0.3 CONTENT

Code	*Topic*	*Sub-topic*	*Time*
	Laboratory layout	• Draw a simple basic laboratory layout. • Visit medical laboratories.	
	Safety	• Glass fittings. • Electrical connection heating. • Fire extinguishing and control. • Protective clothing. • Storage of chemicals, reagents and specimens cabinets.	
		• Carrying, transporting and mixing of chemicals and reagents. • Labelling classification.	
	Cleanliness	• Cleaning of benches, floor, sink, glassware, plasticware and procedures involved.	
	First aid	• Definition, aims and roles of first-aid. • Assessment of accident situation. • Management of clinical conditions requiring first-aid. • Ethics in first-aid. • Demonstrations from St. Johns Ambulance on first-aid techniques.	
	Management	• Inventory and purchasing. • Recording information. • Stock-taking. • Preparation of purchase documents.	

FIRST SCHEDULE—*continued*

Code	*Topic*	*Sub-topic*	*Time*
	Communication	• Communication. • Skills. • Implementing storage and retrieval.	

17.0 MATHEMATICS AND STATISTICS

17.0.1 AIM: This course unit is intended to review and update the trainee knowledge, skills and attitudes required for understanding mathematical and statistical skills applied in the profession.

17.0.2 GENERAL OBJECTIVES

At the end of this course unit, the trainee should be able to—

(a) Perform basic use of numbers and algebraic expressions.

(b) Use graphs and related techniques to solve problems.

(c) Use statistical techniques to collect and represent data.

(d) Carry out basic data analysis.

17.0.3 CONTENTS

Topic	*Sub-topic*
1. Algebra	• Indices. • Logarithms. • Applications of logarithms. • Linear equations. • Simultaneous equations. • Matrices. • Transposition of formulae.
2. Quadratic equations	• Solutions. • Applications.
3. Linear and non-linear graphs	• Construction. • Solutions.
4. Collection, organization and presentation of data	• Data collection. • Data organization. • Date presentation.
5. Data analysis	• Measures of central tendency. • Measures of dispersion.
6. Simple regression and correlation analysis	• Regression analysis equivalent 2 variables only. • Correlation analysis 2 variables only.

18.0 MEDICAL TERMINOLOGY

18.0.1 AIM: This unit is intended to enable students understand medical terminologies for the purpose of interaction in class and work-places and use in reporting laboratory results.

FIRST SCHEDULE—*continued*

18.0.2 GENERAL OBJECTIVES

(1) List commonly used medical terms and words.

(2) Discuss the meanings of these word.

(3) Understand the Greek alphabets.

(4) Explain the usage and applicability of these terms and words.

18.0.3 CONTENTS

(1) Common medical terms, qualities of medical languages, principles of derivation (i.e. words from Latin and Greek).

(2) Discuss word-roots, prefixes, suffixes—

- combining forms;
- compound words (Greek and Latin);
- anatomical synonyms.

(3) Greek alphabet.

(4) Words pertaining to—

- Resemblance.
- Cavites.
- Deficiencies.
- Excess numbers.
- Difficulties.
- Ease.
- Paired and unpaired.
- Measurement and size.
- Shapes.
- Softness, hardness and thickness.
- Sensation, feeling and affection.
- Growth and reproduction.
- Goodness and badness.
- Colour.
- Movement and transport.
- Medical entomological terms.

19.0 RESEARCH METHODS AND PROJECT

19.0.1 AIM: This course aims at equipping the trainees with knowledge, skills and attitudes that will enable them carry out scientific projects.

19.0.2 GENERAL OBJECTIVES

At the end of this course unit, the trainee should be able to—

(1) Collect project data and present the date;

FIRST SCHEDULE—*continued*

(2) Analyze the data;

(3) Interpret the data;

(4) Prepare a project report in a structure format.

19.0.3 CONTENT

Topic	*Sub-topic*
Introduction	• Projects.
Data collection	• Observational method. • Interviews and questionnaires. • Trace measures. • Content analysis. • Data achieves. • Measurements. • Qualitative method ○ Data representation, ○ Central tendency, ○ Dispersion, ○ Regression analysis.
Use of computer	• Application of spreadsheets to compiling data. • Production of report.
Project write-up	• Documentation of sources. • Carrying out of project. • Reporting ○ Layout, ○ Data presentation.

20.0 SOCIAL STUDIES PROFESSIONAL CONDUCT, ETHICS AND LAW

20.0.1 AIM: This course is intended to equip the trainee with knowledge, social skills and attitudes for effective role-play in society and work-place.

20.0.2 OBJECTIVES

At the end of this course unit the trainee should be able to—

(a) Formulate personal ideas;

(b) Relate the behaviors of individual to their efficiency and effectiveness in an organisation;

(c) Understand the Public Health Act and M.L.T.T. Act;

(d) Comply with the provisions of the M.L.T.T. Act and the relevant provisions of the Public Health Act (Cap. 242);

(e) Understand the role of Government.

20.0.3 CONTENT

Topic	*Sub-topic*	*Time*
1. SOCIAL STUDIES	• Basic medical psychology.	

FIRST SCHEDULE—*continued*

Topic	*Sub-topic*	*Time*
	• Basic medical sociology. • Social economics. • Government. • National philosophy. • Science and technology. • Commerce. • Personal inter-relationships.	
2. ETHICS	• Meaning and importance. • Role of religion on society. • Significance of social and individual values. • Constitution of Association of Kenya Medical Laboratory Scientific Officers. • Technology and religion.	
3. LAW	• Definition. • Importance of law. • Sources of Kenyan Law's Public Health Act. • Medical Laboratories Technicians and Technologists Act. • Elements of law. • Law in day to day life of an individual.	

21.0 STERILIZATION AND DISINFECTION

21.0.1 AIM: The subject is intended to equip the trainee with the knowledge, skills and attitudes to understand the importance, and practice sterilisation and disinfection in a medical laboratory.

21.0.2 OBJECTIVES

At the end of the topic, the learner should be able to—

(i) define terminologies used in sterilisation and disinfection.

(ii) explain techniques used for sterility testing.

(iii) explain methods and factors influencing sterilisation.

(iv) practice sterilisation, disinfection and waste disposal in various disciplines.

21.0.3 CONTENT

Topic	*Sub-topic*	*Time*
Terminologies	Sterilization, disinfection, germicides, bactericides, antiseptics, fungicides, bacteriostatics.	
Methods	Physical methods: Heat, dry heat, moist heat. Radiation: Ultra-violet, ionisation radiation, filtration. Chemical methods: Alcohol, chloroform, chlorine, glycerol, phenol, cresol, aldehyde, quaternary ammonium compounds.	

FIRST SCHEDULE—*continued*

Topic	*Sub-topic*	*Time*
Factors influencing sterilisation	Nature, load and type of micro-organisms, nature of material and containers, time and temperature, humidity and organic contaminants.	
Sterility testing	Automatic process control, recording thermometer, thermocouple measurement, chemical indicators, adhesive tape (autoclave) biological control.	
Sterilization, disinfection and waste disposal	Microbiology, clinical chemistry, haematology, blood transfusion, parasitology, histopathology.	

22.0 MICROBIOLOGY

22.0.1 AIM: To equip trainees with adequate knowledge, skills and attitudes to enable them to work in a health centre laboratory effectively.

22.0.2 OBJECTIVES

Year One

By the end of the 1st year, the trainee should be able to—

(i) State and define the major classes of micro-organisms;
(ii) Outline laboratory safety measures;
(iii) Describe various sterilisation methods;
(iv) Explain collection and processing of specimens;
(v) Explain the various staining techniques;
(vi) Describe the types of culture media;
(vii) Explain the cultivation of bacteria;
(viii) Systematic Bacteriology.

22.0.3 SYSTEMATIC BACTERIOLOGY

(i) Explain the morphology and staining of the organism.
(ii) Explain cultural characteristics.
(iii) Explain the biochemical characteristics.

22.0.4 CONTENTS

Year One

Major classes—bacterial, fungi, viruses, protozoa, mycoplasm, chlamydia, and rickettsia safety measures in the laboratory, safety cabinets, WHO code of practice, laboratory acquired infections, handling and storage of chemicals and laboratory waste disposal.

22.0.4.1 Methods of sterilisation

- Definitions.
- Sterilizations.
- Disinfections.
- Antiseptic.
- Heat.
- Chemical.

FIRST SCHEDULE—*continued*

- Radiation.
- Filtration.

22.0.4.2 Collection and processing of specimen

- Specimen containers.
- Collection of specimen.
- Preparation and sterilisation.

22.0.4.3 Types of specimens

- Urine.
- Sputum.
- Stool.
- Pus.
- Fluids.
- Cerebral spinal cord.
- Blood.
- Swab.
- Skin, hair, nail.
- Aspirates.

22.0.4.4 Processing of specimens

22.0.4.5 Staining techniques

- Gram stain.
- Negative stain.
- ZN stain.

22.0.4.6 Culture media

- Types of culture media.
- Basic, enriched, selective.
- Differential, transport.
- Preparation of media.
- Preparation methods, storage—quality control.

22.0.4.7 Culture of Micro-Organisms

- Growth requirements, culture techniques.

22.0.4.8 Identification of Micro-Organisms

- Biochemical tests, serological tests.

22.0.4.9 Systematic Bacteriology

For each genus give*:*

- Morphology and staining, culture characteristics, biochemical characteristics, laboratory diagnosis.
- Genus:
- Staphylococcus, Streptococcus, Neisseria, Escherichia, Klebsiella, Citrobacter, Enterobacter, Yersinia, Salmonella, Shigella, Proteus, Haemophilus.

22.0.4.10 Objectives Year Two (2)

(i) Outline the disc diffusion method of sensitivity.

(ii) Define the terms used in mycology.

(iii) Describe the morphology of fungi.

FIRST SCHEDULE—*continued*

22.0.5 CONTENT YEAR TWO (2)

22.0.5.1 Systematic Bacteriology (continued)

Pseudomonas, Vibrio, Brucella, Bordetella, Clostridium, Bacillus Corynebacterium, Mycobacterium, Treponema.

Antibial sensitivity testing, disc diffusion method.

22.0.5.2 Mycology

- Definition of terms.
- Moulds, yeast.
- Morphology and staining.
- Yeast cells, gram staining, negative stain potassium hydroxide preparation.

23.0 CLINICAL CHEMISTRY

23.0.1 AIM: The course unit is intended to provide the trainee with attitudes, knowledge and skills to be able to work effectively in a clinical chemistry laboratory.

23.0.2 GENERAL OBJECTIVES

At the end of this course unit the trainee should be able to perform the following in a clinical chemistry laboratory—

(i) Describe basic concepts of clinical chemistry;
(ii) Understand basic chemistry;
(iii) Practice safely measures;
(iv) Maintain and care for equipment and apparatus;
(v) Store chemicals and reagents;
(vi) Collect specimen;
(vii) Understand basic principles of techniques.

Year	*Topic*	*Sub-topic*
	Introduction	Clinical Chemistry. Introduction, definition. Physical chemistry, definition of atoms, atomic structure, elements, molecules, compounds, nails micro and organic. Bases: Strong and weak. pH: pH scale. Calculations. Preparation and importance. Indicators: Litmus methyl orange, red Phenolphthalein. Solutions: Standard, working, saturated, supersaturated, normal, molar, solution, formula. $\frac{RV \times RC}{OC}$ Titration – Principle, Procedure, Chloride, Calculations.

FIRST SCHEDULE—*continued*

Year	*Topic*	*Sub-topic*
	Organic chemistry	Definition, structure of carbon, homologous series.
	Biochemistry	Definition, biomolecules, carbohydrates, amino acids, and proteins, lipids, vitamins, classifications.
	Basic physiology	Functions of the body systems— • Kidney, • Liver, • Pancreas, • Stomach, intestines, • Capillaries, arteries, veins.
	Basic pathology	The liver in relation to bilirubin, pancreas in relation to diabetes nephrosis.
	Safety measures— chemicals	Sources of injuries— Cacinogenic poisonous, radioactive, explosives, fuming. Protective measures— Protective gear. Methods of disposal. Decontamination.
	Instruments	Types of injuries— • Mechanical, electric, thermal (hot water, hot air, steam, dry heat. Protective measures: • Protective gear, • Bench organisation, • Proper insulation and voltage.
	Laboratory ware	Source of injuries. Breakages, sharps. Mechanical. Protective measures. Protective gear, proper handling and disposal.
	Maintenance and care of Laboratory ware	Glassware, plastics, ceramics. Cleaning: use of detergents, dichromate solution, strong acids and hot water. Drying: room temperature, hot air oven. Storage, racks, canisters, drawers, cabinets.
	Instruments	Daily maintenance: checks, manufacturer instructions. Laboratory, organisation, instrument installation and regular servicing.
	STORAGE OF CHEMICALS AND REAGENTS	Corrosives: non-metallic containers, labelling, isolation, refrigeration expiry date. Volatile and flammables cold storage. Ventilation, isolation, fireproofing, hazard labels. Analytical reagents and chemicals labelling, aluminium foils and lead containers for radioactive material.

FIRST SCHEDULE—*continued*

Year	*Topic*	*Sub-topic*
		Lockable cabinets, desiccated cabinets, brown containers, and dark rooms. Labelling to include expiry dates.
	Specimen Collection	Containers, anticoagulants, disposable needles, and syringes. Labels, preservatives, request form interpretation.
	Mode of Collection	Aseptic technique, hygienic. Sites of bleeding and stasis. Types of specimen. Blood, stool, urine, C.S.F. Aspirates and exudates saliva, sweat.

Year	*Topic*	*Contents*
	Basic principles	• Graduated.
	Pipettes:	
	• Types	• Volumetric. • Pasteur. • Micropipettes. • Automated.
	• Pipetting	• Mouth. • Fillers. • Capillarity. • Atmospheric pressure.
	Qualitative and quantitative	Urine – physical examination. • Chemical analysis. • Microscopy. Stool—Physical examination. • Chemical analysis. C.S.F.– Physical examination. • Biochemistry. Urine sugars. • Proteins. • Clearance tests. • Osmolarity. • pH. Blood – Glucose. • Urea. • Bilirubin. • Creatinine. • Electrolytes. • Uric acid. • Protein. • Transaminases. • Alkaline phosphatase.

FIRST SCHEDULE—*continued*

Year	*Topic*	*Contents*
	Separation	CSF exudate aspirates. • Glucose. • Protein. Urine sugars – Chromatography.

YEAR TWO (2)

23.0.3 OBJECTIVES—

(a) Carry out diagnostic tests.

(b) Quality control measures.

Year Two	*Topic*	*Content*
	Clinical placement	Clinical placement.
	Practicals Urine Qualitative and quantitative	Volume, colour, appearance, odour, sugars, ketones, bilirubin, blood, protein, pH, crystals, casts, cells, clearance, osmolarity.
	Blood Quantitative	Glucose, urea, creatinine, electrolytes, uric acid, total protein, albumin, transaminases, alkaline, phosphatase.
	CSF, exudates and aspirates	Glucose, protein.
	Saliva and sweat	Enzymes and electrolytes.
	Separation	Urine sugars and reducing substances (chromatographic techniques).
	Quality control measures	Handling of control materials levy, Jennings plots, units in chemical pathology and reference ranges.

24.0 HAEMATOLOGY

24.0.1 AIM: At the end of this course unit, the trainee should be equipped with basic skills and attitudes in haematology to be able to perform haematological techniques and interpret the results accurately in a clinical or research laboratory.

24.0.2 GENERAL OBJECTIVES

At the end of this unit the trainee should be able to—

(i) acquire knowledge on blood formation and various haematological disorders;

(ii) perform haematological techniques and observe safety precautions;

(iii) interpret test results in relation to the established norms.

24.0.3 SPECIFIC OBJECTIVES

At the end of this year, the trainee should be able to—

(i) describe haemopoesis;

(ii) identify blood cells;

(iii) prepare and use haematological stains;

(iv) collect haematological samples;

(v) enumerate blood cells;

(vi) estimate haemoglobin;

FIRST SCHEDULE—*continued*

(vii) perform packed cell volume and erythrocyte sedimentation techniques;
(viii) calculate haematological indices;
(ix) explain the types of anaemia.

24.0.4 CONTENT

24.0.4.1 INTRODUCTION TO HAEMATOLOGY
- Definition.
- Importance.
- Safety in haematology laboratory.

24.0.4.2 BLOOD COMPOSITION AND FUNCTIONS
- Erythrocytes.
- Leucocytes.
- Thrombocytes.
- Plasma.

24.0.4.3 HAEMOPOESIS
- Origin of blood cells.
- Development of all blood cells.

24.0.4.4 HAEMATOLOGICAL SAMPLES
- Blood collection containers.
- Anticoagulants.
- Venous blood sample.
- Capillary blood sample.

24.0.4.5 BLOOD FILM PREPARATION
- Thin.
- Thick.

24.0.4.6 HAEMATOLOGICAL STAINS
- Romanowsky stains.
- Supravital stains.
- Staining techniques.

24.0.4.7 HAEMOCYTOMETRY
- Total blood cell count.
- Differential leucocytes count.
- Reticulocyte count.

24.0.4.8 PACKED CELL VOLUME
- Microhaematocrit.
- Macrohaematocrit.

24.0.4.9 ERYTHROCYTE SEDIMENTATION RATE
- Wintrobe.
- Westergren.
- Landau Adams.

24.0.4.10 HAEMOGLOBIN
- Definition.
- Composition.

FIRST SCHEDULE—*continued*

- Types of haemoglobin.
- Methods of estimation.

24.0.4.11 HAEMATOLOGICAL INDICES

- Mean cell volume.
- Mean cell haemoglobin.
- Mean cell haemoglobin concentration.

24.0.4.12 SYSTEMATIC REPORTING OF FILMS

- Red blood cells.
- White blood cells.
- Platelets.
- Blood parasites.

24.0.4.13 ANAEMIA

- Definition.
- Causes of anaemia.
- Classification.
- Types of anaemia.
- Laboratory investigations.

24.0.4.14 YEAR TWO (2)

At the end of this year the trainee should be able to—

(a) describe vascular system coagulation mechanism;

(b) perform basic haematological techniques.

24.0.4.15 CONTENT

24.0.4.16 HAEMATOSIS

- Definition.
- Role of platelets.
- Basic coagulation mechanism.
- Basic tests for haemostasis.

24.0.5.17 PRACTICAL PLACEMENT

25.0 HISTOPATHOLOGY AND CYTOLOGY

25.0.1 AIM: The course unit is intended to provide trainees with basic knowledge, skills and attitudes that will enable them to handle histopathological and cytological techniques in a medical laboratory.

25.0.2 INTRODUCTION TO HISTOPATHOLOGY (2 HRS)

25.0.2.1 CONTENTS

(i) Definition.

(ii) Application in disease set-ups.

25.0.2.2 Terminologies in common use

(i) Autolysis.

(ii) Putrefaction.

(iii) Biopsies.

(iv) Autopsies.

FIRST SCHEDULE—*continued*

25.0.2.3 Source of Specimens

(i) Autopsies.

(ii) Biopsies.

(iii) Smears.

25.0.2.4 Cell and epithelium

25.0.2.5 Specific objectives

At the end of this topic, the trainee should be able to—

(a) Describe cell structure and cell division;

(b) Describe the four primary tissues;

(c) State types of epithelial cells;

(d) State the functions of epithelial tissue.

25.0.4.6 CONTENTS

25.0.4.7 Cell structure and division

- Cell membrane.
- Nucleus.
- Cytoplasmic organelles.
- Mitosis.
- Meiosis.

25.0.4.8 Primary Tissues

- Epithelium.
- Connective.
- Muscular.
- Nervous.

25.0.4.9 Types of Epithelial Cells

- Cuboidal.
- Columnar.
- Pseudostratified.
- Stratified.

25.0.4.10 Functions of Epithelial Tissues

- Transport.
- Protection.
- Excretion.
- Reproduction.
- Absorption.
- Assimilation.
- Respiration.

25.0.4.11 Fixation and Fixatives

25.0.4.12 Specific objectives

At the end of this topic, the trainee should be able to—

(i) State the purpose of fixation.

(ii) State the effects of fixatives.

(iii) Explain preparation of the fixatives.

FIRST SCHEDULE—*continued*

(iv) Describe methods of fixing tissues.

(v) Explain storage and labelling procedures of fixed specimens.

25.0.4.13 Contents

25.0.4.14 Terminologies used

- Fixation.
- Fixatives.
- Simple – Cytological.
- Compound – Nuclear.
- Micro anatomical – Cytoplasmic.

25.0.4.15 Purposes of fixation

- Autolytic changes.
- Putrefaction changes.
- Preservation of tissue.

25.0.4.16 Effects of fixatives on tissues

- Penetration.
- Precipitation.
- Hardening the tissue.

25.0.4.17 Preparation of fixatives

- Simple fixatives.
- Compound fixatives.
- Advantages and disadvantages.

25.0.4.18 Storage procedures and labelling

- Water-proof and Indian Ink labels.
- Diamond pencils.
- Storage in 70% alcohol.
- 10% formal saline.

25.0.4.19 DECALCIFICATION

25.0.4.20 Specific objectives

At the end of this topic, the trainee should be able to—

(i) Define decalcification;

(ii) Describe methods of decalcification;

(iii) Describe methods of determining end point of decalcification;

(iv) Explain treatment of tissues after decalcification.

25.0.4.21 Definitions

- Purpose.
- Uses.

25.0.4.22 Methods of Decalcification

- Mineral acids.
- Chelating agents.
- Ion exchange resin.
- Electrolysis.
- Factors affecting decalcification.
- Surface decalcification.

FIRST SCHEDULE—*continued*

25.0.4.23 Determination of end Points of Decalcification
- X-ray method.
- Chemical tests.
- Mechanical methods—probing, bending.

25.0.4.24 Treatment of Tissues after Decalcification
- Water method.
- 70% alcohol method.

25.0.4.25 TISSUE PROCESSING

25.0.4.26 Specific objectives

At the end of this topic, the trainee should be able to—

(i) Explain dehydration techniques.

(ii) Describe clearing process.

(iii) Explain impregnation and embedding procedures.

(iv) Mention common embedding media.

(v) Store blocks, slides and reports.

25.0.4.27 Contents

25.0.4.28 Dehydration Techniques
- Use of alcohol.
- Acetone.
- Dioxane.

25.0.4.29 Clearing process by use of—
- Xylene.
- Chloroform.
- Toluene.
- Cedar wood oil.

25.0.4.30 Wax Impregnation and Embedding Procedures
- Paraffin wax method.
- Vacuum embedding methods.

25.0.4.31 Common Embedding Media
- Gelatin.
- Celloidon.

25.0.4.32 Use of Cabinets, Files

25.0.4.33 MICROTOMES AND MICROTOMY

25.0.4.34 Specific objectives

At the end of this topic, the trainee should be able to—

(i) Classify various types of microtomes.

(ii) State types of microtome knives.

(iii) Explain different methods of sharpening microtome knives.

(iv) Describe section cutting.

(v) Explain how to float sections.

FIRST SCHEDULE—*continued*

25.0.4.35 Content

25.0.4.36 Types of microtomes

- Rocking microtome.
- Rotary microtome.
- Base sledge microtome.
- Sliding microtome.
- Freezing microtome.

25.0.4.37 Microtome knives

- Plain wedge.
- Bi-concave.
- Plano-concave.
- Semi-plano-concave.
- John Heifer Knife.

25.0.4.38 Knife sharpeners

- Honing.
- Stropping.
- Automatic sharpener.

25.0.4.39 Faults in section cutting

- Chatter.
- Scores.
- Sections fail to ribbon.
- Section crumble on cutting.
- Sections are squashed.

25.0.4.40 Floating of sections

- Floating out in water bath at 6-10%c lower than the melting point of paraffin wax.
- Use of 20% alcohol.

25.0.4.41 Term three (3), first year

7. Section Adhesives.

At the end of this topic, the trainee should be able to—

(i) State the types of adhesives.

(ii) Describe the use of adhesives.

(iii) Prepare types of adhesives.

25.0.4.42 Contents

(i) Types—

- Mayor's Egg albumin.
- Glycerine jelly.
- Starch paste.

(ii) Use.

(iii) Preparation—

- Ingredients.
- Procedure.

8. Theory of staining.

FIRST SCHEDULE—*continued*

25.0.4.43 Specific objectives

At the end of this topic, the trainee should be able to—

(i) Define dyes and stains.
(ii) Explain preparation of stains.
(iii) Outline various staining methods.
(iv) List staining equipment used.

25.0.4.44 Contents

(i) Dyes and stains.
- Definition.

(ii) Preparation.
- Haematoxylin.
- Eosin.
- Van Gieson.
- Litmus.
- Gram stain.
- Ziehl Nielsen.
- Perls' Prussian Blue.

(iii) Staining methods.
- Direct staining.
- Progressive and regressive staining.
- Negative staining.
- Vital staining.
- Indirect staining.

(iv) Equipments.
- Staining dishes, staining racks.
- Bunsen burners, hot plate, hot air oven.

9 Histological pigments.

25.0.4.45 Specific objectives

At the end of this topic the trainee should be able to—

(i) Define pigments.
(ii) Classify pigments.
(iii) Identify pigments.
(iv) Remove pigments.

25.0.4.46 Contents

(i) Definition.
(ii) Classification—
- Artifacts,
- Exogenous,
- Autogenous,
- Endogenous,
- Haematogenous.

FIRST SCHEDULE—*continued*

(iii) Identification/Demonstration—
- Use of stains.

(iv) Removal—
- Use of bleaching agents.

25.1 CYTOPATHOLOGY

25.1.1 Specific objectives
- Define cytopathology.
- State the use of cytopathology.
- List sources of specimens.
- Collect specimens.
- List equipments and apparatus used.
- List fixatives used.
- State staining methods employed.
- Screen and classify pap smears.

25.1.2 CONTENTS

(i) Definition—
Uses of cytopathology.
Diagnosis of cancer.
Sex determination.

(ii) Sources of specimen—
Cervical smears.
Buccal smears.
Body fluids.
Urine.

(iii) Collection of specimens—
Collection and preparation of smears.
Techniques involved.

(iv) Equipment used—
- Ayre spatula.
- Coplin jars.
- Speculum.
- Bulb pipettes.

(v) Fixation methods used—
- Drop on, Aerosols.
- Alcohols.

(vi) Staining methods—
- Papanicolau stain.
- Haematoxyline and Eosin.
- Methylene blue.

(vii) Screening and classifying pap smears—
- CIN – I – V.

FIRST SCHEDULE—*continued*

- Pap Class I – V.
- Abnormalities associated with malignancy.

25.1.3 Mountants

25.1.4 Specific objectives

At the end of this topic, the trainee should be able to—

(i) Explain types of mountants
(ii) State the uses of mounting media
(iii) Outline different methods of mounting
(iv) Explain what a ringing media is.

25.1.5 Contents

(i) Types of mountants—
- Resinous or synthetic.
- Aqueous.

(ii) Use of mountants—
- Mounting stained sections.
- Mounting frozen sections.

(iii) Methods of mounting—
- Permanent preparations.
- Temporary preparations.

(iv) Ringing media—
- Paraffin media.
- Plasticine.

6TH TERM

25.1.6 Museum techniques

25.1.7 Specific objectives

At the end of this topic, the trainee should be able to—

(a) Collect specimen for museum purposes;
(b) List methods of preservation.

25.1.8 Contents

(i) Methods of collection—
- ♦ Netting,
- ♦ Biopsy specimen,
- ♦ Trapping,
- ♦ Autopsy specimen.

(ii) Preservation—
- ♦ Drying.
- ♦ Chemical treatment.

25.1.9 Safety precautions

At the end of this topic, the trainee should be able—

- To observe safety in a histological laboratory.

FIRST SCHEDULE—*continued*

25.1.10 Contents

(i) Fire hazards.

(ii) Injuries.

(iii) Explosives.

(iv) Handling of specimens.

25.1.11 Mortuary techniques

25.1.12 Specific objectives

At the end of this topic, the trainee should be able to—

(a) Handle the bereaved members of the public emphatically;

(b) Respect all cultures;

(c) Handle the deceased body from the ward level up to the time the body is buried or collected by relatives;

(1) storing at appropriate temperature 0-4°c;

(2) injecting with fixatives in main cavities;

(3) total body fixation-embalming by use of chemical solutions;

(4) dressing and final respects;

(d) Post-mortem—

(5) stitching opened bodies.

25.1.13 Public relations

(a) Handling bereaved persons.

(b) Language.

(c) Basic counselling.

25.1.14 Traditional and Religious Cultures

(a) Major Kenyan cultures.

(b) Major Kenyan religions.

(c) Ethnocentrism.

(d) International cultures.

25.1.15 Handling Deceased Persons

(a) Collection.

(b) Registration.

(c) Storage—

(i) Embalming.

(ii) Minimal preservation.

(d) Body preparation for burial—

(i) Dressing.

(ii) Grooming.

25.1.16 Post-mortem

(a) Reasons.

(b) Importance.

(c) Records.

(d) Stitching the body.

FIRST SCHEDULE—*continued*

25.1.17 EMBALMING

Through the jugular vein you pass (inject) a mixture of formal saline + glycerin + red dye until all clotted blood is liquefied.

25.1.18 PURPOSE OF EMBALMING

(a) Long storage.

(b) International standards transport.

(c) Aseptic purposes.

	Topic	*Sub-topic*	*Time*
1T	INTRODUCTION	• Importance of histopathology and cytology. • Terminologies used. • Sources of specimens.	
2T	CELL AND EPITHELIUM	• Cell structure and division. • The four primary tissues. • Types of epithelial cells. • Function of epithelial tissues.	
3T	FIXATION AND FIXATIVES	• Purposes of fixation. • Terminologies used. • Effects of fixatives. • Preparation. • Methods of fixation. • Storage and labelling.	
4T	DECALCIFICATION	• Definition. • Methods of decalcification. • Treatment of tissue after decalcification. • Determination end point of decalcification.	
5T	TISSUE PROCESSING	• Dehydration. • Clearing. • Wax impregnation and other common embedding media. • Storage of blocks slides and reports.	
6T	MICROTOMY	• Types of microtomes. • Microtomes knives. • Knife sharpeners. • Faults in sectioning. • Floating out of sections.	
7T	SECTION ADHESIVES	• Types of adhesives. • Purpose of adhesives. • Preparation.	
8T	THEORY OF STAINING	• Definition of dyes and stains. • Preparation of stains. • Types of staining reactions. • Staining methods. • Staining equipment.	

FIRST SCHEDULE—*continued*

	Topic	*Sub-topic*	*Time*
9T	HISTOLOGICAL PIGMENTS	• Definition. • Types of pigments encountered. • Their identification and removal.	
10T	CYTOLOGY	• Definition. • Terminologies used. • Uses of cytology. • Sources of specimens and collection. • Equipments/apparatus used. • Fixatives employed. • Staining methods. • Slide screening.	
11T	MOUNTANTS	• Types of mountants. • Uses of mounting media. • Methods of mounting. • Ringing media.	
12T	MUSEUM TECHNIQUES	• Collection of specimens. • Methods of preservation. • Labeling and display of specimens.	
13T	SAFETY PRECAUTIONS	• Physical injuries. • Fire hazards. • Chemicals. • Explosives. • Infectious specimens.	
14T	MORTUARY TECHNIQUES	• Public relations. • Cultural values. • Body handling. • Body dressing. • Basic embalming. • Body suturing.	

26.0 BLOOD TRANSFUSION SCIENCE

26.0.1 AIM: This course unit is intended to provide the trainee with attitudes, knowledge and skills to be able to work effectively in blood transfusion science laboratory.

YEAR 1

At the end of this year the trainee should be able to—

(i) define basic blood transfusion science terminologies.
(ii) explain immune and natural antibodies.
(iii) explain antigen-antibody reactions
(iv) mention various blood group system.
(v) perform blood grouping techniques.
(vi) determine errors affecting results.
(vii) explain the preparation of basic reagents and antisera.

FIRST SCHEDULE—*continued*

(viii) Perform and interpret compatibility test;

(ix) Explain different types of transfusion reactions;

(x) List laboratory investigations performed in transfusion reactions.

26.0.2 CONTENT

26.0.3 INTRODUCTION

Definition of the terms blood transfusion science and blood importance.

26.0.4 TERMINOLOGIES

Antigen, antibody, agglutination, haemolysis, sensitisation, precipitation, complement, hapten.

26.0.5 ABO BLOOD GROUP SYSTEM

History, inheritance, antigens, antibodies, technique and sub-groups.

26.0.6 RHESUS BLOOD GROUP SYSTEM

History, inheritance nomenclature, antigen, rhesus null phenotype, variants of rhesus grouping techniques.

26.0.7 ABH BLOOD GROUP SYSTEM

Definition, H, A, B, O, OH genes and secretor gene.

26.0.8 BLOOD GROUP SPECIFIC SUBSTANCES

Definition, type, importance.

Neutralization tests.

26.0.9 OTHER BLOOD GROUPS

Introduction to other blood groups – MNSS, KELL, DUFFY, I.

26.0.10 BLOOD GROUP ANOMALIES

Physical, and conditional hereditary.

26.0.11 PREPARATION OF REAGENTS

Normal saline, enzymes, bovine albumin, Coombs Reagents, lectins, antisera.

26.0.12 COOMBS TECHNIQUES

Direct Coombs, indirect Coomb's, antibody screening, antibody identification and Titration.

26.0.13 CROSSMATCHING

Definition, purpose, types, phases, techniques.

26.0.14 TRANSFUSION REACTIONS

Definition, categories, laboratory, investigations.

26.0.15 HAEMOLYTIC DISEASE OF THE NEW-BORN

Definition, causes, laboratory investigation, prevention and management.

YEAR 2

26.0.16 OBJECTIVES

At the end of this year the trainee should be able to—

(i) Campaign, recruit and bleed blood donors.

(ii) Describe the procedures of blood screening for infectious disease.

(iii) Describe various anticoagulants used in blood transfusion science.

(iv) Explain blood storage procedures.

FIRST SCHEDULE—*continued*

(v) Describe safety measures in blood bank.

(vi) Describe control in blood transfusion science.

(vii) Explain various blood fractions and plasma products.

(viii) Practice techniques learned in year 1.

26.0.17 CONTENT

26.1.01 BLOOD DONOR SERVICE:

Blood campaign, recruitment of donors, phlebotomy procedures, screening procedures, storage of blood, disposal.

26.1.02 BLOOD PRODUCTS

Definition, types, uses.

26.1.03 CONTROL IN BLOOD TRANSFUSION SCIENCE

Purpose of control on equipment, reagent and laboratory procedures.

26.1.04 CLINICAL PLACEMENT

27.0 MEDICAL PARASITOLOGY

27.0.1 AIM: To provide the trainees with basic knowledge and skills and attitude in medical parasitology, which will enable them carry out simple parasitological techniques in diagnostic and research laboratories as well as field settings.

27.0.2 GENERAL OBJECTIVES*:*

At the end of this course unit the trainee should be able to—

(i) Receive, preserve and store parasitological specimens.

(ii) Observe safety measures in a parasitology laboratory.

(iii) Perform simple laboratory diagnosis of common parasitic infections.

(iv) Prepare common laboratory reagents used in parasitology laboratory.

(v) Use various equipment for parasitological investigations.

(vi) Collect samples for laboratory investigations.

(vii) Prepare specimens for parasitological investigations.

(viii) Carry out appropriate parasitology analysis.

(ix) Give appropriate report on laboratory findings.

27.0.3 CONTEXT— YEAR 1

27.0.4 Introduction to Medical Parasitology and Medical Entomology

Common terminologies.

Simple classification of parasites.

Routes and mechanism of infections.

Exit routes.

Collection preservation transportation, reception and storage of specimen.

Safety precautions and hygiene.

Preparation of common reagents and stains.

Common equipment and apparatus.

Introductory microscopy.

Quality assurance.

FIRST SCHEDULE—*continued*

27.0.5 Parasitological Techniques
Direct methods.
Concentration methods.
Smears.
Swabs.
Basic immunodiagnosis.
27.0.6 Entomological Techniques
Collection of specimen.
Mounting and labelling.
Preservation and storage.
Simple dissections.
27.0.7 Malacological Techniques
Collection of molluscs.
Transportation.
Cercarial sheding.
Preservation.
27.0.8 Helminthology
Introduction.
General classification to genus and species level.
Collection of specimen.
Basic life-cycles.
Morphology of diagnostic stages.
Routine helminthological techniques.
Prevention and control.
27.0.9 Protozoology
Introduction.
General classification to genus species.
Collection of specimen.
Basic life-cycles.
Morphology of diagnostic stages.
Routine protozoological techniques.
Prevention and control.
27.0.10 Medical entomology
Introduction and terminologies.
General classification to genera and species.
Basic life-cycles.
Routine entomological techniques.
Basic identification.
Vector control.

FIRST SCHEDULE—*continued*

28.0 VIROLOGY

28.0.1 AIM: The aim of this course is to equip the trainees with knowledge, skills and attitude to enable them work in a medical virology laboratory.

28.0.2 SPECIFIC OBJECTIVES

28.0.3 YEAR ONE

By the end of the year, the trainee should be able to—

(i) Define the virus;
(ii) Outline general properties of viruses;
(iii) State the major classes of viruses of medical importance;
(iv) Identify the pathogen risk groups;
(v) Explain laboratory associated acquired infections and their prevention;
(vi) Perform the various sterilisation, disinfection and disposal procedures;
(vii) Use various laboratory equipment for virology work.

28.0.4 CONTENT

Year	*Topic*	*Sub-topic*	*Theory* (*t*) *practice* (*p*)	*Hours*
ONE	INTRODUCTION TO VIROLOGY	* DEFINITION OF VIRUSES. * GENERAL PROPERTIES OF VIRUSES. * CLASSIFICATION OF VIRUSES (CRITERIA).	T T	
	BIO-SAFETY	* CATEGORISATION OF PATHOGEN RISK GROUPS. * ACTIVITIES HARMFUL TO THE WORKER AND OTHERS IN VIROLOGY. * OCCURANCE OF LABORATORY INFECTIONS AND THEIR PREVENTION. * MODE OF INFECTIONS IN AND OUT OF THE LABORATORY. * LOCATION OF HEALTH AND SAFETY EQUIPMENT IN THE WORK PLACE (EG. FIRE EXTINGUISHERS). PERSONAL PROTECTION: USE OF SAFETY-GEARS, EG. LAB. GOWNS, GLOVES, MASKS AND GOGGLES. * USE OF PIPETTING AIDS. * USE OF SAFETY CABINETS. * SAFE USE OF OTHER EQUIPMENT, DEFINITIONS AND TYPES.	T T T T	
	STERILIZATION	* METHODS OF STERILISATION, FACTORS INFLUENCING STERILIZATION AND STERILITY TESTING.	P	

FIRST SCHEDULE—*continued*

Year	*Topic*	*Sub-topic*	*Theory (t) practice (p)*	*Hours*
	DISINFECTION AND DISPOSAL	* DISINFECTIONS; 'CIDAL' AND 'STATIC' DISINFECTANTS. * MODE OF ACTION OF DISINFECTANTS. * COMMON DISINFECTANTS AND THEIR USE. DILUTIONS. DISPOSAL: DISINFECTION AND METHODS.	T T	
	EQUIPMENT	USE OF THE FOLLOWING EQUIPMENT IN VIROLOGY: INVERTED MICROSCOPE AUTOCLAVE,	T P	
	SPECIMEN	WATER BATHS, DEEP FREEZERS, REFRIGERATORS, INCUBATORS, BIO-SAFETY CABINETS.	T P	
	STERILIZATION	PRACTICAL SPECIMEN: COLLECTION, HANDLING,. TRANSPORTATION,. PRESERVATION AND STORAGE. PRACTICAL METHODS: MOIST HEAT, DRY HEAT, CHEMICAL, DISINFECTANTS.	P	

28.0.5 YEAR TWO

- By the end of the year, the trainee should be able to—
- Describe and perform the various techniques used for specimen collection.
- Explain the various techniques used in specimen preparation, storage, transportation and disposal.
- Perform basic virological tests.

29.0 IMMUNOLOGY

29.0.1 AIM: This course unit is intended to provide the trainee with attitudes, knowledge and skills to be able to work effectively in an immunology laboratory.

29.0.2 OBJECTIVES

At the end of this unit the learner should be able to—

- define immunology;
- outline the scope of immunology;

FIRST SCHEDULE—*continued*

- explain the types of immunity;
- identify the cells involved in immunity;
- explain the role played by various cells in immune response;
- prepare blood smears;
- perform staining procedures of the thin blood film;
- identify the various lymphoid tissues and organs involved in immunity;
- describe the function of antibodies;
- classify various types of antibodies;
- outline the principles of immunological techniques.

Year	*Topic*	*Content*	*Theory* (*T*) *Practice* (*P*)	*Hours*
ONE	INTRODUCTION	Definition of immunology. Brief history of immunology. Immunology. Types of immunity.	T T	6
	IMMUNITY	Innate. Acquired. Thin blood smear staining techniques. Identification of cells. Cells involved in immunity and their basic roles. Tissue and organs involved in immunity and their basic roles.	 T P P P T	8 16 3
	BIOLOGY OF THE IMMUNE SYSTEM	Bursa of fabricus. Bone marrow. Spleen. Lymph nodes. Dissection of a named laboratory animal (eg. mouse, rat or guinea pig). To display the organs of the immune system. Disposal of the carcass. Definition and basic structure of an antibody molecule.	 P P P	
	ANTIGENS AND ANTIBODIES	Definition and examples of antigens. Definition of hapten. A brief classification of immunoglobulins. Principles of the techniques. Distribution of immunoglobulins. Principles of the techniques.	 T T T	
	IMMUNOLOGICAL TECHNIQUES	Demonstration of procedures. Precipitation tests.	T P	

FIRST SCHEDULE—*continued*

30.0 Appendix 1: TRAINING STANDARDS

30.0.1 STAFF/STUDENT RATIO

30.0.2 LECTURES

THEORY 1:10

PRACTICAL 1:5

SUPPORT STAFF—

TECHNOLOGIST (DIPLOMA LEVEL): ONE (1)

TECHNICIANS: TWO (2)

30.0.3 ACADEMIC STAFF QUALIFICATIONS

Minimum M.L.S. (DIP) with three (3) years experience plus a certificate in Medical Education,

OR

M.L.S. (DIP) with five (5) years working experience,

AND a good track record.

30.0.4 ATTENDANCE—90%

30.0.5 AVERAGE PASS MARK—50%

30.0.6 EXAMINATION DECLARATION

- Common examination
- Examination results shall be declared two (2) weeks after the last paper.

31.0 Appendix 2: ESSENTIAL EQUIPMENT

31.0.1 Microbiology

(1)	Autoclave (portable)	1 between 10 students
(2)	Medium water bath	1 between 5 students
(3)	pH meters	1 between 5 students
(4)	Anaerobic jars	1 between 5 students
(5)	Incubators/Hot air oven (adjustable)	1 between 10 students
(6)	Distillers	2 for the whole institute
(7)	De-ionizers	two small
(8)	Microscopes binocular	1 between 10 students
(9)	Weighing balance	1 top pan load balance
(10)	Wood lamp	1
(11)	Centrifuge	1 between 4 students
(12)	Bunsen Burner/spirit	1 between 2 students
(13)	Tripod stands/asbestos mat	1 between 10 students
(14)	Fridge/deep freezer	1 between 10 students
(15)	Safety cabinet	1 per laboratory
(16)	Teaching microscopes	1 between 10 students
(17)	Mechanical shaker	1 between 10 students
(18)	Inoculating loops	1 per student
(19)	Assorted microbiology glassware	adequate

FIRST SCHEDULE—*continued*

31.0.2 CLINICAL CHEMISTRY

(1)	Colorimeters	1 between 4 students
(2)	Analytical balance0150 – top pan loading	
(3)	Sensitivity up to 1mg.	1 between 5 students
(4)	Flame photometers	1 between 10 students
(5)	Centrifuge	1 between 4 students
(6)	Refrigerators/Freezers	1 between 10 students
(7)	Water bath medium	1 between 4 students
(8)	pH meter	1 between 5 students
(9)	Mechanical mixers	2
(10)	Electrophoresis equipment	2 per institution/class
(11)	Distiller/deionizer	2
(12)	Hot air oven/incubator adjustable	10

31.0.3 HAEMATOLOGY

(1)	Haemoglobinemters	1
(2)	Centrifuge	1
(3)	Microhaematocrit centrifuge	1 between 5 students
(4)	Blood mixers rollers	1 between 10 students
(5)	Water bath	1 between 10 students
(6)	Incubator	1 between 10 students
(7)	Colorimeter	1 between 10 students
(8)	Electrophoresis equipment	1 between 10 students
(9)	Sphygmomanometer	1 between 5 students
(10)	E.S.T. stands	1 between 4 students
(11)	Deep freezer/fridge	1 per 10 students
(12)	Deep freezer	1 between 5 students
(13)	Coulter counter	1 for each class
(14)	Neubaeur Chambers	1 for each student
(15)	Distiller	2 per institution/class
(16)	Analytical balance	1 between 10 students

31.0.4 BLOOD TRANSFUSION SCIENCES

(1)	Blood bank refrigerator	1 per class/institution
(2)	Grouping tiles	1 per student
(3)	Water bath adjustable	Medium size
(4)	Plasma extractors	15 students
(5)	Centrifuges	1 between 4 students
(6)	Weighing balance	1 between 5 students
(7)	Syphmomanometers	1 between 5 students
(8)	Hot air oven (adjustable)	1 in the whole institution
(9)	De-ionizers and stillers	1 for the whole class/institution
(10)	Mechanical shaker	
(11)	Blood transfusion bleeding unit	
(12)	Assorted blood transfusion glassware and adequate apparatus	
(13)	Microscopes	1 per 2 students

31.0.5 HISTOPATHOLOGY

(1)	Microtome rocking/rotary	1 per 4 students
(2)	Manual tissue processing set	1 between 4 students
(3)	Hot plate	1 between 4 students
(4)	Hone and strope	1 between 4 students
(5)	Automatic knife sharpener	1 per class/institution
(6)	Water bath, medium size	1 between 4 students
(7)	Microscope (teaching)	1 for the institution
(8)	Cold plate	1 between 6 students
(9)	Weighing balances	1 between 5 students
(10)	De-ionizers	1 per class/institution
(11)	Fume chamber	1 per laboratory/institution

31.0.6 PARASITOLOGY

(1)	Microscopes	1 for 4 students
(2)	Centrifuges	1 for 4 students
(3)	Refrigerators	1 for 4 students
(4)	Pestle and mortar	1 per student
(5)	Teaching microscope	
(6)	QBC unit	
(7)	Assorted apparatus eg. sieves racks, test tubes, stirring rods, applicator sticks, forceps funnels, kato kits, hand lenses	
(8)	Stereo microscope/dissecting microscope	

31.0.7 VIROLOGY

(1) Hepatitis screening equipment
(2) H.I.V. Screening equipment
–ELIZA
–Immunoblots (Western Blot)
–P.C.R. (Polymerase chain reaction)
(3) CD4/CD8 Counting machine
(4) Tissue lines
(5) Immunoflourescent equipment
(6) Inverted microscopes
(7) Computer

31.0.8 IMMUNOLOGY

(1) Mechanical shakers
(2) Centrifuges
(3) Water baths
(4) Refrigerators
(5) Geiger Muller Counter
(6) Chromatographic sets
– G.L.C. gas liquid chromatograph
– H.P.L.C. high pressure liquid chromatography
– T.L.C. thin layer chromatography
(7) Thermocycler
(8) Computer

[Subsidiary]

32.0 Appendix 3: LEARNING BOOKS

32.0.1 GENERAL BOOKS

	Title	*Author*
1.	Introduction to Medical Laboratory Technology	F.J. Baker & Silverton (Current Edition)
2.	Medical Laboratory Manual for Tropical Countries, Parts I and II	Monica Chesbourogh

32.*0.2* MEDICAL MICROBIOLOGY

	Title	*Author*
1.	Colour Atlas and Text Book of Diagnostic Microbiology	Elmer W. Koneman *et al*
2.	Short Text Book of Microbiology	Satish Gupte

32.0.3 CLINICAL CHEMISTRY

	Title	*Author*
1.	A Handbook of Clinical Chemistry	V.W. Sitati
2.	Practical Clinical Biochemistry	Harold V. Valley
3.	Essential of Volumetric Analysis	J. Lambert

32.0.4 HAEMATOLOGY

	Title	*Author*
1.	A Short Textbook of Haematology	R.B. Thomson
2.	Atlas of Haematology	McDonald Dodds
3.	Practical Haematology	Dacie & Lewis

32.0.5 HISTOPATHOLOGY

	Title	*Author*
1.	Carlton's Histological Techniques	Drowry and Wellington
2.	Colour Atlas	Irwing Bernem
3.	Theory and Practice of Histological Techniques	John Bancroft

32.0.6 BLOOD TRANSFUSION

	Title	*Author*
1.	Blood Group Serology	Cathleen E. Boorman and Barbar E. Dodd (Simplified Version)
2.	Blood Groups in Man	R.R. Race and Ruth Sanger
3.	Techniques in Blood Grouping	Ivor Dunford and C. Christopher Bowky

32.0.7 MEDICAL PARASITOLOGY

	Title	*Author*
1.	Basic Clinical Parasitology	Harold W. Brown

FIRST SCHEDULE—*continued*

	Title	*Author*
2.	Introduction to Parasitology	A.C. Chandler
3.	Atlas of Helminthology Protozoology	Leach
4.	Lecture Notes on Medical Entomology	M.W. Service
5.	Tropical Diseases	Manson Barr

32.0.8 VIROLOGY

	Title	*Author*
1.	Practical Virology for Medical Students and Practitioners in Tropical Countries	D. Metasalaar *et al*
2.	Fundamentals of Medical Virology	Kucera & Louis S.
3.	Virological Procedures	Hopkins *et al*
4.	Virology – Practical Approach	B.S. Mahy *et al*
5.	Medical Virology	D. White & F. Fenner
6.	Medical Virology – A Practical Approach	Editor – U. Desselberger
7.	Principles of Molecular Virology	A.J. Cann

32.0.9 IMMUNOLOGY

	Title	*Author*
1.	The Principles of Immunology	Ivan Roitt
2.	Fundamentals of Immunology	Tesdale
3.	Practical Immunology	Hudsons and Hay
4.	Practical Immunology	Talwar
5.	Basic and Clinical Immunology	Peakman & Vergains
6.	Understanding Immunology	Peter Woods & Prentice Hall

SECOND SCHEDULE

r. 2

REPUBLIC OF KENYA

MINISTRY OF HEALTH

THE KENYA MEDICAL LABORATORY

TECHNICIANS AND TECHNOLOGISTS BOARD

CURRICULUM

FOR

DIPLOMA

IN

MEDICAL LABORATORY SCIENCES

TABLE OF CONTENTS

COURSE TITLE

DIPLOMA IN MEDICAL LABORATORY SCIENCES

1.0 INTRODUCTION

This course is intended to equip the trainees with knowledge, skills and attitudes to enable them to work as medical laboratory technologists.

2.0 RATIONALE

The public has become more aware of their health needs hence increasing the demand for laboratory services, which also includes use of technology and techniques that were not available previously. Therefore the course aims at providing health care professionals who will serve at Class B Laboratory level at both the public and private sector.

3.0 ROLES AND FUNCTIONS

(i) Carry out laboratory tests.
(ii) Analyse, interpret and report laboratory results.
(iii) Manage laboratory resources.
(iv) Initiate and participate in the improvement of diagnostic procedures.
(v) Create awareness and appreciation of laboratory services to the general public.
(vi) Plan and set up a laboratory.
(vii) Participate in the training of laboratory personnel.
(viii) Supervise other laboratory personnel.
(ix) Carry out quality assurance and quality control.
(x) Participate in continuing medical education.

4.0 PROGRAMME AIM

The course is intended to equip trainees with knowledge, skills and attitudes that will enable them to provide health services at Class B Laboratory level as medical laboratory technologists.

5.0 PROGRAMME OBJECTIVES

At the end of the course the trainee should be able to—

(i) apply the principles that form the basis of medical laboratory;
(ii) apply laboratory practice;
(iii) practise safety precautions in a medical laboratory;
(iv) select, set up and operate laboratory equipment;
(v) carry out standard procedures to obtain quality results;
(vi) interpret laboratory results;
(vii) carry out research;
(viii) manage service and resources of a medical laboratory;
(ix) participate in the multi-disciplinary planning, implementation, co-ordination and evaluation of healthcare of the individual and community;
(x) contribute to the development of science and technology through creativity and application of acquired knowledge, skills and attitudes;
(xi) demonstrate the ability to evaluate own performance;
(xii) plan continuing education for self and others;
(xiii) observe the professional code of conduct and ethics.

6.0 ADMISSION REQUIREMENTS

Trainees entering this course should have the following minimum requirements *obtained at one sitting*—

Kenya Certificate of Secondary Education (K.C.S.E.) with a mean grade of C, or equivalent, and in addition a minimum grade of C in the following—

Biology/Biological Sciences

Chemistry/Physical Sciences

English or Kiswahili

They should also have a minimum grade of C in the following—

Mathematics or Physics

OR

Holders of Certificate in Medical Laboratory Sciences with two (2) years relevant experience.

7.0 COURSE DURATION

The course is designed to have duration of 3 960 contact hours where 1 930 hours are spent on campus and 1 760 hours are spent on clinical placement.

8.0 ATTENDANCE PATTERN

The course is designed to be covered as follows—

Year		*On Campus*	*Clinical Placement*
	TERM I	440	–
	TERM II	440	–
	TERM III	440	–
	TERM IV	–	440
	TERM V	–	440
	TERM VI	440	–
	TERM VII	–	440
	TERM VIII	–	440
	TERM IX	440	–

9.0 AWARD OF CERTIFICATES

K.M.L.T.T.B. or its agents shall award the certificates.

10.0 TEACHING METHODS

For trainees to attain the basic competencies the following teaching methods shall be applied—

- Discussion;
- Lectures;
- Role play;
- Simulation;
- Demonstration;

SECOND SCHEDULE—*continued*

- Independent study (Assignments);
- Class practicals;
- Projects;
- Tutorials;
- Attachment;
- Field visits.

11.0 TEACHING AIDS AND RESOURCES

The following teaching aids and resources shall be applied in the teaching methods employed during the course—

- Chalkboard;
- Chart;
- Flipcharts;
- Models;
- Specimens;
- Overhead projector;
- Radio;
- Video/film;
- Computer interactive learning;
- Computer aided/assisted learning;
- Computer.

12.0 RESOURCES

- Recommended textbooks.
- Library.
- Laboratory.
- Health institutions.
- Mortuary and museum.

13.0 FORMAT OF STUDENTS ASSESSMENT AND EVALUATION

13.0.1 Each trainee shall be expected to attend at least 90% of the possible attendance in each subject and complete satisfactorily the course work to qualify for the summative exam.

13.0.2 Each trainee shall be expected to have passed each subject at 50% as the pass mark to qualify to sit that same subject at summative level.

13.0.3 Course work will be given a weighting of 40% and the final examination given a weighting of 60% in the determination of final results.

13.0.4 Assessment and evaluation shall be categorised as follows—

13.0.5 Continuous assessment (conducted by institutions)—

- Timed tests;
- Carry-away tests;
- Practicals and orals;
- Assignments;
- Projects;
- Oral examination (viva voce);

SECOND SCHEDULE—*continued*

13.0.6 Summative examinations

Shall be conducted by the authorized examining body.

13.0.7 Format of the subjects for examination in final examination shall be—

(a) Project;
(b) Practical and orals;
(c) Theory papers—
  (i) Microbiology,
  (ii) Clinical Chemistry,
  (iii) Haematology,
  (iv) Transfusion Sciences,
  (v) Histopathology,
  (vi) Parasitology and Immunology.

13.0.8 Length of papers

Time for each paper shall be allocated as follows—

Project	60 hours
Practicals and orals	3 hours each
Theory	2 hours each

13.0.9 Paper Structure

The following formats are suggested theory papers—

Alternative A:	Section A M.C.Q. (40 marks)
	15 short, structured questions
	Section B (30 marks)
	Section C (30 marks)
	Two out of three attempted
Alternative B:	Section A (40 marks)
	15 short, structured questions
	Section B (60 marks)
	Three out of five attempted (long and short)

The following grading system shall be used—

Grade	*Score by %*
A	75–100
B	65–75
C	50–64
D	40–49
E	1–39

CHEMISTRY

This course is intended to provide trainees with the knowledge-base in the application of knowledge and skills in the professional subjects.

GENERAL OBJECTIVES

At the end of the course the trainee should be able to—

- State physical and chemical changes;

SECOND SCHEDULE—*continued*

- Describe the atomic structure;
- Describe the periodic table, relative to the first twenty elements;
- Explain various types of bonds;
- Balance chemical equations;
- Explain use of pH scale;
- Explain the terms used in chromatography as a qualitative method;
- Explain the application of different types of chromatography;
- Explain titrimetric analysis as a quantitative technique;
- Explain concentration terms;
- Prepare solutions;
- Define the term organic compounds;
- Identify functional groups of hydrocarbons;
- State common uses of hydrocarbons.

Code	*Topic*	*Sub-topic*	*Time*
	Quantitative analysis	• Definition of qualitative analysis, terms used in chromatography. • Concentration terms. • Preparation of solutions. • Acid/base indicators. • Glassware used in quantitative measurements.	
	Organic chemistry	• Terms used. • Difference between saturated and unsaturated compounds. • Homologous series. Common used. Alkanes. Aldehydes. Ketones. Carboxylic acids. Amines.	
	Physical and chemical changes	• Physical changes • Chemical changes.	
	Atom, elements, compounds and mixtures	• Structure of an atom. • Preparation of an atom. • Dalton's Atomic Theory. Mixture and compounds. The Periodic Table. Relationship of atom structure of an element to its position in the Periodic Table. Relationship of physical and chemical properties of elements in the Periodic Table.	
	Chemical combinations	• Types of bonds. • Chemical equations. • Properties of bonds.	

SECOND SCHEDULE—*continued*

Code	*Topic*	*Sub-topic*	*Time*
	Acid, bases and salts	• Definition. • Properties. • Differences between weak and strong human acid and bases. • pH scale neutralisation. • Salts.	

COMPUTERS

AIM:

This unit intends to prepare the trainee to understand the role of computers in managing medical laboratory services and project writing.

General Objectives

At the end of this unit the trainees should be able to—

(1) Describe the basic components of a computer;

(2) State the principles of computer operations and information processing;

(3) Apply common computer software packages for data management;

(4) Use computer for basic data analysis;

(5) Appreciate the role of computers in laboratory sciences.

CONTENTS

Topic	*Sub-topic*
Introduction to computers	Concept of computing. Components of a computer. Hardware – C.P.U. (A.L.U. and control units)— • Main memory, • RAM, • ROM, • Auxiliary memory, • Peripherals. Software – OS and Applications. Interaction of hardware and OS.
Principles of computer operations	Computer capability Computer environment— • Power assurance, • Dust, • Water leakages, • Temperature, • Humidity. Data – Definition of data and information. Data entry (capturing)— • Optical, • Magnetic, • Sound (verbal).

SECOND SCHEDULE—*continued*

Topic	*Sub-topic*
	Data security— • Data back-up, • Persons role to assure correct data, • Operating system, • Application compatibility, • Selection of applications.
Data management	• Introduction to Windows. • Word processing— (1) Setting up files, (2) Modifying, (3) Storing, (4) Retrieval of information, (5) Printing. Spreadsheets— Types: Excel File set-up.
Data analysis	Data entry. Data modifications. Printing process. Basic statistical functions. Interpreting of the outputs.
Role of computers	Role of computers in managing laboratory sciences.

ENTREPRENEURSHIP EDUCATION

AIM: This course unit is intended to equip the trainee with the necessary knowledge, skills and attitudes that will enable the trainee to start, operate and manage a personal or group business enterprise.

OBJECTIVES

At the end of this unit the trainee should be able to—

(1) identify a viable business opportunity;

(2) understand factors liable to affect the success situations;

(3) apply entrepreneurial competencies in business situations;

(4) acquire managerial skills necessary for running a successful enterprise.

CONTENT

	Topic	*Sub-topics*	*Time*
1.	INTRODUCTION	Entrepreneurs and entrepreneurship. Entrepreneur's contribution to national development. Role of entrepreneurs in business.	
2.	ENTREPRENEURIAL OPPORTUNITIES	Generation of business ideas. Business opportunities. Selection of suitable market. Marketing.	

SECOND SCHEDULE—*continued*

	Topic	*Sub-topics*	*Time*
3.	ENTREPRENEURIAL AWARENESS	Business information. Procedures in starting a business. Sources of finance. Factors considered when selecting sources of business finance. Legal aspects of a business enterprise. Government policy. Tendering. Business environment. Technology choice. Business ethics.	
4.	ENTREPRENEURIAL MOTIVATION	Characteristics of a successful entrepreneur. Self assessment of entrepreneurial potentials. Incentives for aspiring entrepreneurs.	
5.	ENTREPRENEURIAL COMPETENCIES	Decision-making. Coping with change and competition. Risk-taking. Leadership. Communication. Time management.	
6.	ENTERPRISE MANAGEMENT	Setting business objectives. Resources management. Financial management. Production planning. Public relations.	

INSTRUMENTATION

AIM This course unit is intended to equip the trainee with attitudes, knowledge and skills to be able to handle, maintain, operate and troubleshoot laboratory instruments and apparatus.

OBJECTIVES

At the end of this subject, the trainee should be able to—

(1) Identify the various types of laboratory instruments and apparatus;

(2) Install instruments and organise benches;

(3) Understand the principles of functional units and their application, operate instruments and troubleshoot;

(4) Maintain daily checks, services and decontamination.

Topic	*Sub-topic*	*Contents*
Types of laboratory instruments	Instruments	• Flame photometer, dissecting microscope, tissue processor, wax dispensers, staining processors, microtomes, paraffin wax oven, knife shapeners, photometers, flourimeters, ISE, pH meter elecrophoresis systems, chromatographic systems, oven incubators, centrifuges, refrigerators, balance, still, glucometers, incubators, autoclave, microscopes, vacuum

SECOND SCHEDULE—*continued*

Topic	*Sub-topic*	*Contents*
		embedding, cryostat ELISA readers, ELISA washers, mixers, rollers, urinometers, automation, biosafety cabinets sonic and ultrasonic macerators.
	Apparatus	• Fans, electric wiring, plasma extractors, dilutors, dispensers, laboratory ware, hand lenses, intergral syringes, stropes, dissecting kit.
Instrument Installation	Dimensions	Size of instrument, weight, voltages, ventilation.
	Bench organization	Safety from water, volatile chemical, fumes, fire outbreak, biowaste
	Measurements:	Balances
	Weight	Dilutors, Dispensers
	Volume	Integral syringes and reagent bottles
	Electro-chemistry	Ion selective electrode, deionizers, pH meter
	Pressure	Vacuum embedding.
Daily Maintenance	Instruments	Dusting, covering, cleaning of instruments, daily checks, servicing visits, trouble shooting, greasing, defrosting.
	Pressure	Cleaning, drying
	Decontamination:	Disinfectants, anti-septics, sterilization
	Measurements	Balances
	Weight	Dilutors, dispensary, integral syringes and reagent bottles.
	Volume	
	Electro-chemistry	Ion selective electrode, deionizers, pH meter
	Pressure	Vacuum embedding autoclave.
Daily maintenance	Instruments	Dusting, covering, cleaning of instruments, daily checks, servicing visits, trouble shooting, greasing, defrosting.
	Apparatus	Cleaning, drying
	Decontamination	Disinfectants, anti-septics, sterilization.
Principles of functional units	Photometry	Colorimeter, spectrophotometer, random access, nephelometer, automation flame photometer, glucometers.
	Heating elements	Water bath, incubators, hot air oven, autoclaves, stills, incinerators. Automatic tissue processor, paraffin wax oven, float baths wax dispenser.
	Microscopy	Light, inverted, photoelectric fluorescent, dark ground, dissecting.
		Centrifuges, automatic stain processor, refrigerated centrifuge.
	Refrigeration	Deep freezers, refrigerators, cold room cryostat,
	Density	Urinometers.

SECOND SCHEDULE—*continued*

Topic	*Sub-topic*	*Contents*
Types of laboratory instruments	Instruments	Flame photometer, dissecting microscope, tissue processors, wax dispensers, staining processors, microtomes, paraffin wax oven, knife sharpeners, photometers, ISE, pH meter electrophoresis systems, chromatographic systems, oven incubators, centrifuges, refrigerators, balance, still glucometers, incubators, autoclave, microscopes, vacuum embedding cryostat Elisa readers, Elisa washers, mixers, rollers, urinometers, automation. Biosafety cabinets. • Sonic and ultrasonic macerators • Fans electric wiring Plasma extractors, dilutors, dispensers, laboratory ware, hand lenses, integral syringes stropes, dissecting kit.
Instrument Installation	Dimensions	Size of instrument, weight, voltages, ventilation.
	Bench organization	Safety from water, volatile chemical, fumes, fire outbreak, biowaste.
Principles of functional units	Photometry	Colorimeter, spectro-photometer, Random Access) Nephelometer automation, flame photometers Glucometers
	Heating elements	Water bath, incubators, hot air oven, autoclaves, stills, incinerators.
	Microscopy	Automatic tissue processor, paraffin wax oven, float baths, wax dispenser light, inverted, photoelectric, fluorescent, dark ground, dissecting.
	Centrifugal forces	Centrifuges, automatic stain processor, refrigerated centrifuge.
	Refrigeration	Deep freezers, refrigerators, cold room, cryostat
	Density	Urinometers.
Types of laboratory instruments	Instruments	Flame photometer, dissecting microscope, tissue processors, wax dispensers, staining processors, microtomes, paraffin wax oven, knife sharpeners, photometers, flourimeters, ISE, pH meter electrophoresis systems, chromatographic systems, oven incubators, centrifuges, refrigerators, autoclave, microscopes, vacuum embedding, cryostat Elisa readers, Elisa washers, mixers, rollers, urinometers, Automation. Biosafety cabinets. – Sonic and ultrasonic macerators – Fans, electric wiring
	Apparatus	Plasma extractors, dilutors, dispensers, laboratory ware, hand lenses, integral syringes, stropes, dissecting kit.
Instrument Installation	Dimensions	Size of instrument, weight, voltages, ventilation.
	Bench organization	Safety from water, volatile chemical, fumes, fire outbreak, biowaste.
Principles of functional units	Photometry	Colorimetr, spectro-photometer, random access) nephelometer automation, flame photometers, glucometers

SECOND SCHEDULE—*continued*

Topic	*Sub-topic*	*Contents*
	Heating Elements	Water bath, incubators, hot air oven, autoclaves, stills, incinerators, automatic tissue processor, paraffin wax oven, float baths, wax dispenser, light inverted, photoelectric fluorescent, dark ground, dissecting
	Microscopy	
	Centrifugal forces	Centrifuges, automatic stain processor, refrigerated centrifuge
	Refrigeration	Deep freezers, refrigerators, cold room, cryostat
	Density	Urinometers
	Measurements	Balances
	Weight Volume	Dilutors, dispensers, integral syringes and reagents bottles
	Electro-chemistry Pressure	Ion selective electrode, deionizers, pH meter, Vacuum embedding.
Daily maintenance	Instruments	Dusting, covering, cleaning of instruments, daily checks, servicing visits, troubleshooting, greasing, defrosting.
	Apparatus	Cleaning, drying
	Decontamination	Disinfectants, anti-septics, sterilization.

HEALTH MANAGEMENT

AIM: This course unit intends to improve the management of health care services and training institutions.

GENERAL OBJECTIVES

At the end of this course unit the trainee should be able to—

(1) Describe various principles and management theories applicable to the management of health facilities and training institutions;

(2) Formulate human resources development plan within and out of the organisation;

(3) Manage financial resources in health service organisations and training institutions;

(4) Participate in project proposals and management;

(5) Manage change;

(6) Manage disaster.

No	*Topic*	*Sub-topic*
1.	OVERVIEW OF MANAGEMENT	Role of managers in organisations. Process of management. Importance of management in organisations.
2.	TECHNIQUES OF ORGANIZING	Process of planning. Importance of planning. Techniques used in planning. Strategic planning.
3.	TECHNIQUES OF ORGANIZING ACTIVITY	Basis of organising activities. Circumstances of choosing basis. Merits and demerits of each base.

SECOND SCHEDULE—*continued*

4.	TECHNIQUES OF CO-ORDINATION	Process of co-ordination. Role of manager in directing organisational activities. Techniques used in co-ordination.
5.	HUMAN RESOURCE CO-ORDINATION	Structuring the system (analyzing and designing jobs). Recruitment, selection, placement internal mobility. Separations, death, retirements or resignation. Performance appraisal. Preparing for advancement.
6.	MANAGEMENT OF CHANGE OF CONFLICTS	Factors influencing organization chances. Causes of resistance to change. How to overcome employee resistance to change. Techniques of managing change.
7.	TECHNIQUES OF MANAGING TIME	Meaning of conflicts. Advantages and disadvantages of conflicts in an organization. Techniques of managing conflicts.
8.	STRESS MANAGEMENT	Meaning of stress. Causes of stress. Techniques of managing stress.
9.	TECHNIQUES OF CONTROL IN ORGANISATIONS	Importance and nature of control. Types of control systems. Control techniques.

MANAGEMENT AND LABORATORY PRACTICE

AIM: This course unit is intended to equip trainees with knowledge, skills and attitudes to manage laboratory personnel, materials and equipment.

GENERAL OBJECTIVES

At the end of this course unit the trainee should be able to—

(1) Design a standard laboratory layout;
(2) Practice general safety procedures in the laboratory;
(3) Care for laboratory equipment apparatus and glassware;
(4) Maintain a laboratory store;
(5) Administer first aid;
(6) Demonstrate first aid procedures to handle a victim;
(7) Manage the laboratory resources;
(8) Communicate effectively.

Code	*Topic*	*Sub-topic*	*Time*
	Laboratory design	Setting of the laboratory. Layout/floor plan. Bench types. Sinks and drainage. Floor surfaces. Types of ventilation. Lighting in the laboratory. Conversion of an existing building to laboratory.	

SECOND SCHEDULE—*continued*

	Safety precautions	Sources of danger in the laboratory and their prevention. Lab operation. Chemicals. Biological materials. Fires. Explosions. Gas cylinders. Electricity. Radiation. Use of protective clothing. Handling procedures. Choice of laboratory materials. Regulations. Role of supervisor.	
	Care for laboratory equipment	Spectrophotometers. Refrigerators. Microscopes. Incubators ovens. Water baths. Distillers and deionizers. Balances. Flame photometers. ELISA equipment. pH meters. Electrophoresis equipment. Microtomes.	
	Management	Explanation of management. Management and schools of thought. Principals of management. Planning and forecasting. Organizing. Controlling. Leading. Directing staffing. Co-ordinating. Motivating.	
	Organization	Structure. Principles of organization. Relationship. Delegation.	
	Management styles	Management by objectives. Management by exceptions. Management by crisis.	

SECOND SCHEDULE—*continued*

Code	*Topic*	*Sub-topic*	*Time*
	Materials control	Sources of information. Purchasing procedures. Receiving procedure. Types of storekeeper. Store documents. Control of stock levels. Security and protection of materials.	
	Laboratory records	Methods of storing and retrieving. Setting up protection of materials.	
	Communication	Purpose of communication. Process of communication. Informal and formal. Methods of transmission. Forms of written communication. Procedures used in planning and conducting. Interviews and meetings. Report writing— 1. General, 2. Technical. External communication. Mass media as a form.	
	First-aid	Definition, aims and roles of first-aid. Assessment of accident situations. Clinical conditions requiring first-aid. First-aid. Ethics in first-aid. Demonstrations from St. John on first-aid and techniques.	

MATHEMATICS AND STATISTICS

AIM: This course unit is intended to equip the trainees with the knowledge, skills and attitude required for the understanding of mathematical and statistical skills applied in the core and support areas.

GENERAL OBJECTIVES

At the end of this subject the trainee should be able to—

(1) Perform basic operations on numbers and algebraic expressions;

(2) Perform calculations using the scientific calculator;

(3) Demonstrate knowledge of the statistical techniques applied in data collection representation and interpretation.

	Topic	*Sub-topic*	
1.		The scientific calculator, use of.	
2.	NUMBERS	Decimals. Fractions.	

SECOND SCHEDULE—*continued*

	Topic	*Sub-topic*	
		Rounding. Standard form.	
3.	ALGEBRA	Algebraic expressions. Equations – linear; simultaneous. Quadratic— indices and logarithms— exponential and log, equations.	
4.	GRAPHS	Straight line graphs. Curves. Exponential. Deduction of laws to linear form. Gradients intercepts.	
5.	RATIO, PROPORTION, PERCENTAGE AND VARIATION	Ratio. Proportion/Variation. Inverse, direct partial and joint. Percentage.	
6.	MEASURING	Systems, conversions of units. Area, calculation of volume.	
7.	DIFFERENTIATION AND INTEGRATION	Introduction of differentiation. Introduction of integration. Applications of differentiation and integration.	
8.	STATISTICS	Collection of data. Organization of data. Representation of data. Statistical measures. Mean. Median. Mode. Standard deviation. Interpretation of data. Introduction. Simple regression and correlation. Analysis.	
9.	PROBABILITY	Definition of probability. Classical definition. Axiomatic definition.	

MEDICAL TERMINOLOGIES

AIM: This unit is intended to enable students apply medical terminologies in reporting of laboratory results and use them for the purposes of interaction in class and the work-place.

OBJECTIVES

At the end if this unit the students should be able to—

(1) List commonly used medical terms and words;

(2) Discuss the meaning of medical words and terms;

(3) Understand Greek alphabets;

(4) Explain the usage and applicability of terms and words used in medicine;

(5) Understand the synthesis and analysis of medical words and terms;

(6) Synthesize and analyze medical words and terms.

	Topic	*Sub-topic*
1.	Introduction to medical terminologies	History and origin of medical terms. Qualities of medical languages. Principles of derived from Latin and Greek languages without alterations or modified to improve accuracy by addition of— ■ "oid", ■ "iform", ■ prefixes such as "para" and "pseudo".
2.	Medical words and terms	Words roots, prefix, suffix, combining forms. Compound words. Greek and Latin. Anatomical synonyms.
3.	Greek alphabets	List Greek alphabets and their meaning.
4.	Application of medical words and terms	Resemblance – words derived with little or no alterations. Prefix **"pseudo"** (meaning an example). Words pertaining to— Cavities, membranes and partitions. Opening and communications— – fluids and substance quantity, – deficiency. Deficiency. Excess numbers. Paired and unpaired. Measurements and size. Textures and fabrics. Air and breadth. Form and sharp. Color. Hardness and softness. Thickness and weight. Surface identity relations. Age. Positions and relative arrangements and distributions.

SECOND SCHEDULE—*continued*

	Topic	*Sub-topic*
		Approximation and separation. Visibility. Temperature. Time. Goodness and badness. Ease and difficulty. Movement and transport. Sensation, feeling and affection. Growth and reproduction. Nutrition, digestion and excretions. Special service, cutaneous sensation. Mental states construction. Destruction and obstruction. Protection. Wasting, decay and death. Entomological terms.

RESEARCH METHODS AND PROJECTS

AIM: This course aims at equipping the trainees with knowledge, skills and attitudes that will enable them carry out scientific projects.

GENERAL OBJECTIVES

At the end of this course unit, the trainees should be able to—

(i) Formulate hypotheses;
(ii) Prepare a research proposal and budget proposal;
(iii) Design a sampling frame;
(iv) Collect, organise and represent data;
(v) Use statical techniques in data analysis;
(vi) Apply computer techniques in data analysis;
(vii) Observe ethical standards in research;
(viii) Present a project report in a structured format.

Topics	*Sub-topic*
Introduction	– Hypothesis, research questions, objectives. – Ethical considerations.
Population and Sampling	– Population. – Types of sampling. – Probability sampling methods. – Non-probability sampling methods.
Data collection	– Observation methods. – Interviews and questionnaires. – Trace measures. – Content analysis. – Data archives. – Measurements.

SECOND SCHEDULE—*continued*

Topics	*Sub-topic*
Data analysis	– Qualitative methods. – Quantitative method (Statistics)— ■ binomial distribution, ■ poison distribution, ■ normal distribution, ■ student distribution, ■ estimation theory, ■ test of hypothesis in large and small samples.
Use of computer	– In statistical analysis. – In data organization. – Production of report.
Sampling frame	– Significance of sampling. – Methods of sampling— ■ probability samples, ■ non-probability samples.
Data collection	– Methods of collecting data— ■ observation methods, ■ interviews and questionnaires, ■ trace measures, ■ content analysis, ■ data archives, ■ measurements.
Data analysis	– Qualitative. – Quantitative analysis— ■ binomial distribution, ■ poison distribution, ■ student distribution.
Test of hypothesis	– Estimation theory. – Test of hypothesis in large sample and small sample.
Computer applications	– Application of statistical computer packages for analysis. – Application of computers packers for data organization.

SOCIAL STUDIES, PROFESSIONAL CONDUCT, ETHICS AND LAW

AIM: This course unit is intended to equip the trainee with knowledge skills and attitudes for effective role-play in society and work-place.

OBJECTIVES

At the end of this course unit the trainee should be able to—

(1) portray acquired attitudes in relation to work and society;

(2) develop cultural values for self-development;

(3) formulate personal ideas;

(4) relate the behaviour of individuals to their efficiency and effectiveness in an organisation;

(5) understand the Public Health Act (Chapter 242 of the Laws of Kenya) and the KLMTTB Act (Act No. 10 of 1999) and any other relevant provisions of the general law;

SECOND SCHEDULE—*continued*

(6) comply with the provisions of the M.L.T.T. Act and the relevant provision of the Public Health and other relevant provisions of the general law;

(7) understand the role of Government.

CONTENT

	Topics	*Sub-topics*
1.	Social studies	– Medical psychology. – Medical sociology. – Basic economics – elements. – Social economics. – Government. – National philosophy. – Science and technology. – Commerce. – Personal inter-relationships. – Public relations.
2.	Ethics	– Meaning and importance. – Description of the role of religion influencing morality in society. – Significance of social and individuals. – Role of humanism in society. – Professional conduct and ethics— – Part VI of the Constitution of the Association of Kenya Medical Laboratory Scientific Officers. – Technology and religion.
3.	Law	– Definition. – Importance. – Sources of Kenyan Law: – Constitution, Public Health Act Cap. 242 of the Law of Kenya, Medical laboratory Technicians and Technologists – Act No. 10 of 1999. – Law of contract. – Law of tort. – Family law. – Land/real property – basic interests. – Law in the day to day life of an individual.

STERILIZATION AND DISINFECTION

AIM: The subject is intended to equip the trainee with knowledge skills, and attitudes to be able to practise sterilisation and disinfection in medical laboratory.

OBJECTIVES

At the end of this course unit the trainee should be able to—

(1) define terminologies used in sterilisation and disinfection;

SECOND SCHEDULE—*continued*

(2) explain the principles of sterilisation and disinfection;

(3) explain methods and factors influencing sterilisation;

(4) describe the techniques used in sterility testing;

(5) carry out sterilisation, disinfection, waste disposal and check sterilisation.

	Topic	*Sub-topic*
(i)	Terminology	Germicides, disinfection, Bactericides, antiseptics, Fungicides, bacteriostats.
(ii)	Principles	Oxidation, Lysis (membrane disruption) denaturation of proteins, ionization and enzyme poisons.
(iii)	Methods	Physical Heat: dry heat, moist heat. Radiation: Ultra-violet. Radiation: Ionizing. Filtration: Chemicals: Alcohol, chloroform, chlorine, glycerol, phenol, cresol, aldehydes, ethylene oxide, quarternary, ammonium compounds.
(iv)	Factors	Nature, local and type of Micro-organisms, nature of Material and containers, time, temperature, humidity, organic, contaminants.
(v)	Sterility testing	Automatic process control. Recording thermometers. Thermocouple measurement. Chemical indicators, autoclave tape. Biological control.
(vi)	Practicals	Safety measures, sterilization. Disinfection, waste disposal, check sterility.

MEDICAL MICROBIOLOGY

AIM: This course unit is intended to equip the trainee with knowledge, skills and attitudes to be able to work, supervise and teach as a Medical Laboratory Technologist in a Class B Laboratory.

GENERAL OBJECTIVES

At the end of this course unit the trainee should be able to—

(1) explain the principles relating to taxonomy, nomenclature, classification and characterisation of micro-organisms;

(2) understand and apply safety precautions in sterilisation and disposal methods;

(3) understand the principles and operations of equipments used in the laboratory;

(4) explain and carry out the procedure of specimen collection and handling;

SECOND SCHEDULE—*continued*

(5) apply the laboratory procedures used to investigate the diseases caused by micro-organisms;

(6) contribute to the development of knowledge and research in medical sciences;

(7) handle patients with care;

(8) understand and apply the principles of quality control;

(9) describe the sampling procedures in water, food and milk bacteriology.

YEAR 1

GENERAL OBJECTIVES

At the end of the first year the trainee should be able to—

(1) state and define the major classes of micro-organisms;

(2) understand and apply safety precautions in sterilisation and disposal methods;

(3) explain and carry out the procedures of specimen collection and handling;

(4) explain the preparation of common stains;

(5) prepare and use common culture media;

(6) explain the identification methods of bacteria;

(7) describe and apply antimicrobial susceptibility testing;

(8) describe the properties, pathogenesis and epidemiology of medically important bacteria;

(9) describe the laboratory diagnosis.

CONTENT YEAR 1

	Topic	*Sub-topic*	*T*	*P*
1.	INTRODUCTION TO MICRO-BIOLOGY	– Definition. – Nomenclature. – Classification. – Characterization.		
2.	SAFETY	– W.H.O. code of practice. – Laboratory acquired infections. – Classes of laboratories. – Hazard groups. – Laboratory wastes. – Types of safety cabinets. – Handling and storage of chemicals.		
3.	STERILIZATION	– Definitions. – Methods of sterilization. – Factors influencing sterilization. – Sterility testing.		
4.	COLLECTION AND PROCESSING OF SPECIMENS	– Specimen containers. – Types of specimens. – Transportation.		

SECOND SCHEDULE—*continued*

	Topic	*Sub-topic*	*T*	*P*
		– Processing. – Preservation.		
5.	STAINING	– Preparation of a smear. – Types of stains. – Preparation of stains. – Staining methods. – Factors affecting staining.		
6.	CULTURE MEDIA	– Types. – Ingredients. – Classes. – Preparation. – Storage. – Quality control.		
7.	CULTURIVATION of MICRO-ORGANISMS	– Culture methods. – Factors affecting growth. – Cultural characteristics.		
8.	IDENTIFICATION OF BACTERIA	– Biochemical tests. – Serological tests.		
9.	ANTIMICROBIAL SUSCEPTIBILITY TESTING	– Definition. – Mechanisms of action. – Factors affecting susceptibility tests. – Susceptibility testing.		
10.	BACTERIOLOGY	Genus— – Staphylococcus, – Streptococcus, – Neisseria, – Escherichia, – Klebsiella, – Citrobacter, – Enterobacter, Yersinia, Salmonella, Shigella, Proteus, Haemophilus, Peudomonas, Vibrio, Brucella, Bordetella, Bacillus, Costridium.		

SECOND SCHEDULE—*continued*

YEAR 2

GENERAL OBJECTIVES

At the end of the second year the trainee should be able to—

(1) Apply safety techniques in a medical microbiology laboratory;
(2) Perform sterilisation, disinfection and disposal methods in microbiology;
(3) Collect, handle, transport, process and preserve specimens;
(4) anAlyse data for project work;
(5) Write a project report—
- project title selections;
- sources of data;
- available materials and equipment;
- finance/budget.

	Topic	*Sub-topic*
1.	SAFETY	Safety techniques in microbiology laboratory.
2.	STERILIZATION	Sterilization methods. Disinfection.
3.	SPECIMENS	Collection. Transportation. Preservation. Processing.
4.	LABORATORY DIAGNOSIS	Laboratory procedures used in diagnosis of common diseases. Sensitivity tests.

YEAR 3

GENERAL OBJECTIVES

At the end of the third year the trainee should be able to—

(1) describe the sampling procedures in water bacteriology;
(2) describe bacteriological analysis of water, milk and food;
(3) classify moulds and yeasts of medical importance;
(4) state various fungal diseases;
(5) describe the culture methods;
(6) explain the laboratory diagnosis.

1.	BACTERIOLOGY (CONTD)	Corynebacterium. Mycobacterium. Borrelia. Leptospira.		
2.	BACTERIOLOGY OF WATER, MILK AND FOOD	Water sampling. Bacteriological analysis of water, milk and food.		

SECOND SCHEDULE—*continued*

	Topic	*Sub-topic*		
3.	MYCOLOGY	Definition. Morphological classification. Laboratory diagnosis. Diseases. Culture methods.		

CLINICAL CHEMISTRY

AIM: This course unit is intended to equip the trainee with attitudes, knowledge and skills to be able to work, supervise and teach as a Medical Laboratory Technologist in a class B laboratory.

GENERAL OBJECTIVES

At the end of this course unit the trainee should be able to—

(1) explain and apply chemistry;
(2) describe and apply clinical chemistry;
(3) explain and practice safety measures;
(4) maintain, operate and care for equipment and apparatus;
(5) store chemicals and reagents;
(6) explain theories of principles of techniques in clinical chemistry;
(7) carry out various diagnostic techniques;
(8) collect specimens;
(9) apply clinical chemistry in research.

YEAR 1

GENERAL OBJECTIVES

(TO COVER YEAR 1: TERMS 2 AND 3, AND YEAR 2)—

(i) Understand chemistry and its application.
(ii) Describe and apply concepts of clinical chemistry.
(iii) Explain safety measures.
(iv) Maintain, operate and care for equipment and apparatus.
(v) Store chemicals and reagents.
(vi) Explain theories of principles.
(vii) Collect specimens.

	Topic	*Sub-topic*	*Content*
TERM II	Introduction		Definition, diagnosis, importance.
	General Chemistry	Physical chemistry	Atoms, atomic structure, valency, thermo-chemistry, redox, reactions, acids, bases, colligative properties, rates of reactions, theories of catalyses.
		Inorganic reactions	Colour of solids and solutions, solubility, thermodynamics, qualitative analysis.
		Volumetric analysis, titrimetric analysis is preferred	Standard solutions, weights and measures, theory and choice of indicators, dissociation constants, buffers, pH, acid-base, redox and precipitation.
			Titrations.

SECOND SCHEDULE—*continued*

	Topic	*Sub-topic*	*Content*
		Organic chemistry	Structure of carbon compounds isomerism, homologous series, aromatic compounds, functional groups, reaction process.
	Concepts of clinical chemistry	Biochemistry	Amino acids and proteins, carbohydrates, lipids, vitamins, enzymes, nucleo-proteins, nucleic acids, porphyrins and bile pigments.
		Physiology organs	Kidney, liver, pancreas, stomach, lungs, heart.
		Hormones	Origin, structure, general functions, control, feedback and other regulatory factors.
		Blood fluids	Blood, ascitic, lymph, CSF.
		Pathology	Nephrosis, renal calculi, diuresis, acidosis, alkalosis, hepatomegaly, cirrhosis, hepatoma, hepatitis, gallstones, myocardial infarction glycaemia, cancer of the pancreas, diabetes, gastritis, fertility hormones, thyroid hormones, tertiary hypercalcaemia.
		Function tests	Renal, thyroid, liver cardiac, pancreatic, lipid profile.
	Safety measures	Chemicals	Sources of injuries – carcinogenic, poisons, corrosives, volatiles, radio-active, explosives, fumes. Protective measures – protective gear, handling fire, fighting, gadgets and disposal.
		Biological specimen	Sources of infection – exudates, stool aerosols, CSF. Protective measures – mechanical, electric thermal (hot water), air dry heat. Protective measures – protective gear, bench organization, insulation, voltage.
		Laboratory ware	Sources of injuries – breakages, sharps, mechanical. Protective measures – protective gear, handling, disposal.
	Specimen collection		Containers, anticoagulants. Disposable syringes and needles, labels, preservatives, request form, interpretation.
		Mode of collection	Aseptic techniques, hygienic sites and stasis.
		Types of specimen	Blood, urine, stool, CSF, aspirates, exudates.
	Principle of techniques	Pipeting	Capillarity, negative pressure, atmos-pheric pressure.
		Qualitative analysis	Physical examination, chemical analysis, chromatography, microscopy.
		Quantitative analysis	Photometry, volumetric analysis, gravimetry, fluorimetry, electrochemistry chromatography, electrophoresis, radio-activity, automation.

SECOND SCHEDULE—*continued*

TERM 3

DIAGNOSTIC TECHNIQUES

THEORY AND PRACTICALS (URINE CHEMISTRY)

Diagnostic Techniques	Urine	Quantitive: Volume, colour, appearance, odour, sugar, ketones, bilirubin, urobilinogen, urobilin, urinary proteins, pH, crystals, casts, cells, SG, surface tension, nitrate, hormones, porphyrines. Quantitive: clearance, osmolarity, electrolytes, phosphates, enzymes, proteins, Glucose, hormones, porphyrins, electrophoresis, chromatography.

YEAR 2: TERM I

DIAGNOSTIC TECHNIQUES

THEORY AND PRACTICALS (BLOOD)

	Blood (plasma)	Qualitative: Haemolysis, jaundice, coagulum, lipaemia. Quantitative: Sugars, proteins, urea, bilirubin, creatinine, electrolytes, uric acid, enzymes, hormones, lipids, HB AIC, inorganic phosphates, TIBC, electrophoresis, chromatography.

YEAR 3: TERM II AND III

GENERAL OBJECTIVES

At the end of this period the trainee should—

(1) Practice safety measures;
(2) Apply concepts of clinical chemistry;
(3) Maintain, operate and care for equipment and apparatus;
(4) Store chemicals and reagents;
(5) Collect specimens;

SECOND SCHEDULE—*continued*

(6) Carry out diagnostic techniques;

(7) Apply clinical chemistry in research.

Content:

Take precautions when handling: carcinogens, poisons, corrosives, volatiles, radioactives, explosives, fumes, biological specimens, (urine, blood, stool, CSF, aspirates, exudates) instruments, laboratory ware, maintain, operate and care for microscope, centrifuge, refrigerator, balances, auto-analysers, electrophoresis machine, pH meter, mantle heaters, mechanical heaters, water bath, colorimeter, flame photometer, spectrophotometer, distillers, de-ionisers, incubators, glucometer, fluorimeter, scanners.

–Store acids, alkalis, reagents, and chemicals.

–Collect urine, blood, stool, aspirates, exudates, and blood separation.

–Check for volume appearance, odour, colour, SG, pH, proteins, glucose, bilirubin, urobilinogen, urobilin, nitrates, ketones.

–Determine urinary glucose, proteins enzymes, chlorides, and urea.

–Determine the following in blood glucose, albumin, total protein, bilirubin, urea, electrolytes, cardiac enzymes, L.F.T.S., lipid, profile, fertility, hormonal profile, thyroid hormones.

Determine the following in body fluids—

CSF – appearance, colour, clots, biochemistry (glucose, protein).

Aspirates and exudates (glucose protein).

Determine the following in stool—

– tryptic activity,

– faecal fat.

Occult blood.

Perform the following in gastric juice—

– check for volume, appearance, starch, bile pigments, blood, and mucus,

– determine pH and tritable acidity,

– clinical chemistry in research.

– collect data for the analytes.

GENERAL OBJECTIVES: YEAR 3 TERMS 2 AND 3—

- explain theories of principles;
- manage resources;
- apply clinical chemistry in research,

Year 3	Body Fluids	Qualitative: Appearance, coagulum, turbidity, volume, chemical analysis, pH.
Term 2		Quantitative: Biochemistry – proteins and sugars, titration, pH.
Resource Management	Fiscal	Financial Resources: Maintenance cost, record keeping, centralised Storage.
	Human	Personnel management, intersectoral collaboration.

SECOND SCHEDULE—*continued*

Clinical	Nosographical	Epidemiology, sensitivity, correlation to reference ranges (values).
Chemistry Research	Situation Analysis	Therapeutic drug monitoring (TDM)
Year 3	Project revision	
Term 3	Examination	

HAEMATOLOGY

AIM: At the end of this course unit the trainee should be equipped with knowledge, skills and attitudes in order to perform and detach hematological techniques and manage laboratory resources in a Class B laboratory.

GENERAL OBJECTIVES

At the end of this session the trainee should be able to—

(a) explain the use of haematology;
(b) observe safety measures in haematology laboratory;
(c) explain composition and functions of blood components;
(d) explain haemopoesis;
(e) collect and store haematological blood samples;
(f) prepare and store haematological reagents;
(g) enumerate all blood cells;
(h) perform P.C.V. and E.S.R. estimation;
(i) describe haemoglobin estimation;
(j) calculate all haematological indices and interpret results;
(k) prepare stain report and comment on peripheral blood film;
(l) explain various types of anaemia.

YEAR 1: TERMS (2, 3)

AIM: At the end of this course the trainee should be equipped with basic knowledge, skills and attitudes to be able to perform haematological techniques and interpret the results accurately in a laboratory.

OBJECTIVES

(1) explain the use of haematology;
(2) observe safety measures in haematology laboratory;
(3) explain composition and functions of blood components;
(4) explain haemopoesis;
(5) collect and store haematological reagents;
(6) prepare and store haematological reagents;
(7) enumerate all blood cells, perform P.C.V. and E.S.R. estimations;
(8) describe haemoglobin synthesis;
(9) perform haemoglobin estimation;
(10) calculate all haematological indices an interpret results;
(11) prepare stain report and comment on peripheral blood film.

SECOND SCHEDULE—*continued*

CONTENT

	Topic	*Sub-topic*
1.	INTRODUCTION	Definition. Importance. Safety precaution.
2.	BLOOD COMPOSITION	Erythrocytes. Leucocytes. Thrombocytes. Plasma.
3.	FUNCTION OF COMPONENTS	Erythrocytes. Neutrophilis. Monocytes. Lymphocytes. Eosinophils. Basophils. Thrombocytes. Plasma.
4.	HAEMOPOERISIS	Intra-uterine (foetal). Post-uterine (after birth). Extra-medullary hemopoeisis. (Myeloid metaplasia). Life-span of blood cells.
5.	HAEMATOLOGICAL SAMPLES	Anticoagulants, blood collection containers. Capillary blood sample. Venous blood sample techniques.
6.	PERIPHERAL BLOOD	Thin film preparation. Thick film preparation. Uses, purpose techniques.
7.	CYTOMORPHOLOGY OF BLOOD CELLS	Normal blood cells— (a) erythrocytes leucocytes platelets; (b) immature blood cells characteristics and significance.
8.	HAEMATOLOGICAL STAINS	Romanowsky stain; (i) Leishman; (ii) Jenners stains; (iii) Wrights stain; (iv) May grunwald; (v) Giemsa.
9.	HAEMOCYTOMETRY	Total blood cell counts. Red blood cells. White blood cells.

SECOND SCHEDULE—*continued*

	Topic	*Sub-topic*
		Platelets. Differential leukocyte count. Battlement method. Longitudinal. Reticulocyte count.
10.	PACKED CELL VOLUME	Electronic blood cell counter. Micro haematocrit method. Macro haematocrit method. Electronic method. Sources of error techniques.
11.	ERYROCYTE SEDIMENTATION RATE	Wintrobe method. Westergren method. Laudau Adam's. Electronic method. Factors affecting E.S.R. estimation techniques.
12.	HAEMOGLOBIN	Definition. Synthesis. Types of haemoglobin. Heamoglobinopathes. Methods of estimation. Haemoglobin curve.
13.	HAEMATOLOGICAL INDICES	Mean cell volume. Mean cell haemoglobin. Concentration. Mean cell haemoglobin (manual and electronic) techniques.
14.	SYSTEMATIC REPORTING OF THE FILM	Red blood cells. White blood cells. Platelets. SI blood parasites. Comments.
15.	ANAEMIA	Definition. Pathogenesis. Causes of anaemia. Classification. Types of anaemia. Laboratory investigation. Management.
16.	HAEMASTOSIS	Definition. Vascular system. Coagulation mechanism— i)intrinsic mechanism,

SECOND SCHEDULE—*continued*

	Topic	*Sub-topic*
		ii) extrinsic mechanism, iii) common pathway.
17.	FIBRINOLYSIS	*Investigation of haemostatic— Bleeding time, Clotting time, Prothrombin time test, A.P.T.T. Thrombin time substitution test.
18.	INTRODUCTION TO AUTOMATED COAGULATION, INTRODUCTION TO SUBSTITUTION TESTS	Electronic methods. KCCT Substitution test. Using normal plasma. Using old serum. Using absorbed plasma. PTT substitution test. Using Russel viper venom. Thrombin time substitution test. Using reptilase. Using protamine sulphate. Using aminocarproic acid.

YEAR 2: TERMS 4, 5, 6

OBJECTIVES

At the end of this year, the trainee should be able to—

- produce data for research;
- perform the tests listed in the practical rotation guidelines booklet;
- explain types of anaemia.

CONTENT

- Practical placement.
- Data collection for project work.
- Performance of haematological tests as listed in the practical rotation booklet.

Topic	*Sub-topic*
Anaemia	– Definition. – Classification. – Clauses. – Types of anaemia. – Laboratory investigations. – Management.

YEAR 3 – TERMS 7, 8, 9

At the end of this session, the trainee should be able to—

- explain haemostatic mechanism;

SECOND SCHEDULE—*continued*

- perform tests for haemostatic disorders;
- explain substitution tests;
- produce research project work.

CONTENT

Topic	*Sub-topic*
Haemostasis	– Definition. – Vascular system. – Coagulation mechanisms— (i) Intensive mechanisms, (ii) Extrinsic mechanisms, (iii) Common pathway, (iv) Fibrinolytic mechanisms. – Investigation of hemostasis— (i) Bleeding time, (ii) Clotting time, (iii) Prothrombin time test, (iv) A.P.T.T., (v) Thrombin time.
Introduction to substitution tests	KCCT Substitution Test— (i) Using normal plasma, (ii) Using old serum, (iii) Using adsorbed plasma. P.T.T. substitution test— (i) Using russell viper venom, (ii) Thrombin time. Substitution test— (i) Using reptilase, (ii) Using protamine sulphate, (iii) Using amino caproic acid. Revision.

HAEMATOLOGY PRACTICALS

1.	COLLECTION OF BLOOD	– Thin film. – Thick film.
2.	PREPARATION OF ROMANOWSKY STAINS	– Leishman's stains. – Field stain. – Leishman stain. – Marygrunwald stain. – Jenner's stain. – Wrights stain.
3.	ROMANOWSKY STAINING TECHNIQUES	
4.	BLOOD CELL COUNT	– Total. – Differential.

SECOND SCHEDULE—*continued*

5.	SUPRAVITAL STAINS	– B.C.B. – New Methylene Blue. – Methyl Violet.
6.	SUPRAVITAL STAINING	– Recticulocyte count. – Heinz body preparation.
7.	PCV ESTIMATION	– Micro method. – Macro method.
8.	E.S.R.	– Wintrobe's method. – Westergren's method.
9.	HAEMOGLOBIN ESTIMATION	– Sahli method. – Cyanmethaemoglobin. – Oxyhaemoglobin method. – Haemoglobin curve.
10.	REPORTING OF BLOOD FILM	– Red cells. – White cells. – Platelets. – Comments.
11.	HAEMATOLOGICAL INDICES	– M.C.V. – M.C.H. – M.C.H.C.
12.	BONE MARROW FILM PREPARATION	– Straight film. – Squash film.
13.	IRON STAINING TECHNIQUE (PPB)	
14.	L.E. BODY PREPARATION	
15.	OSMOTIC FRAGILITY TEST	
16.	HAEMOGLOBIN ELECTROPHORESIS (LAPE)	
17.	HAEMOGLOBIN-F ESTIMATION (SINGER'S METHOD)	
18.	G.G.P.D. SCREENING TEST	– Ivy's method.
19.	BLEEDING TIME TEST	– Duke's method.
20.	CLOTTING TIME TEST	– Lee and White Method.
21.	PROTHROMBIN TIME TEST	
22.	THROMBIN TIME TEST	
23.	KAOLIN AND CEPHALIN CLOTTING TIME TEST (KCCT) OR A.P.T.T.	
24.	WASHING OF GLASSWARE	

HISTOPATHOLOGY AND CYTOPATHOLOGY

AIM: The course unit is intended to equip the trainees with knowledge, skills and attitudes that enable them to handle histopathological and cytopathological situation in Class B laboratory.

SECOND SCHEDULE—*continued*

GENERAL OBJECTIVES

At the end of this course unit, the trainees should be able to—

(i) explain concepts related to histopathological and cytopathological techniques;

(ii) apply knowledge, skills and attitudes acquired for diagnostic purposes in Histopathology and cytology laboratory;

(iii) select and apply histopathogical and cytopathological techniques;

(iv) understand the principles and operations of equipments used in histopathology and cytopathology;

(v) perform cytological screening techniques for diagnostic purposes;

(vi) apply mausoleum techniques for diagnostic purposes and service to the public;

(vii) observe and practice safety procedures in the reagents and apparatus.

YEAR 1: TERM 2

OBJECTIVES

At the end of this term, the trainee should be able to—

(i) eplain terms used in histopathology and cytopathology;

(ii) dmonstrate cell and epithelium;

(iii) dscribe the systems of the body;

(iv) dfine fixation and classify fixatives.

CONTENTS

Introduction—

Importance and uses of histopathology and cytopathology.

–Terminologies used.

–Sources of specimens.

–*Cell and Epithelium—*

–Cell structure and composition;

–Cell function;

–Cell division;

–Cell ageing;

–Four primary tissues;

–Types of epithelial cells;

–Functions of epithelial.

–*The body systems—*

Parts and functions of—

urinary, circulatory, digestive, reproductive, muscular, skeletal, glandular and respiratory systems.

–*Fixation and fixatives—*

–Definition, terms used;

–Purposes of fixation;

–Fixing agents;

SECOND SCHEDULE—*continued*

–Effects of fixations;

–Preparation of fixations;

–Methods of fixing;

–Storage after use.

YEAR 1: TERM 3

OBJECTIVES—

At the end of this term, the trainee should be able to—

(i) perform decalcification and decalcifying methods employed;

(ii) perform tissue processing;

(iii) identify various types of equipments used;

(iv) explain and prepare section adhesives.

CONTENTS

(i) *Decalcification: Definition*

–Methods of decalcification;

–End points of decalcification;

–Treatment after decalcification.

(ii) *Tissue processing*—

–Dehydration, clearing;

–Infiltration, Impregnating;

–Embedding, Embedding media;

–Embedding moulds.

(iii) *Contents*

–Automatic tissue processors;

–Microtomes, vacuum embedding machines, microtomes knives;

–Hones, stoppers, knife sharpeners;

–Cryostas.

(iv) *Section Adhensives*—

–Types of adhensives;

–Purpose of adhensives;

–Preparation of adhensives.

YEAR 2: TERM 4

OBJECTIVES

At the end of this term, the trainee should be able to—

(i) Describe principles of staining;

SECOND SCHEDULE—*continued*

(ii) Demonstrate histological pigments;

(iii) Prepare mountants and classify mounting media.

Contents

(i) *Principles of staining*—Definition of dyes and stains
–Preparation of stains;
–Types of staining reactions, types of stains;
–Staining methods;
–Staining equipments and apparatus used.

(ii) *Histological pigments*—
–Definitions;
–Types of pigments;
–Their identification;
–Their demonstration and or removal.

(iii) *Mountants*—
–Types of mounting media;
–Uses of mountants;
–Methods of mounting;
–Ringing media.

YEAR 3: TERM 8

OBJECTIVES

At the end of this term, the trainee should be able to—

Describe cytopathology and perform cytological techniques;

Perform museum techniques.

CONTENTS

(i) Cytopathology—
–Definition, terminologies used, applications of cytology;
–Sources of specimens;
–Collection, Fixatives employed;
–Staining methods;
–Screening and classification of pap smears;
–Equipments and apparatus used.

(ii) Museum Techniques—
–Collection of museum specimens;
–Methods of preparation;
–Labeling and display of specimens.

SECOND SCHEDULE—*continued*

YEAR 3: TERM 9

OBJECTIVES

At the end of this term, the trainee should be able to—

(i) understand concepts related to mausoleum techniques;

(ii) explain safety precautions in relation to histopathological and cytological laboratories.

CONTENTS

(i) *Mausoleum Techniques*—

Public relations;

Cultural/religious values;

Body handling;

Body dressing;

Public Health Act on body disposal;

Embalming;

Body suturing.

(ii) *Safety Precautions*—

Fire hazards;

Physical injuries;

Chemical injuries;

Explosives/implosives;

Infectious specimen.

BLOOD TRANSFUSION SCIENCE

AIM: At the end of this course unit the trainee should be equipped with knowledge, skills and attitudes in order to perform and teach various laboratory techniques and manage laboratory resources at the intermediate level.

GENERAL OBJECTIVES

(i) describe various blood group systems;

(ii) perform ABO and Rh typing;

(iii) perform compatibility tests;

(iv) investigate complication arising from antigen-antibody reaction;

(v) interpret the laboratory test and advice accordingly;

(vi) prepare reagents used in blood transfusion laboratory; observe lab safety and quality control measures;

(vii) organize blood campaigns, recruit donors and screen donated blood for infectious diseases;

(viii) prepare and store blood products;

(ix) manage blood donor centre.

SECOND SCHEDULE—*continued*

YEAR ONE 1

OBJECTIVES

At the end of this session the trainee should be able to—

(i) define terminologies used in blood transfusion science;
(ii) describe various blood group systems;
(iii) perform ABO and Rh typing;
(iv) explain blood group anomalies;
(v) carry out compatibility test;
(vi) perform blood transfusion techniques;
(vii) investigate complication arising from antigen-antibody reaction;
(viii) interpret laboratory test results and advise accordingly;
(ix) prepare reagents used in blood transfusion laboratory;
(x) observe laboratory safety and quality control measures;
(xi) explain haemolytic disease of the new-born.

CONTENT

Topic	*Sub-topic*
Introduction	Definition of the term. Blood transfusion service. Blood importance.
Terminologies	Antigen. Antibodies. Agglutination. Haemolysis. Sensitization. Precipitation. Complement. Hapten. Inhibition. Neutralization. Immunization.
ABO blood group system	History. Significance of ABO system. Inheritance. Antigens. Antibodies. ABO sub-groups. ABO grouping techniques.

SECOND SCHEDULE—*continued*

Topic	*Sub-topic*
Rhesus blood group system	History. Significance of Rh System. Inheritance. Antigens. Nomenclature. Variants of D antigens. Rhesus null phenotype. Rhesus grouping techiniques.
TOPIC (4)	
ABH blood group system	Definition. H-Gene. A-Gene. B-Gene. O-gene. Bombay phenotype.
Blood group specific substances	Definition. Types. Secretor status (Se gene). Significance. Techniques.
Other blood group systems	MNSS. Kell. Duffy. I. P. Lewis. Lutheran. Kidd. Xg.
Blood group anomalies	Conditional, physical. Hereditary.
Preparation of reagents used in blood transfusion	Normal saline. 22% bovine albumin. Coombs reagents (AHG). Lectins. Antisera. Enzymes.
TOPIC (5)	
Blood transfusion techniques	Direct coomb's. Indirect coomb's. Antibody screening test.

SECOND SCHEDULE—*continued*

Topic	*Sub-topic*
	Antibody titration. Antibody identification. Absorption techniques. Absorption techniques. Elution techniques.
Crossmatching	Definition. Importance. Types. Phases. Techniques.
Transfusion reaction	Definition. Categories. Laboratory investigation.
Haemolytic disease of the new-borns	Definition. Causes. Clinical signs & symptoms. Laboratory investigation. Prevention. Management.

YEAR 2

OBJECTIVES

At the end of this session the trainee should be able to—

(a) perform techniques in transfusion science;

(b) produce data for research project work.

CONTENT OF YEAR 2

Practical attachment (i.e. Term 5, 6, 7)—

(i) perform tests listed in the practical rotation guideline books;

(ii) collection of data for project work.

Topic	*Sub-topic*
Year 2	Practical attachment (i.e. Term 5, 6, 7) ➢ Perform tests listed in the practical rotation guideline. ➢ Booklet. ➢ Collection of data for project work.

YEAR 3

OBJECTIVES

At the end of this session the trainee should be able to—

(i) Organize blood campaign;

(ii) Recruit donors;

SECOND SCHEDULE—*continued*

(iii) Screen donated blood for infectious diseases;
(iv) Maintain records in blood donor unit;
(v) Prepare and store blood and blood products;
(vi) Dispose blood;
(vii) Perform quality control;
(viii) Maintain blood bank equipment;
(ix) Explain the application of blood groups to forensic medicine;
(x) Interpret National policy guidelines;
(xi) Analyze research project research;
(xii) Present/publicize research project.

CONTENT

Topic	*Sub-topic*
COMPLEMENT	INTRODUCTION TO COMPLEMENT SYSTEM.
BLOOD DONOR SERVICE	Organization of blood donor centre. Blood campaigns. Recruitment – donors. Phlebotony procedure. Anticoagulants. Screening of donated blood. Documentation. Storage of blood. Disposal of blood. Quality control measures. Safety in blood bank. Maintenance of blood bank equipments.
BLOOD PRODUCTS	Definition. Types. Uses. Preparation. Storage.
APPLICATION OF BLOOD GROUP TO FORENSIC MEDICINE	1st order of exclusion. 2nd order of exclusion. Differentiation of human stains from others.
NATIONAL POLICY GUIDELINES IN BLOOD TRANSFUSION	Collection of blood. Distribution. Uses. Legal aspects.

SECOND SCHEDULE—*continued*

PRACTICAL SCHEDULE

Topic	*Practicals*
ABO blood group system	Slide and tube. Forward and reverse grouping. ABO sub-group.
Rhesus blood group system	Slide method. Tube method. 22% bovine method.
Coomb technique	Direct Coomb's test. Indirect Coomb's test. Du test. Anti-body screening test.
Neutralization test	Neutralize natural antibodies. Detection of blood group specific substance.
Enzyme technique	Low's method (papain method).
Anomalies	Para-agglutination. Chmeras. Blood group A with anti A in serum. Blood group O from an infant.
Blood donor centre	Blood campaign. Blood donor recruitment. Maintenance of record. Phlebotomy. Blood screening for— HIV, Hepatitis, VDRL, Mass blood grouping. Preparation of various blood products— packed cells, white cell concentrate, poor white cell plasma, platelet rich plasma, FFP–fresh frozen plasma, etc.
Preparation of reagents	Physiological saline. Preparation of 22% bovine albumin from 30%.

MEDICAL PARASITOLOGY

AIM: To equip the trainees with knowledge, skills and attitudes which will enable them to carry out parasitological and entomological techniques in Class B diagnostic and research laboratories as well as in fieldwork.

SECOND SCHEDULE—*continued*

General objectives

At the end of this course unit the trainee should be able to—

(i) explain the concepts of medical parasitology and entomology;

(ii) collect, receive, preserve and store parasitological and entomological specimens;

(iii) observe safety precautions;

(iv) maintain quality assurance;

(v) describe the classification, morphology, life cycles, pathogenicity, pathology, epidemiology, prevention and control of parasites and vectors;

(vi) carry out parasitological and entomological techniques;

(vii) handle, operate, care and maintain laboratory equipment;

(viii) analyze, interpret and report findings of laboratory investigations.

YEAR 1

OBJECTIVES

At the end of year one the trainee should be able to—

(i) explain terms used in Medical Parasitology;

(ii) classify parasites;

(iii) describe the host-parasite relationship;

(iv) describe modes of parasite transmission;

(v) explain the harmful effects of parasites on the hosts;

(vi) understand the concepts of epidemiology and surveillance of parasitic infections;

(vii) collect, receive, preserve, transport parasitological specimens;

(viii) prepare reagents and stains for use in a parasitology laboratory;

(ix) observe safety precautions;

(x) care, handle, operate and maintain equipment and apparatus;

(xi) understand concepts of quality assurance.

CONTENT

Introduction to parasitology—

–Definitions and terminologies;

–Nomenclature and general classification;

–Host-parasite interrelationships;

–Transmission and effects of parasites on their hosts;

–Epidemiology and surveillance of parasitic diseases;

–Parasitological specimens;

–Parasitological reagents and stains—

–Lugol's iodine,

–Formal saline,

–Normal saline,

–Zinc sulphate solution,

–Brine,

–Giemsa,

SECOND SCHEDULE—*continued*

–Leishman,
–Fields,
–Eosin,
–Malachite green,
–Acetocarmine,
–Indian ink.

–Laboratory equipment—
–Microscopes,
–Centrifuges;

–Laboratory safety;

–Quality assurance in a parasitology laboratory.

PROTOZOOLOGY

Introduction and general characteristics of protozoa.

Classification of protozoa of medical importance, geographical distribution of protozoan parasites, lifecycles and morphology of developmental stages, pathogenesis, pathology and epidemiology of protozoal infections.

Laboratory diagnosis of medically important protozoa.

The Amoebae—

Entamoeba histolytica;
Entamoeba hartmani;
Entamoeba coli;
Entamoeba gingialis;
Endolimax nana;
Dientamoeba fragilis;
Iodamoeba butschlii.

The Flagellates—

Giardia lambia;
Chlomastix mensnili;
Trichomonas vaginalis;
Trichomonas hominis;
Trypanosoma brucii;
Trypanosoma cruzi;
Trypanosoma gambiense;
Trypaaosoma rhodesiense;
Leishmania donovani;
Leishmania aethiopica;
Leshmania tropica;
Leishmania braziliensis;
Leishmania chagasi;
Leishmani infantum.

SECOND SCHEDULE—*continued*

Other Protozoa—

Plasmodium falciparum;
Plasmodium malariae;
Plasmodium ovale;
Plasmodium vivax;
Toxoplasma gondii;
Pneumocystis carinii;
Babesia divergns cytosporidium;
Sarcocystis;
Coccidia.

HELMINTHOLOGY

Introduction and general characteristics of helminthes.
Classification and geographical distribution of common helminthes.
Lifecycles and morphology of developmental stages.
Pathogenesis, pathology and epidemiology of helminthic infections.
Laboratory diagnosis of medically important helminthes including culture methods.
Intestinal Nematodes—

Necator americanus;
Ancylostoma duodenale;
Culture methods;
Non-human hookworms;
Strongyloides stercoralis;
Ascaris lubricoides;
Non-human ascarids;
Trichuris trichiura;
Enterobius vermicularis.

Tissue Nematodes—

Trichinella spiralis;
Dracuncullus medinensis;
Onchocerca volvulus;
Wuchereria bancrofti;
Mansonella perstans;
Mansonella streptocerca;
Brugia malayi;
Mansonella ozzardi;
Dioctophyma renale;
Gnathstoma spinigerum;
Larva migrans;
Other non-pathogenic microfilaria.

SECOND SCHEDULE—*continued*

Trematodes—

Schistoma mansoni;
Schistoma haematobium;
Schistoma japonicum;
Non-human schistosomes;
Carcarial dermatitis;
Fasciola hepatica;
Fasciola gigantica;
Fasciolopsis buski;
Paragonimus westermanii;
Opisthorchis sinensis (clonorchis sinensis);
Opisthorchis felineus;
Opisthorchis viverini;
Heterophyes heterophyes;
Dicrocoelium dedriticum;
Gastrodiscoides hominis.

YEAR 2

OBJECTIVES

At the end of practical rotation the trainee should be able to—

(i) collect specimens;
(ii) process specimens;
(iii) examine specimens and note findings;
(iv) collect data for research project;
(v) analyse the data and write a project report.

CONTENT

Preparing reagents and stains receiving, preserving and storing.
Collection of parasitological specimens.
Recording, registering the specimens.
Processing of the specimens.
Examining the specimens.
Recording the results.
Analyzing data.
Writing the project.

Techniques to be performed while on attachment—

Stool specimens.
Macroscopic examination.
Direct wet preparations using normal saline and eosin.
Concentration methods using formal ether, zinc sulphate solution and brine.
Microscopic examination of stained/unstained preps to demonstrate protozoan tropho-zoites and cysts as well as helminth eggs.

SECOND SCHEDULE—*continued*

Culture stools to demonstrate filariform lava of hookworm and strongyloides.

Stain flukes and proglottids for identification.

Prepare and examine Kato thick smear.

YEAR 3 CONTENT

MEDICAL ENTOMOLOGY

Introduction and terminologies.

Classification of phylum arthropoda.

General characteristics.

General structures and external anatomy of insects.

Prevention and control of arthropods.

Sub-Order: Nematocera.

Family: *Culicidae (mosquitoes);

*Simulidae (simulium);

*Ceratopogonidae (Culicoides);

*Psycodidae (Phlebotomus).

Sub-Order: Brachycera.

Family: Tabanidae (chrysops, Tabans Haematopota).

Muscidae (Musca, Muscina, Fannia, Stomovys).

Sub-Order: Cyclorrhapha.

Family: Glossiniddae

*Calliphoridae;

*Oestridae;

*Sarcophagidae;

*Gasterophilidae;

*Hyppoboscidae.

Order: Anoplura.

Phthiraptera.

(Anoplura and malluphaga).

Order: Siphonaptera.

Hemiptera;

Family: Cimicidae

Raduviidae.

CLASS: Arachnida

Order: Acarina (mites and ticks);

Family: Argasidae

Ixodidae;

Order: Aranae (Scorpions and spiders).

SECOND SCHEDULE—*continued*

CESTODES

Taenia solium;
Taenia saginata;
Hymenolepis nana;
Hymenolepis diminuta;
Echinococcus granulosus;
Echinococcus multilocularis;
Multiceps, multiceps;
Diphyllobothrium latum;
Dipylidium caninum;
Spirometra (and sparganosis).

MALACOLOGY

Introduction and general characteristics of molluscs;
Classification of molluscs;
Medical importance;
Geographical distribution;
General life cycles;
Morphology and identification of snails;
Collection, cercarial shedding and identification;
Prevention and control of snails.

MAMMOLOGY

Introduction and general characteristics of mammals;
General classification of mammals;
Medical importance of mammals;
Animal house;
Management, use and disposal of laboratory animals.
Control and destruction of mammalian reservoir hosts.

INSECTICIDES

Introduction to common insecticides;
General classification and basic formulations;
Demonstration of application methods;
Safety precautions in handling, use and disposal.

MEDICAL PARASITOLOGY THEORY

Topic	*Sub-topic*
Introduction to medical parasitology and medical entomology	–Definition and terminology. –Classification. –Host-parasite relationship. –Modes of transmission. –Harmful effects of parasite on hosts. –Safety precautions.

SECOND SCHEDULE—*continued*

Topic	*Sub-topic*
	–Collection/reception of specimens. –Preservation. –Transportation. –Storage. –Preparation of reagents and stains. –Epidemiology and surveillance of parasitic infections. –Equipment and apparatus. –Quality assurance.
Parasitological and Entomological techniques	–Direct wet preparations. –Concentration methods. –Smears swabs and cultures. –Xenodiagnosis. –Immunodiagnosis. –Collection of arthropods. –Mounting and labelling. –Identification. –Dissections. –Insectary.
Helminthology	–Introduction and terminologies. –Classification. –Geographical distribution. –Lifecycles. –Morphology of developmental stages. –Pathogenesis and pathology. –Laboratory diagnosis. –Epidemiology, prevention and control of helminthic infections.
Medical Entomology	–Introduction and terminologies. –Classification. –Lifecycles. –Morphology of developmental stages. –Identification of vectors. –Medical importance. –Geographical distribution. –Prevention and control of vectors.
Malacology	–Introduction and terminologies. –Classification. –Lifecycles. –Morphology and identification of vector snails. –Geographical distribution. –Medical importance. –Control. –Malacological techniques. –Collection and transportation of molluscs. –Carcarial shedding and identification. –Preservation and identification of molluscan shells.

SECOND SCHEDULE—*continued*

Topic	*Sub-topic*
Protozoology	–Introduction and terminologies. –Classification. –Geographical distribution. –Lifecycles. –Morphology of developmental pathogenesis and pathology. –Laboratory diagnosis. –Epidemiology, prevention and control of protozoan infections.
Mammalogy	–Introduction and terminologies. –General classification of animals. –Animal house. –Management, use and disposal of laboratory animals. –Medical importance. –Control of mammalian reservoir host.
Insectcides and molluscides	–Classification. –Formulation. –Introduction to application methods. –Safe use.
MEDICAL PARASITOLOGY	PRACTICALS.
Introduction	–Receiving, recording and storing specimens. –Care and use of laboratory equipment and apparatus. –Educational visit to meteorological station.
Parasitological techniques	–Direct wet preparations. –Concentration methods— sedimentation, modified formal ether, zinc sulphate floatation, membrane filtration, brine floatation. –Parasite count— Kato thick smear, Stoll's method, MacMaster chamber, Malaria/QBC. –Swabs and smears. –Cultures. Immunodiagnosis.
Protozoology	–Collection, processing and examination. –Identification of diagnostic stages. –Reporting the findings. –Analysing the results.

SECOND SCHEDULE—*continued*

Topic	*Sub-topic*
Helminthology	–Collection, processing and examination of specimens. –Identification of diagnostic stages. –Reporting the findings. –Analyzing the results.
Medical entomology	–Collection and mounting of anthropods. –Identification and labelling. –Preservation and storage. –Dissections. –Xenodiagnosis. –Educational visit to insectary.
Malacological techniques	–Collection and transportation of molluscs. –Carcarial shedding and identification. –Preservation and identification of molluscan shells.
Mammalogy	–Management and use of laboratory animals. –Disposal of laboratory animals. –Destruction. –Destruction of reservoir hosts.
Insectcides	Preparation for use— insectcides/imagicides, larvicides, molluscides, acaricides, miticides, tungicides. –Storage and disposal of chemicals.

VIROLOGY

AIM: This course is intended to equip trainees with knowledge, skills and attitudes to enable them work in a Class B laboratory.

GENERAL OBJECTIVES

At the end of this course the trainee should be able to—

(i) Describe the scope of virology;
(ii) Apply biosafety techniques in virology;
(iii) Apply sterilization, disinfection, and disposal methods in virology;
(iv) Care for instruments and equipment in a medical virology laboratory;
(v) Perform the relevant techniques for specimen collection and processing;
(vi) Describe transmission modes of viruses for public health control and disease management;
(vii) Classify viruses to families and genus;
(viii) Perform the laboratory procedures for investigating viral diseases;
(ix) Observe QC and QA measures.

Year	*Term*	*Topic*	*Sub-topic*
ONE	TWO	INTRODUCTION	–Definitions: Viruses. Virology

SECOND SCHEDULE—*continued*

Year	*Term*	*Topic*	*Sub-topic*
			–General properties of viruses. –Classification of viruses criteria.
		EPIDIMEOLOGY OF VIRAL DISEASES	–Acute infections. –Chronic infection. –Slow infections route of spreading of viruses to the community.
		BIOSAFETY	–Categorisation of pathogens to risk groups. –Activities harmful to the worker and others in virology. –Occurrence of laboratory infections and their prevention. –Location of health and safety equipment in the work place e.g. fire extinguisher. –First-aid kit. –Use of safety gear. –Use of pipetting aids. –Use of safety cabinets.
	THREE	PATHOGENESIS	Clinical and sub-clinical and latent –infections. –Virulence. –Localized and systemic infections.
		USE OF EQUIPMENT	Use and care of equipment and instruments in a virus laboratory. Inverted microscope. Water baths. Refrigerated centrifuge. Deep freezer. Refrigerator. Autoclave. Incubator CO2. Cool boxes. Elisa equipment. Biosafety cabinets.
		VIROLOGICAL SPECIMENS	Types of specimen collection. Specimen containers.
		VIROLOGICAL	Handling. Transportation. Storage. Preservation.

SECOND SCHEDULE—*continued*

Year	*Term*	*Topic*	*Sub-topic*
		SYSTEMATIC VIROLOGY	RNA viruses. Unclassified viruses. RNA virus. (Introduction).

YEAR 2

At the end of year two the learner should be able to—

(i) apply biosafety techniques in a medical virology laboratory;
(ii) perform sterilization, disinfection and disposal methods in virology;
(iii) collect, handle, preserve, transport and process virological specimens;
(iv) analyse data for project work;
(v) write a project report.

PROJECT GUIDELINES

Project title selection.
Sources of data.
Available appropriate technology.
Materials and equipment.
Finance/budgeting.

ATTACHMENT CONTENT

Topic	*Sub-topic*
SAFETY	–Bio safety technology in virology laboratory.
STERILIZATION	–Sterilization techniques, disinfection.
EQUIPMENT	–Care of virology equipment.
SPECIMENS	–Collection containers, transport, storage, preservation.
LABORATORY DIAGOSIS	–Laboratory procedures used in diagnosis of common diseases.
ANIMAL HOUSE	–Handling, bleeding, injection, feeding.

YEAR 3

OBJECTIVES

At the end of this year the learner should be able to—

(i) perform the various techniques used for specimen collection;
(ii) explain the various techniques used in specimen handling and transportation;
(iii) describe methods of specimens storage and preservation;
(iv) perform the processing of virological specimens;
(v) carry out laboratory diagnosis;
(vi) outline the mode of treatment and vaccination of some viral diseases;
(vii) carry out quality control and quality assurance (TQM).

SECOND SCHEDULE—*continued*

CONTENT

Term 8	Systemic specimen processing and laboratory diagnosis	DNA viruses processing Tissue culture Animal inoculation Serology/immunological techniques	 T P T/P	 13 Hrs 10 Hrs 22
9	Laboratory diagnosis	Elisa RPHA Simple rapid assyas	T/P T/P T/P	22 18
	Treatment and vaccination of viral diseases	Target sites for antiviral drugs Introduction to vaccinations Definition and concepts	T T T	7 4 2
	Total quality management	TQM QC and QA Designs and benefits Project		

IMMUNOLOGY

AIM: This course is intended to equip the trainees with knowledge, skills, and attitudes on the principles on immunology to enable them to work in a Class B laboratory.

GENERAL OBJECTIVES

At the end of this course the trainee should be able to—

(i) state the development and scope of immunology;
(ii) explain the immune defense mechanism;
(iii) describe the biology of the immune system;
(iv) demonstrate the organs, tissues and cells involved in the immune system;
(v) describe the role and mechanisms involved immunodeficience states;
(vi) explain hypersensitivity state;
(vii) explain basic concepts in transplantation immunology;
(viii) outline mechanisms of immunity to infectious diseases;
(ix) perform immunological techniques employed in an immunology laboratory.

YEAR 1, TERM 2 AND 3

OBJECTIVES

At the end of this course the trainee should be able to—

(i) state the development and scope of immunology;
(ii) explain the immune defense mechanism;
(iii) describe the biology of the immune system;
(iv) demonstrate the organs, tissues and cells involved in immunodeficiency states;

SECOND SCHEDULE—*continued*

(v) explain hypersensitivity state;
(vi) explain basic concepts in transplantation immunology;
(vii) outline mechanisms of immunity to infectious diseases;
(viii) perform immunological techniques employed in immunology laboratory.

Year	*Topic*	*Sub-topic*
	Introduction to immunology	– Definition of immunology. – History of immunology. – Development of vaccines e.g. vaccines.
	Adaptive and innate immunity	Immune system. Adaptive immune system— • natural, • artificial.
	Biology of immune system	– Primary lymphoid organs. – Secondary lymphoid organs. – Dissection of a named laboratory animal e.g. mouse, rat, or guinea pig to display the primary and secondary lymphoid organs.
	Cell involved in the immune system	B Lymphocytes. T Lymphocytes. The mononuclear phagocyte system. Polymorphonuclear granulocytes. Thin blood smear. Staining techniques. Identification of cells.
	The major	– Arangements of MHC genes.
	Histocompatibility	– Functions of MHC antigens Class I, II, III.
	Immunochemistry	– Immunoglobulins— • structure, • classification, • distribution. – Antibody – antigens reactions. – The agglutination reaction. – Precipitation tests. – Haemolytic immune. – Body titration. – Compliment system. – Complement titration. – Theories of antibody formation.

SECOND SCHEDULE—*continued*

Year	*Topic*	*Sub-topic*
	Antigen recognition and cell co-operation in immune responses	B-cell antigen recognition. T-cell antigen recognition. Antigen presenting cells— – primary immune response, – secondary immune responses, – immunological memory.
	Hypersensitivity states	Type I. Type II. Type III. Type IV. Demonstrate type O Reaction using guinea pig.

YEAR 3

OBJECTIVES

At the end of this year the learner should be able to—

(i) explain the main factors to consider when selecting an immunological project;

(ii) select appropriate instruments in immunological assays;

(iii) apply biosafety techniques in an immunology laboratory.

THREE		
	Auto-immunity	– Self tolerance. – Emergence of auto-immune disorders.
	Transplantation and rejection	– Tissue transplantations. – Organ transplantations.
	Immuno-deficiency	– Definition.
	States	– Primary immuno-deficiency. – Secondary immuno-deficiency. – Mechanisms leading to immuno-deficiency. – Methods of investigation. – Elisa.
	Infection and immunity	– Mechanisms of immunity to infectious diseases. – Antibody antigen reactions.
		– Agglutination. – Precipitation. – Haemagglutination. – CFT. – Elisa.

SECOND SCHEDULE—*continued*

Project Guidelines.

Project title selection.

Sources of data.

Available appropriate technology.

Materials.

Finance/budgeting.

Attachment Content

Topic	*Sub-topic*
SAFETY LABORATORY ANIMALS	Biosafety techniques in an immunology laboratory. Handling. Bleeding. Injection.
IMMUNO-CHEMISTRY	Antibody separation.
IMMUNOLOGICAL TECHNIQUES	Ab-Ag reactions.
	Agglution. Precipitation. CFT. Elisa. ETC.
EQUIPMENTS	Use and care of the equipment.

APPENDIX 1

TRAINING STANDARDS

STAFF/STUDENT RATIO:

1. LECTURERS:

   THEORY:1:0.

   PRACTICAL 1:5.

2. SUPPORT STAFF:

   TECHNOLOGIST (DIPLOMA LEVEL) ONE (1).

   TECHNICIANS TWO (2).

3. ACADEMIC STAFF QUALIFICATIONS:

   Minimum HD MLS with three (3) years experience plus a certificate in Medical Education;

   OR

   HD MLS with (5) years working experience and good track record.

4. ATTENDANCE – 90%.
5. DURATION OF PROGRAMME – Three (3) years.

SECOND SCHEDULE—*continued*

6. DISTRIBUTION OF LEARNING—

   THEORY – 50%.

   PRACTICAL – 50%.

7. SUBJECTS TAKEN: ALL.
8. AVERAGE PASS MARK – 50%.
9. EXAMINATION DECLARATION—

   Common examination shall be given to all students.

   Examination results shall be declared two weeks after the last paper.

APPENDIX *2*

ESSENTIAL EQUIPMENT

MICROBIOLOGY

1.	Autoclave (portable)	1 between 10 students
2.	Medium water bath	1 between 5 students
3.	Lovibond comparators – assorted	
4.	pH meters	1 between 5 students
5.	Anaerobic jars	1 between 5 students
6.	Incubators/hot air oven (adjustable)	1 between 10 students
7.	Distillers	2 for the whole institute
8.	De-ionizers	2 (small)
9.	Microscopes binocular	1 between 10 students
10.	Weighing balance	1 top pan load balance
11.	Woods lamp	1
12.	Centrifuge	1 between 4 students
13.	Bunsen burner/spirit	1 between 2 students
14.	Tripod stands/asbestos mat	1 between 10 students
15.	Fridge/deep freezer	1 between 10 students
16.	Safety cabinet	1 per laboratory
17.	Teaching microscopes	1 between 10 students
18.	Mechanical shaker	1 between 10 students
19.	Inoculating loops	1 per student
20.	Assorted microbiology glassware	adequate

CLINICAL CHEMISTRY

1.	Colorimeters	1 between 4 students
2.	Analytical balance – top pan loading	

SECOND SCHEDULE—*continued*

3.	Sensitivity up to 1 mg	1 between 5 students
4.	Flame photometers	1 between 10 students
5.	Centrifuge	1 between 4 students
6.	Refrigerators/freezers	1 between 10 students
7.	Water bath medium	1 between 4 students
8.	pH meter	1 between 5 students
9.	Mechanical mixers	2
10.	Electrophoresis equipment	2 per institution/class
11.	Distiller/de-ionizer	2
12.	Hot air oven/(incubator) adjustable	10
13.	Flame photometer	1 between 5 students
14.	Ion selective electrodes	2 of item
15.	Electrophoresis equipment	1 between 10

HAEMATOLOGY

1.	Haemoglobinometers	1
2.	Centrifuge	–ditto–
3.	Microhaematocrit centrifuge	1 between 5 students
4.	Microscopes – Blood mixers rollers	1 between 10 students
5.	Water bath	–ditto–
6.	Incubator	–ditto–
7.	Colorimeter	–ditto–
8.	Electrophoresis equipment	1 between 10 students
9.	Sphygmomanometer	1 between 5 students
10.	E.S.R. stands	1 between 4 students
11.	Deep freezer/fridge	1 between 10 students
12.	Deep freezer	1 between 5 students
13.	Coulter counter	1 for each class
14.	Neubaeur chambers	1 each student
15.	Distiller	2 per institution/class
16.	Analytical balance	1 between 10 students
17.	Stethoscopes	1 between 5 students
18.	Spectroscope – direct vision/revision	
19.	Refrigerated centrifuge	1

HISTOPATHOLOGY

1.	Microtome rocking/rotary	1 per 4 students
2.	Manual tissue processing set	1 between 4 students
3.	Hot plate	1 between 6 students
4.	Hone and strope	1 between 4 students
5.	Automatic knife sharpener	1 per class/institution
6.	Water bath, medium size	1 between 4 students

SECOND SCHEDULE—*continued*

7.	Microscope (teaching)	1 for the institution
8.	Cold plate	1 between 6 students
9.	Weighing balances	1 between 5 students
10.	De-ionizers	1 per class/institution
11.	Fume chambers	1 per laboratory/institution.
12.	Automatic tissue processor	1 per class/institution
13.	Automatic staining machine	1 per class/institution
14.	Freezing microtone – hard set	1 per class/institution
15.	Centrifuge	1 per class/institution

BLOOD TRANSFUSION SCIENCE

1.	Blood bank refrigerator	1 per class/institution
2.	Grouping tiles	1 per student
3.	Water bath	adjustable (medium size)
4.	Plasma extractors	15 students
5.	Centrifuges	1 between 4 students
6.	Weighing balance	1 between 5 students
7.	Syphomomanometers	1 between 5 students
8.	Hot air oven (adjustable)	1 in the institution
9.	De-ionizers and stillers	1 per class/institution
10.	Mechanical shaker	
11.	Blood transfusion bleeding unit	
12.	Assorted blood transfusion glassware and adequate apparatus.	
13.	Microscopes	1 per 2 students
14.	Deep freezer 70 degrees centigrade	
15.	Automated centrifuge for blood products	
16.	Cool boxes.	

MEDICAL PARASITOLOGY

1.	Microscopes	1 for 4 students
2.	Centrifuge	–ditto–
3.	Refrigerators	–ditto–
4.	Pestle and motor	1 per student
5.	Teaching microscope	
6.	QBC unit	
7.	Assorted apparatus e.g. sieves racks, test-tubes, stirring rods, applicator sticks, forceps funnels, Kato kits, hand lenses.	
8.	Stereo microscope/dissecting microscope.	
9.	Fluorescent microscope	1 per class
10.	Geiger Muller counter/scintillator	

VIROLOGY

1. Hepatitis Screening equipment.
2. H.I.V. Screening equipment–
   (a) Eliza;

SECOND SCHEDULE—*continued*

(b) Immunoblots (Western Blot);
(c) P.C.R. (Polymerase chain reaction).

3. CD4/CD8 Counting machine.
4. Viral load machine.
5. Tissue lines.
6. Immuno fluorescent equipment.
7. Inverted microscopes.

IMMUNOLOGY

1. Mechanical shakers.
2. Centrifuges.
3. Water baths.
4. Refrigerators.
5. Geiger Muller counter.
6. Chromatographic sets—
   (a) G.L.C. gas liquid chromatography;
   (b) H.P.L.C. high pressure liquid chromatography;
   (c) T.L.C. thin layer chromatography.
7. Thermocycler.

APPENDIX *3*

ESSENTIAL BOOKS

	Title	*Author*
1.	Introduction of medical laboratory technology	F.J. Baker *et al*
2.	Medical Laboratory Manual for Tropical Countries Part I and II	Monicah Chesbourough

MEDICAL MICROBIOLOGY

	Title	*Author*
1.	Review of Medical Microbiology	Ernest Jawetz, *et al*
2.	Medical Microbiology. A guide to Microbial Infection, Pathogenesis, Immunity and Laboratory Diagnosis and Control.	David Green
3.	Clinical Bacteriology	Joan E. Stocks
4.	Bacteriology Illustrated	Giels and Dodd
5.	Practical Medical Microbiology	J.G. Colle *et al*
6.	Hand book of Bacteriology	Baker *et al*

CLINICAL CHEMISTRY

	Title	*Author*
1.	Practical Clinical Chemistry Vol. I & II	Harold Varley

SECOND SCHEDULE—*continued*

	Title	*Author*
2.	A Basic Biochemiostry	Hayashi *et al*
3.	Essentials of Volumetric Analysis	Lambert
4.	Biochemistry a Case Oriented Approach	Montgomery

HAEMATOLOGY

	Title	*Author*
1.	Practical Haematology	Dacie and Lewis
2.	Clinical Haematology in Medical Practice	De Gruchy
3.	Essential Haematology	Petit
4.	Atlas of Haematology	Macdonald Dodds

HISTOPATHOLOGY

	Title	*Author*
1.	Carleton's Histological Techniques	Drory and Wellington
2.	Theory and Practice of Histological Techniques	Bancroft
3.	Cellular Pathology Technique	C.F.A Culling *et al*
4.	Text/Atlas of Histology	Leeson and Pagaro
5.	Basic Histology	Luis Carlos *et al*
6.	Practical Section Cutting and Staining	Clayton

BLOOD TRANSFUSION

	Title	*Author*
1.	Blood Serology	Boorman and Dood (England Edition)
2.	Modern Blood Banking and Transfusion Services	F. Harmening & Pittiglio
3.	Blood Trasfusion Guidelines	Ministry of Health
4.	Blood Groups in Man	Race and Sanger
5.	Blood Transfusion in Clinical Medicine	Mollison Patrick
6.	Blood Group Technique	S.I.B. Harris
7.	Technique in Blood Grouping	Ivon Danford *et al*

MEDICAL PARASITOLOGY

	Title	*Author*
1.	Basic Clinical Parasitology	Harold W. Brown
2.	Introduction to Parasitology	A.C. Chandler
3.	Worms and Diseases	R. Muller
4.	Tropical Diseases	R. Muller
5.	Medical Entomology	Patton W.S.
6.	Parasitic Disease in Man	Richard Knight

SECOND SCHEDULE—*continued*

	Title	*Author*
7.	Lecture Notes on Entomology	M.W.Service
8.	Atlas of Medical Helminthology Proto-zoology	Jeffrey and Leach

VIROLOGY

	Title	*Author*
1.	Practical Virology for Medical Students and Practitioners	D. Metasalaar *et al*
2.	Fundamentals of Medical Virology	Kucera and Louis S.
3.	Virological Procedures	Hopkins *et al*
4.	Virology – Practical Approach	B.S. Nahy *et al*
5.	Medical Virology	D. White & F. Fenner
6.	Medical Virology – A Practical Approach	Editor – U. Desselberger
7.	Principles of Molecular Virology	A.J. Cann

IMMUNOLOGY

	Title	*Author*
1.	The Principles of Immunology	Ivan Roitt
2.	Fundamentals of Immunology	Tesdale
3.	Practical Immunology	Hudsons and Hay
4.	Practical Immunology	Talwar
5.	Basic & Clinical Immunology	Peakman & Vergains
6.	Understanding Immunology	Peter Woods & Prentice-Hall

THIRD SCHEDULE

REPUBLIC OF KENYA

MINISTRY OF HEALTH

KENYA MEDICAL LABORATORY
TECHNICIANS AND TECHNOLOGISTS BOARD

CURRICULUM

FOR

HIGHER DIPLOMA

IN

MEDICAL LABORATORY SCIENCES

TABLE OF CONTENTS

COURSE TITLE: "HIGHER DIPLOMA IN MEDICAL LABORATORY SCIENCES"

INTRODUCTION

The aim of this course is to produce is to produce specialists in various Disciplines of Medical Laboratory Sciences.

RATIONALE

There is inadequacy of personnel at specialist level in the Management of Medical Laboratory Services. Due to this there is not enough supervision in the maintenance of quality service in the various disciplines of Medical Laboratory Sciences. The training of Medical Laboratory Technology needs to be improved and updated regularly in order to cope with the dynamism in Medical Laboratory Sciences, hence the need for training at this level.

The Higher Diploma holder should be trained well enough to carry out the following roles—

(1) to train medical laboratory personnel and to participate in the improvement of standards.

(2) to participate in curriculum review.

(3) to implement and monitor the provision of medical laboratory services.

(4) to plan for continuous Medical education for self and others.

(5) to evaluate and make decisions in the provision of medical laboratory services.

PROGRAMME AIM

This course is intended to equip the trainees with knowledge, analytical skills and attitudes to enable them to work and manage medical laboratories of Class 'C' level and above.

PROGRAMME OBJECTIVES

At the end of this course the trainees should be able to—

(1) develop procedures in Medical Laboratory Sciences.

(2) perform laboratory tests.

(3) analyse and interpret laboratory results.

(4) conduct scientific research.

(5) manage services and resources of a medical laboratory.

(6) train health professional in medical laboratory sciences.

(7) participate in multidisciplinary planning, implementation, co-ordinating, monitoring and evaluation of laboratory medicine.

(8) institute the professional code of conduct and ethics.

ADMISSION REQUIREMENTS

Trainees entering this course should have the following minimum requirements—

Passed Diploma in Medical Laboratory Sciences, and registered by K.M.L.T.T.B.

Approved equivalent, and have acquired relevant experience of at least 2 years.

COURSE DURATION

The course is designed to have a duration of 1320 hours.

ATTENDANCE PATTERN

The course is designed to be covered as follows—

TERM	HRS ON CAMPUS	HRS IN CLINICAL PLACEMENT
1	440	—
2	320	120
3	440	—
Total	1200	120

AWARD OF CERTIFICATE

K.M.L.T.T.B. or its agent shall award the certificate.

TEACHING METHODS

For trainees to attain the basic competencies the following teaching methods shall be applied—

(i) discussion;
(ii) lectures;
(iii) role-play;
(iv) simulation;
(v) demonstration;
(vi) class practicals;
(vii) project;
(viii) tutorials;
(ix) attachment;
(x) field visits.

TEACHING AIDS AND RESOURCES

The following aids and resources shall be applied in the teaching methods employed during the course—

AIDS

(i) chalkboard;
(ii) charts;
(iii) slide projector;
(iv) models;
(v) white boards;
(vi) specimens;
(vii) realia;
(viii) overhead projector;
(ix) radio;
(x) video film;
(xi) computer interactive learning;
(xii) computer aided/assisted learning.

RESOURCES—

(i) recommended textbooks;
(ii) library;
(iii) laboratory;
(iv) health institution;
(v) mortuary;
(vi) museum.

FORMAT OF STUDENTS ASSESSMENT AND EVALUATION

- Each trainee shall be expected to attend at least 90% of the possible attendance in each subject and complete satisfactorily the coursework to qualify for the summative examination.
- Each trainee shall be expected to have passed each subject at 50% as the pass mark to qualify to sit that same subject at summative level.
- Project 10% (*research project*).
- Final examination will be given a weighting of 90% in the final results.

The project must be submitted for a candidate to sit for final.

Actual assessment and evaluation shall be categorised as follows:

Continuous assessment—

- Timed tests;
- Carry away tests;
- Practical and orals;
- Projects.

Summative examinations shall be conducted by the authorized examination body and will follow the format below—

Theory Papers	–	100 Marks
Practicals	–	*3hrs* – 150 marks
Oral	–	50 marks

Project

The project must be submitted for one to qualify and shall be given a weighting of 10% of the final results.

COMPUTER

AIM: This unit is intended to equip trainees with computer skills to enable them manage resources and write projects.

GENERAL OBJECTIVES

At the end of this course the trainees should be able to—

(i) Discuss the process of developing a presentation;
(ii) Stage a presentation;
(iii) Appreciate the role of Networks in sharing resources in Health Services;
(iv) Browse the Internet for Health Information gathering;
(v) Perform statistical analysis of data using scientific package for social studies (SPSS).

CONTENT

	Topic	*Sub-topic*
1.	Process of developing a presentation	Planning. Preparing. Presentation.
2.	Presentation	Launching a presentation software. Setting-up a file. Creating slides. Animating a presentation. Retrieval of a presentation. Printing handouts and notes. Staging a presentation.
3.	Principles of networking	Principles of networking. Types of networks. Benefits of networks. Data security in a network environment.
4.	Internets	Introduction to internet. Websites. Results of internet searches. Printing, copying and saving internet. Searches. E-mail services.
5.	Searching techniques	Defining the search topics. Use of search engines. Abbreviations and list of medically important journal. Relevant home pages.
6.	Statistical analysis of data	Launching of SPSS. Defining variable. Setting up files. Transforming data. Computing analysis of data. Interpreting outputs.

EPIDEMIOLOGY

AIM: This unit is intended to equip the trainee with knowledge, skills and attitudes that would enable them understand the prevention and management of diseases.

GENERAL OBJECTIVES

At the end of this course unit, the trainee should be able to do the following in Epidemiology—

(1) define terminologies used;
(2) describe the types;
(3) explain the uses;
(4) describe the study designs;
(5) explain levels of disease patterns;
(6) understand diseases screening and surveillance.

THIRD SCHEDULE—*continued*

CONTENT

	Topic	*Sub-topic*	*Time*
	Epidemiology	Definition, terms used.	
	Types	Descriptive. Analytical.	
	Use of epidemiological data	Planning for resources. Classification of diseases. Describing determinates of disease. Observation and experimental.	
	Study designs	Cross-sectional. Prospective. Retrospective. Experimental (Intervention). Clinical.	
	Disease patterns	Primary. Secondary. Tertiary.	
	Screening and surveillance	Types. Application. Uses.	

HEALTH MANAGEMENT

AIM: This course unit is intended to improve the management of health care services and training institutions.

GENERAL OBJECTIVES

At the end of this course unit, the trainee should be able to—

(1) describe various principles and management theories and other applicability to the management of health facilities and training institutions;

(2) formulate human resources development plan within and out of the organisation;

(3) manage financial resources in health service organizations and training institutions;

(4) participate in project proposals and management;

(5) manage change;

(6) manage disaster.

CONTENT

No.	*Topic*	*Sub-topic*
1.	Overview of management	– Role of managers in organisations. – Process of management. – Importance of management in organisations.
2.	Techniques of organising	– Process of planning. – Importance of planning. – Techniques used in planning. – Strategic planning.

THIRD SCHEDULE—*continued*

No.	*Topic*	*Sub-topic*
3.	Techniques of organising activity	– Basis of organising activities. – Circumstances of choosing basis. – Merits and demerits of each base.
4.	Techniques of co-ordination	– Process of co-ordination. – Role of manager in directing organisational activities. – Techniques used in co-ordination.
5.	Human resource co-ordination	– Structuring the system (analysing and designing jobs). – Recruitment, selection, placement internal mobility. – Separation, death, retirements or resignation. – Performance appraisal. – Preparing for advancement.
6.	Management of change and conflict resolution	– Factors influencing organisation changes. – Causes of resistance to change. – How to overcome employee resistance to change. – Techniques of managing change.
7.	Techniques of managing time	– Meaning of conflicts. – Advantages and disadvantages of conflicts in an organisation.
8.	Stress management	– Meaning of stress. – Causes of stress. – Techniques of managing stress.
9.	Techniques of control in organizations	– Importance and nature of control. – Types of control systems. – Control techniques.
10.	Problem solving techniques	– Importance and nature control. – Stages of problem solving. – The merits and demerits of each. – Problems solving techniques. – Barriers to effective problem solving.
11.	Stores management	– Inventory control systems. – Setting order quantities. – Stock records.
12.	Public finance	– Sources of Government funds. – Public finance. – Government budgetary cycle. – Budgetary control analysis and interpretation. – Book-keeping. – Accounting for donor funds. – Small business enterprises.

THIRD SCHEDULE—*continued*

No.	Topic	Sub-topic
13.	Community development	– Community work. – Community organisation. – Community participation. – Community surveys diagnosis. – Intra- and inter-sectoral collaboration. – Field visits.
14.	Quality management techniques	– Need for quality maintenance. – Strategies for quality maintenance. – Limitations of the strategies for quality management. – Measures for approving quality performance.

RESEARCH METHODS AND PROJECT

AIM: This unit aims at equipping the trainees with knowledge, skills and attitudes that will enable them conduct scientific research.

GENERAL OBJECTIVES

At the end of this course unit the trainees should be able to—

(i) Distinguish types of research.
(ii) Observe ethical standards in research.
(iii) Select appropriate methods to apply to a given research type.
(iv) Formulate hypotheses.
(v) Prepare a research proposal with its budgetary proposal.
(vi) Design a research strategy.
(vii) Design a sampling frame.
(viii) Collect, organise and represent data.
(ix) Use statistical techniques in data analysis.
(x) Apply computer statistical packages in data analysis.
(xi) Interpret scientific data.
(xii) Present a project report in a structured format.
(xiii) Manage a project.

Topic	*Sub-topic*
Introduction	Definition of research. Types of research: • pure research, • applied research, • action research. Justification of research. Ethical considerations.
Methods of research	Descriptive research. Survey. Correlational.

THIRD SCHEDULE—*continued*

Topic	*Sub-topic*
	Retrospective. Experimental. Action research.
Research design	Purpose. Hypotheses research, questions, objective, formulation. Characteristics of good research designs. Pre-experimental designs. True experimental designs. Quasi experimental designs. Export factor designs.
Population and sampling	Review of— Population. Types of sampling. Probability sampling method. Non-probability sampling method.
Data collection	Observation methods. Interviews and questionnaires. Trace measures. Content analysis. Data archives. Measurements.
Data analysis	Qualitative method. Quantitative method. Review of— – Binomial distribution, – Poison distribution, – Normal distribution, – Student distribution, – ANOVA, – X2 test, – F – test. – Test of hypothesis in large and small samples.
Use of computer	In statistical data analysis. In data organisation. Production report.
Project write-up	Selection of project. Documentation of sources. Development of proposal. Carrying out of project. Reporting. Layout of reports. Data presentation.

THIRD SCHEDULE—*continued*

Topic	*Sub-topic*
Project management	Needs assessment. Proposal preparations and presentations. Implementations. Monitoring and evaluation. Impact evaluation and sustainability.

SOCIAL AND DEVELOPMENT STUDIES, PROFESSIONAL CONDUCT, ETHICS AND LAW

AIM: This course unit is intended to equip trainees with knowledge, social skills and attitudes for their role play in society and the work-place.

OBJECTIVES

At the end of this course unit the trainee should be able to—

(i) Acquire attitudes that relate to work and social ethics for self-fulfillment and self-development.

(ii) Acquire cultural values for self-development.

(iii) Relate their behaviour to their efficiency and effectiveness in an organisation.

(iv) Understand the Public Health Act (chapter 242 of the laws of Kenya) and Medical Laboratory Technicians and Technologists Act (No. 10 of 1999) and any other relevant provisions of general law.

(v) Complete with and apply the provisions of the Medical Laboratory Technicians and Technologists Act and the relevant provisions of the Public Health Act and other provisions of the general law.

(vi) Understand and apply basic principles of guidance and counselling.

(vii) Understand the role of Government.

(viii) Understand development issues.

CONTENT

	Topics	*Sub-topics*
1.	Social and development studies	Medical psychology. Medical sociology. Economics. Social economics and development. Government of Kenya. National philosophy. Science and technology. Commerce. Public relations. Development theories. Natural environment and development.
2.	Ethics	Revise meaning and importance. Major religions of the world and influence of religion on ethics. Professional ethics and conduct. With particular reference to Part VI of the Constitution of the Association of Kenya Medical Laboratory Scientific.

THIRD SCHEDULE—*continued*

	Topics	*Sub-topics*
		Officers and any other relevant codes of Ethics. Technology and religion. Natural law.
3.	Law	Revise definition & importance. Sources of Kenyan Law. Constitution of Kenya, relevant Acts of Parliament and subsidiary legislation. Law of contract. Law of torts. Family law. Land law.
4.	Guidance and counselling	Guidance. Counselling. Counselling techniques.

MEDICAL BACTERIOLOGY AND MYCOLOGY

AIM: The course unit is designed to equip the trainee with knowledge, skills and attitudes to meet the requirement of Class "C" laboratory and above.

TERM 1

OBJECTIVES

At the end of this term, the trainee should be able to—

(i) State the development and major contributors of medical microbiology.
(ii) Describe the taxonomy of bacteria and fungi.
(iii) Understand and apply safety precautions, sterilisation and disposal methods.
(iv) Explain microbial metabolism.
(v) Understand and apply the principles of microbial genetics.
(vi) Describe the sources and transmissions of bacterial and fungal infections.
(vii) Describe the pathogenic mechanisms of micro organisms.
(viii) Describe and carry out laboratory procedures used to investigate diseases caused by bacteria and fungi.

CONTENT

Topic	*Sub-topic*	*T*	*P*
History of microbiology	Major contributors. Development. Introduction of micro-organisms and disease.	T	P
Taxonomy	Classification. Nomenclature. Identification.	T	P
Safety	Laboratory associated infections. Precautions against accidents in laboratory. Safety cabinets. Disinfection and decontamination of laboratory wastes. Handling of chemicals and laboratory animals.	T	P

THIRD SCHEDULE—*continued*

Topic	*Sub-topic*	*T*	*P*
Sterilization	Definition. Methods of sterilisation. Factors affecting sterilisation. Quality control of sterilisation.	T	P
Microbial genetic and molecular microbiology	Basis of heredity. Mutations. Gene transfer. Drug resistance. Molecular techniques.	T	P
Sources of transmission of microbial infections	Sources. Transmission routes. Types of infections.	T	P
Pathogenicity	Association to the host. Pathogenic mechanisms.		
Specimens	Types. Containers. Methods of collections. Transportation. Processing. Preservation.	T	P
Staining	Preparation of smears. Types of stains. Preparation. Staining methods. Factors affecting staining.	T	P
Culture media	Types. Ingredients. Classes. Preparation. Storage. Quality control.	T	P
Cultivation of micro-organisms	Culture methods. Factors affecting growth. Cultural characteristics.	T	P
Identification of micro-organisms	Biochemical tests. Serological tests. Phage typing. Colicine typing. P.C.R. Animal pathogenicity (inoculation).	T	P
Antimicrobial susceptibility testing	Definition. Mechanisms of action. Factors affecting susceptibility tests. Susceptibility testing. Drug assays.	T	P

TERM II

OBJECTIVES

At the end of this course unit, the trainee should be able to—

(i) Describe the morphological and biological classification of bacteria.

(ii) Explain the general properties of bacteria.

(iii) Describe the pathogenesis, laboratory diagnosis, treatment and prevention of bacterial diseases.

(iv) Select and write a project proposal.

Topic	*Sub-topic*
Systemic bacteriology and mycology	Genus— Staphylococcus, Streptococcus, Neisseria, Branhamella, Veillonella, Escherichia, Citrobacter, Klebsiella, Proteus, Pseudomonas, Serratia, Providencia, Salmonella, Shigella, Morganella, Yersinia, Brucella, Gardnetella, Francisella, Bordetella, Alcaligenes, Pasteurella, Haemophilus, Corynebacrerium, Listeria, Erysipelothrix, Bacillus, Clostridium Myeobacterium.
Project	Data collection. Data analysis.

TERM III

OBJECTIVES

At the end of this course unit, the trainee should be able to—

(i) Describe the biological classification of Spirochaetes, Chlamydia and Rickettsia;

(ii) Explain the general properties of Spirochaetes, Rickettsiae and Chlamydia;

(iii) Describe the pathogenesis, laboratory diagnosis, treatment and prevention of spirochaetal, Rickettsial and chlamydial diseases;

(iv) Explain the pathogenesis, laboratory diagnosis, treatment and prevention of Mycosis;

(v) Describe and perform bacterial and mycological methods used in analysis of milk, water food and air;

(vi) Apply the principles of quality control;

(vii) Carry out the research and write up report.

CLINICAL CHEMISTRY

Topic	*Sub-topic*	*T*	*P*
Spirochaetes	Treponema. Borrelia. Leptospira.		
Rickettsiae	Rickettsiae.	T	P
Chlamydia	Chlamydia.	T	P
Mycology	Superficial Mycosis.	T	P
Public health	Water. Food. Milk. Air.	T	P
Quality control	Specimens. Microbial techniques. Culture media. Stains. Equipment. Report and record.	T	
Project	Data analysis. Project report write-up. Presentation.		

GENERAL OBJECTIVES

(i) Explain the application of total quality management (T.Q.M).

(ii) Explain principles and operations of specialised instruments.

(iii) Explain the concepts of clinical chemistry.

(iv) Explain the principles of techniques.

(v) Carry out diagnostic techniques.

(vi) Manage resources.

(vii) Carry out research.

(viii) Develop technical and clinical innovations.

OBJECTIVES OF TERM 1

(i) Explain the concepts of clinical chemistry.

(ii) Carry out diagnostic techniques.

THIRD SCHEDULE—*continued*

Topic	*Sub-topic*	*Contents*	
Concept of Clinical Chemistry 220 hrs	Review of general chemistry Physical chemistry	Atoms, atomic structure, valency. Thermo chemistry, redox reactions, acids, bases, colligative properties, rates of reactions, theories of catalyses.	T
	Inorganic chemistry	Colour solids and solutions. Solubility, thermodynamics. Qualitative analysis.	T/P
	Volumetric analysis	Standard solutions, weights and measures, theory and choice of indicators, dissociation constraints, buffers, pH acid-base, redox and precipitation titration.	T/P
	Organic chemistry	Structure of carbon compounds. Isomerism, homologons series, aromatic compounds, functional groups, reaction processes.	

OBJECTIVES OF TERM II

(i) Explain the concepts of Clinical chemistry.
(ii) Explain the applications of total quality management.
(iii) Explain principles and operations of specialised instruments.
(iv) Carry out diagnostic techniques.

Topic	*Sub-topic*	*Content*	
Concept of clinical chemistry	Biochemistry Biologic oxidation	Redox reactions, phosphate bond energy, co-enzyme cytochrome C.	T
	Bio-molecules	Classification, structure. Metabolism, pathology of— Carbohydrates, lipids, amino acids and proteins nucleoproteins and genetic coding, vitamins, porphyrines, enzymes.	T
	Physiopathology	Liver, kidney, heart, gut, pancreas, lungs, endocrines, blood, CNS, inorganic constituents of the body fluids.	
	Drugs & poisons	Therapeutics. Drugs of abuse. Poisons.	T/P
	Oncology	Tumour markers, biochemical effects of diffused endocrine. System, carcinoid and multiple. Endocrine adenopathy (MEA).	T/P

THIRD SCHEDULE—*continued*

Topic	*Sub-topic*	*Content*	
	Foetal chemistry	Amniocetesis Bilirubin Neonatal thyroid functions. Plasma alpha feto proteins, Eustriol.	T/P
	Inborn error of metabolism	Genetics, metabolic pathways. Screening of inborn errors of metabolism, laboratory diagnosis, pathology.	T/P
Total Quality Management (TQM)	Quality assurance	Specimen collection. Quality assessment. Quality control.	
	Reference ranges	Factors affecting reference. Values. Population studies in deriving reference values, multivarial normality, diagnostic uses of reference values.	T/P
	Resources	Planning, procurement, fiscal, human, stock control.	
Principles of specialized instruments	Auto analyser	Central processing unit (CPU). Reagent control unit (RCU). Sample control unit. Data control unit.	
	Scintillation counter	Radio Immuno-labelling.	T/P
	Immuno-chemistry auto analyser	Micro-particle-enzyme-immuno-assay (MPEIA). Enzyme linked immuno-sorbent. Assay (ELISA).	T/P
	HPLC/GLC	Chromatographic separations.	
	Electrophoresis systems	Isoelectric focusing. Zone electrophoresis. SD-PAGE electrophorsis. High voltage elctrophorsis.	T P
	Blood gas analyser	Electrochemistry.	T/P
	Thermocycler	Polymerase chain reactions.	T/P
Operations of specialized instruments	Random access systems	Initialization, programming, standardization, loading, data collection.	

OBJECTIVES OF TERM III

At the end of this course unit the trainee should be able to—

(i) Explain the principles of techniques;

(ii) Carry out diagnostic techniques;

THIRD SCHEDULE—*continued*

(iii) carry out research.

Topic	*Sub-topic*	*Contents*	
Principles of techniques	Photometry	Endpoints, kinetics, EIA, absorption, emission, tubdimetry.	T/P
	Separation	Chromatographic, electrophoresis, diffusion.	T/P
	Electrochemistry	ISE, Ion Exchange Resin.	T/P
	Fluorimetry	IFT, MEIA, ELFA.	T/P
	Radiation	RIA.	T/P
	Thermocycler	Polymerase chain reactions (Nucleoproteins: DNA, mRNA, TRNA, HLA typing).	T/P
Techniques	Function profiles	Malabsorption, RFT, LFT'S, lipid, collagen, gastric, muscle enzymes, cardiac enzymes, fertility hormones, triple tests, thyroid hormones, protein profile. Allergy and allergens, blood gases, Hb and derivatives, electrolytes. Corticosteroid hormones.	T/P
	Specific measurements	C-peptide, HBAIC, GTT, insulin, 5H1AA, 17-ketostosteoids, VMA, catecholamines, G6 PD, 17 hydroxycorticosteroids, porphyrins, osmolarity, reducing substances, CEA, CA 125, CA 15.3, CA 1.9, PSA, AFP, B.HCG, microproteins, electrophoresis, HPLC, GLC Iron and TIBC, parathyroid hormone, thyroid antibody, cardiolipin antibody.	T/P
Research	Nosographical Situation analysis	Epidemiology, sensitivity. Correction to reference ranges. Therapeutic drug monitoring. Nutrition, physiotherapy.	

KEY

PAGE 4:

(i) MEIA – Micro-particle-enzyme-immuno-assay
(ii) ELISA – Enzyme-linked-immunosorbent-assay
(iii) SD-PAGE
(iv) Polymerisation chain reaction

PAGE 5:

(i) ISE – Ion-selective electrode

THIRD SCHEDULE—*continued*

(ii) IFT – Immuno-fluorescent techniques
(iii) ELFA – Enzyme-linked-fluorescence-assay
(iv) RIA – Radiommuno-assay
(v) DNA – Deoxyribose nucleic acid
(vi) mRNA – Messenger ribonucleic acid
(vii) TRNA – Transfer ribonucleic acid
(viii) HLA – Human lymphocyte antigen

PAGE 6:

(i) RFT – Renal function tests
(ii) LFT – Liver function test
(iii) Hb – Haemoglobin
(iv) C-Peptide – Crystalline peptide
(v) HBA ic – Glycocylated haemolobin
(vi) GTT – Glucose tolerance test
(vii) 5-HIAA – 5 Hydroxy-indole acetic acid
(viii) VMA – Vinyl mandelic acid
(ix) G 6 PD – Glucose 6 phosphate dehydrogenase
(x) CEA – Carcino embroyonic antigen
(xi) CA – Cancer antigen
(xii) PSA – Prostatic specific antigen
(xiii) AFP – Alpha feto protein
(xiv) B-HCG – Beta human chorionic gonadotrophin
(xv) HPLC – High power liquid chromatography
(xvi) GLC – Gas liquid chromatography
(xvii) TIBC – Total iron binding capacity.

HAEMATOLOGY

AIM: The course unit is designed to produce specialised medical laboratory technologists to run a Haematology laboratory at all levels and develop technological innovations.

TERM 1

OBJECTIVES

At the end of the course unit the trainee should be able to—

(i) Explain cytochemistry of haemopoiesis.
(ii) Prepare and store haematological reagents.
(iii) Describe the various types of anemia.
(iv) Investigate types of anaemia.

CONTENT

	Topic	*Sub-topic*
1.	Cytochemistry of haemopoiesis	RNA. DNA. Defective. Erythropoiesis.

THIRD SCHEDULE—*continued*

	Topic	*Sub-topic*
2.	Haematological reagents	Romanousky stain. Supravital stains. Cytochemical reagents. Anticoagulants. Other routine haematological reagents and storage.
3.	Anaemia	Iron deficiency. Megaloblastic anaemia. Aplastic anaemia. Sideroblastic anaemia. Haemolytic anaemia. Haemoglobinopathies.

TERM II

OBJECTIVES

At the end of the term the trainee should be able to—

(i) Explain haematological enzymopathies.
(ii) Perform haemolytic screening procedures.
(iii) Describe the haemostatic mechanisms.
(iv) Perform coagulation screening procedures.
(v) Perform blood coagulation factors assay.
(vi) Monitor coagulation therapy.
(vii) Explain various types of Leukaemia.
(viii) Classify Leukemoid reactions.
(ix) Collect bone marrow specimen.
(x) Process bone marrow specimen.
(xi) Examine and report bone marrow smear.
(xii) Perform cytochemical tests.
(xiii) Perform Kleuhaur Betke tests.
(xiv) Explain myeloproliferative disorders.
(xv) Explain myelodysplasic syndrome.
(xvi) Write a project proposal.
(xvii) Generate prospective data for research project.

CONTENT

Topic	*Sub-topic*
Enzymopathy	G6PD. Pyruvate kinase. Analysis techniques. Peripheral blood film examination.
Haemolytic screening procedures	Reticulocytes count. Heinz body preparation.

THIRD SCHEDULE—*continued*

Topic	*Sub-topic*
	Osmotic fragility test. Hb electrophoresis. Hb F estimation. Direct Coomb's test. Antibody screening test. Bilirubin Estimation. Polypeptide assay. Ham's test. Estimation of Hb A2.
Haemostasis	Vascular System. Blood coagulation. Fibrinolytic mechanism.
Coagulation screening procedures	Haemogram. Prothrombin time test. Activated partial thromboplastin time test. Thrombin time test. Substitution tests. Euglobin clotlysis test. International normalized ratio. Bleeding time test. Clotting time test
Blood coagulation factor assay with specific reference	Factor IX. Factor I. Factor II. Factor VII. Factor V. Factor XIII.
Automatic coagulation procedures	Routine tests. Specialized techniques.
Coagulation therapy with specific reference to	Heparin. Warfarin/koumarin. Monitoring.
Leukaemia	Acute lympoblastic leukaemia. Acute myoloblastic leukaemia. Chronic lymphocytic leukaemia. Chronic granulocytic leukaemia. Chronic monocytic leukaemia. Acute yelomonocytic leukaemia. Erythroleukaemia.
Leukaemia	Lymphoid leukemoid reaction. Myeloid reaction.

THIRD SCHEDULE—*continued*

Topic	*Sub-topic*
	Aleukaemoid. Psedoleukaemia.
Bone marrow specimen	Collection procedure. Processing procedure. Examination and reporting.
Cytochemical test	Sudan black. Periodic acid Schiff's. Iron staining. Leukocyte alkaline phosphate. Feulgen reaction. Muramidase reaction.
Kleuhaeur Betke test	Uses. Techniques.
Myeloproliferative disorders	Leukaemia. Non-leukaemia.
Mylodysplastic Syndromes	Causes. Detection techniques.
Project	Project proposal. Generating data.

TERM III

OBJECTIVES

At the end of this course unit the trainee should be able to—

(i) Describe systems disorders.
(ii) Demonstrate various systemic disorders.
(iii) Explain various types of lymphomas.
(iv) Explain polycythaemia rubravera.
(v) Perform phlebotomy therapy for polycythaemia rubra vera.
(vi) Describe the principles of electronic blood counters.
(vii) Operate and maintain electronic blood counters.
(viii) Explain radioisotopes used haematology.
(ix) Explain blood volume estimation.
(x) Determine rate of erythropoiesis.
(xi) Handle and take care of laboratory animals.
(xii) Identify blood parasites.
(xiii) Ensure and observe quality assurance measures.
(xiv) Produce exam project report.

CONTENT

Topic	*Sub-topic*
Systemic disorders	Lupus erythromatosus.

THIRD SCHEDULE—*continued*

Topic	*Sub-topic*
	Microangiopathy. Detection techniques.
Multiple myelona	Plasma cell leukaemia. Abnormal immunoglobulins. Detection techniques.
Malignant lymphomas	Hodgkin's disease. Non-Hodgkin's diseases. Burkettes lymphoma.
Polycythaemia	Erythraemia. Absolute polycythaemia. Relative polycythaemia.
Electronic counters	Mucipus. Operation. Prevention maintenance.
Radioisotopes	Types. Uses. Safety precautions.
Laboratory animals	Types. Handling. Disposal.
Blood parasites	Types. Significance. Detection techniques.
Project	Data analysis. Project report. Write-up and presentation.

HISTOPATHOLOGY AND CYTOPATHOLOGY

AIM: The course unit is designed to equip the trainee with knowledge, skills and attitudes to meet the requirements of a Class "C" laboratory and above.

GENERAL OBJECTIVES

At the end of this course unit the trainee should be able to—

(i) Explain concepts related to Histopathological and Cytological techniques.

(ii) Understand the principles and operations of light and electron microscopes.

(iii) Apply knowledge, skills and attitudes acquired for diagnosis, teaching and research purposes.

(iv) Apply knowledge, skills and attitudes acquired for medical legal and mausoleum services.

(v) Supervise and manage resources in laboratory setting;

(vi) Observe quality control and quality assurance measures.

THIRD SCHEDULE—*continued*

TERM 1

OBJECTIVE

At the end of this course unit the trainee should be able to—

(i) explain terms used in histopathology and cytopathology;
(ii) describe cell and epithelium;
(iii) describe fixation and classify;
(iv) perform decalcification.

CONTENTS

Topic	*Sub-topic*
Introduction	Terminology used, relation of histopathology to other subjects, reception, handling of samples, microscopic appearance of body organs, source of samples.
Cell and epithelial	Cell structure, cell division, four primary tissues, types and functions of epithelial cells, connective tissues, muscular tissue, nervous tissue, overview of body systems.
Fixation and fixatives	Definitions, purposes, effects, terminologies used, characteristics, methods of fixation, storage of fixed tissues.
Decalcification	Purpose, methods, tissues requiring decalcification, end points of decalcification, treatment of tissues after decalcification.

TERMS II

OBJECTIVES

At the end of this course unit the trainee should be able to—

(i) describe tissue processing
(ii) carry out section cutting.
(iii) carry out section staining.
(iv) mount sections.
(v) examine and report mounted sections.
(vi) collect cytological samples.
(vii) carry out staining.
(viii) classify and report cytological smears.
(ix) design a project.

TERM III

OBJECTIVES

At the end of this course unit the trainee should be able to—

(i) apply safety measures.
(ii) describe histochemistry.
(iii) describe museum techniques.
(iv) describe and use microscopes.
(v) understand concepts related to mausoleum techniques.
(vi) carry out mausoleum procedures.
(vii) manage resources.
(viii) apply quality control measurements.

THIRD SCHEDULE—*continued*

CONTENT

Topic	*Sub-topic*
Safety Measures	Fire hazards, physical and chemical injuries, explosives, implosives, infectious material.
Histochemistry	Nature of enzymes, types, frozen section, freeze drying, freeze substitution, equipments used, demonstration techniques.
Museum techniques	Collection, preservation, labelling, display, staining of gross specimens, photomicrography.
Microscopy	Review of light microscope, principles of electron microscope differences, limitations of light and electron microscopes, preparation of electron microscopy samples, examination and interpretation.
Mausoleum techniques	Government policy on bodies, reverence for the dead, medical legal cases, post-mortems, embalming, disposal of bodies, mausoleum design.
Management	Human resources management, material resource management, monetary management, design of a histological laboratory.
Quality control	Reagents, procedures, techniques.

BLOOD TRANSFUSION SCIENCE

AIM: The course unit is designed to produce specialised medical laboratory technologists to run a Blood Transfusion Science Laboratory at all levels and develop technological innovations.

GENERAL OBJECTIVES

At the end of this course unit the trainee should be able to—

(i) Explain antigen-antibody reaction.
(ii) Perform antibody-screening test.
(iii) Perform antibody identification test.
(iv) Perform antibody titration test.
(v) Explain blood group systems and other subgroups.
(vi) Compare and contrast 1Gg and 1Gm antibodies.
(vii) Perform differentiation and identification procedures for IgG and IgM antibodies.
(viii) Discuss haemolytic diseases of the newborn.
(ix) Explain blood transfusion reactions.
(x) Determine the survival of transfused red blood cells.
(xi) Perform blood volume estimation technique.
(xii) Apply blood group systems in forensic medicine.
(xiii) Establish and manage blood donor centre.
(xiv) Prepare reagents used in blood donor centre.
(xv) Prepare lectins used in blood grouping.
(xvi) Organize blood campaign.
(xvii) Prepare, store and use blood and blood products.

THIRD SCHEDULE—*continued*

(xviii) Ensure safety and quality assurance measure

(xix) Interpret and implement the National blood transfusion policy.

TERM 1

OBJECTIVES

At the end of this course unit the trainee should be able to—

(i) Explain blood group systems and the subgroups;

(ii) Perform antibody-screening tests;

(iii) Perform antibody identification test;

(iv) Perform antibody titration test;

(v) Compare and contrast 1gG and 1gM antibodies;

(vi) Perform differential and identification procedures for 1gG and 1gM antibodies.

CONTENT

Topic	*Sub-topic*
ABO blood group system	ABO antigens. ABO antibodies. Structure of A and B antigen and their synthesis.
ABH blood group system	Precursor substance. H gene. Secretor. Non-sector. Bombay phenotype. Inheritance. Nomenclature. Rh antigen. Rh pull phenotype.
Other blood group systems	Mnss, P, Xg, Kell Ii. Lewis, Dufy, Lutheran, Kidd and private blood group system.
Auto-immune antibodies and non-specific antibodies	Warm antibodies. Cold antibodies. Conditions associated with autoimmune antibodies.
Immuno-globulins	Types. Characteristics. Differentiation and identification techniques. Importance.

TERM II

OBJECTIVES

At the end of this course unit the trainee should be able to—

(i) Discuss haemolytic disease of the newborn.

(ii) Perform laboratory investigations on haemolytic disease of the newborn.

(iii) Explain blood transfusion reactions.

THIRD SCHEDULE—*continued*

(iv) Perform laboratory investigations on blood transfusion reaction.
(v) Explain red cell hereditary disorders
(vi) Determine transfused red cell survival rate.
(vii) Establish a blood donor centre.
(viii) Organize blood campaign.
(ix) Prepare, store and use blood and blood products.
(x) Prepare reagents used in blood centre.
(xi) Prepare lectures.
(xii) Generate prospective data for research content.

CONTENT

Topic	*Sub-topic*
Haemolytic disease of the new-born	ABO antibodies. Rh antibodies. Causes/aetiology. Pathogenesis. Laboratory investigation. Exchange transfusion. Intra-uterine blood transfusion. Admission of RhoGam. Amniocentesis.
Blood transfusion reaction	Intravascular transfusion reaction. Extra vascular transfusion reaction. Febrile non-haemolytic reaction. Anaphylactic. Decreased red cell lifespan. Diagnostic techniques. G6PD deficiency. Management. Spherocytosis.
Red cell hereditary conditions	Ellitocytosis. Stomatocytosis. Laboratory investigation.
Blood donor centre	Planning. Setting. Recruitment of donors. Phlebotomy. Screening of donated blood. Maintaining cold chain maintenance. Disposal of contaminated blood. Safety and quality. Assurance in blood bank. First-aid.

THIRD SCHEDULE—*continued*

Topic	*Sub-topic*
Blood products	Cryoprecipitate. Fresh frozen plasma. Platelet rich plasma. Platelet concentrate. Red cell concentrate. Neocytes. White cell concentrate.
Preparation of reagents and antisera	Anticoagulants. Grouping antisera. Lectins. Enzymes. Bovine albumin. Anti human globulins.

TERM III

OBJECTIVES

At the end of this course unit the trainee should be able to—

(i) Determine the survival of transfused red blood cells.
(ii) Apply blood group system in forensic medicine.
(iii) Manage blood transfusion centre.
(iv) Ensure safety and quality assurance.
(v) Use, operate and maintain special blood bank equipment.
(vi) Interpret and implement the National Blood Transfusion Policy.

CONTENT

Topic	*Sub-topic*
Application of radioisotopes	Estimation of blood volume. Determination of transfused red survival rate. Safety precaution.
Blood group in forensic medicine	Medical-legal.
Management of blood transfusion centre	Human resources. Laboratory resources. Documentation.
National blood transfusion policy	Interpretation. Implementation.
Instrumentation	Automatic blood group analyser. Operation and preventive maintenance.

MEDICAL PARASITOLOGY AND ENTOMOLOGY

AIM: The Higher Diploma Course in Medical Parasitology is designed to produce specialised medical laboratory technologists to meet the needs of the dynamic scientific and technological advances in laboratory medicine by managing laboratory services at all class levels.

THIRD SCHEDULE—*continued*

GENERAL OBJECTIVES

At the end of training the medical laboratory technologist in a parasitological laboratory should be able to—

(i) Plan and set up a medical laboratory.
(ii) Plan and institute safety measures.
(iii) Manage laboratory and field investigations.
(iv) Carry out laboratory and field investigations.
(v) Interpret and correlate laboratory results.
(vi) Carry out disease prevention and control.
(vii) Conduct research.
(viii) Establish and maintain quality control and quality assurance
(ix) Plan and organize continuing education for self and others.

TERM 1

OBJECTIVES

At the end of this course unit the trainee should be able to—

(i) Plan and set up medical parasitology laboratory;
(ii) Observe laboratory safety measures;
(iii) Describe host-parasite interrelationship;
(iv) Explain the immunology for parasitic diseases;
(v) Describe the transmission of protozoan infections;
(vi) Carry out laboratory diagnosis of protozoan diseases;
(vii) Establish and maintain quality assurance.

CONTENT

Topic	*Sub-topic*	*T*	*T*
Parasitology laboratory	Laboratory set up. Furnishing equipment and apparatus. Chemicals and reagents and stains. Laboratory safety and waste disposal. Other expendable items.		
Host parasite interrelationship	Evolution of human parasitic infection. Host selection by parasites. Adaption and establishment of parasites. Evasion mechanisms. Pathological effects of parasite on their hosts. Immunology of parasitic diseases.		
Parasitological specimens	Types and special collection methods. Preservation and transportation. Processing and disposal.		

THIRD SCHEDULE—*continued*

Topic	*Sub-topic*	*T*	*T*
Transmission and laboratory diagnosis	Protozoan infections. Amoebiasis. Giardiasis. Trichomoniasis. Balantidiasis.		
	Cryptosporidiosis. Isosporidiosis. Malaria. Leishmaniasis. Trypanosomiasis.		

TERM II

OBJECTIVES

At the end of this course unit the trainee should be able to—

(1) Describe the transmission of cestodeal, tramatodeal and protozoal infections;

(2) Carry out laboratory diagnosis of cestodeal, trematodeal, nematodeal and protozoal infections;

(3) Prepare project proposal.

Topic	*Sub-topic*	*T*	*P*
Transmission and laboratory diagnosis	Protozoal infections. Toxoplasmosis. Babesiosis. Pneumocystosis. Sacocystosis. Acanthamoebiasis. Acanthaoeiasis. Amoebi meningoepicaphalitis. Other minor protozoal diseases.		
	Cestodeal infections.		
	Taeniasis. Cysticercosis. Hydatidosis. Sparaganosis. Diphyllobothriasis. Sparaganosis. Coenurosis. Hymenolepiasis. Other minor cestodeal infections. Trematodeal infections. Schistosomiasis. Fascioliasis.		

THIRD SCHEDULE—*continued*

Topic	*Sub-topic*	*T*	*P*
	Fasciolopsiasis. Paragonimiasis. Opisthorchiasis. Clonorchiasis. Heteropyiasis. Other minor trematodeal infections. Nematodeal infections. Ascariasis. Trichuriasis. Ancylostomiasis.		

TERM III

OBJECTIVES

At the end of this course unit the trainee should be able to—

(1) Describe the transmission of nematodeal and minor parasitic infections.
(2) Describe the transmission of arthropod caused conditions.
(3) Carry out vector identification and incrimination.
(4) Carry out parasitological and entomological surveys.
(5) Interpret and correlate laboratory results.
(6) Carry out disease prevention and control.
(7) Carry out sensitivity and sensitivity and susceptibility testing.
(8) Monitor and evaluate control measures.
(9) Manage laboratory resources and services.

Topic	*Sub-topic*
Transmission and lab diagnosis	Nematodeal infections. Trichinellosis and trichinosis. Enterobiasis. Strongyloidiasis. Loiasis. Mansonelliasis. Bancoroftian filariasis. Brugian filariasis. Onchocerciasis. Dipetalonemiasis. Dracunculiasis. Capillariasis.
	Minor parasitic infections. Gnathostomiasis.

THIRD SCHEDULE—*continued*

Topic	*Sub-topic*
	Macracanthrorhynchiasis. Pentastomidiasis.
	Arthropod caused conditions. Myiasis. Scabies. Tungiasis. Pediculosis. Entomosis, entomophobia including delusory parasites. Paralysis (tick induced). Envenomisation, dermatitis. Sensitization and hypersensitivity.
Vector indentification and incrimination	Special methods. Forensic entomology.
Parasitological entomological surveys	Geographical reconnaissance. Baseline data collection on parasites and vectors. Vector bionomics. Forecasting of epidemics.
Prevention and control	Epidemiology of parasitic disease. Anti-parasitic and anti-vector measures. Integrated approaches environmental considerations. Sensitivity and susceptibility testing.
Monitoring and evaluation of control measures	Verifiable indicators. Means of verification. Inputs. Outputs. Impacts assessment.
Revision, project compilation, examinations.	

VIROLOGY

AIM: This course unit is intended to equip the trainee with knowledge, skills and attitudes to enable them to work, manage and research in all laboratories.

GENERAL OBJECTIVES

At the end of this course unit the trainee should be able to—

(1) discuss the major contributions, development and discovery of viruses.

(2) understand the structure and components of viruses.

(3) describe the specialized virus laboratory setting.

(4) apply sterilization, disinfection and disposal methods in medical virology.

(5) apply bio-safety techniques to be observed in virology.

(6) apply preventive maintenance of instruments and equipment in diagnostic and research laboratories.

THIRD SCHEDULE—*continued*

(7) perform the collection, labelling, transportation, processing and storage of specimens.

(8) explain the fundamental concepts of molecular biology and microbial genetics.

(9) classify viruses into families, genera, and species of medical importance.

(10) explain the pathogenesis, laboratory diagnosis, treatment and prevention of diseases caused by viruses.

(11) apply various techniques for isolation of viruses notably tissue culture, laboratory animals, etc..

(12) implement total quality management as it applies to virology.

TERM 1

OBJECTIVES

At the end of this course unit the trainee should be able to—

(1) Differentiate viruses from other microbial organisms.

(2) Outline the major developments and contributions in virology.

(3) Discuss the criterion for virus classification.

(4) Apply bio-safety techniques relevant to virology laboratories.

(5) Describe the virus laboratory setting, design and operations.

(6) Perform relevant sterilisation techniques used in virology.

CONTENT

Term	*Topic*	*Sub-topic*	*T/P*	*Hours*
ONE.	Introduction	Definition of viruses. History of virology. Major developments and contributions in virology.		
	Classification of viruses	Criteria used for classification. Virus architecture— • structure, • components. Virus replication. Methods of studying viruses.		
	Bio-safety	Bio-safety procedures applied in Virology. Code of practice. Categorization of pathogens into risk groups.		
	Virus laboratory Categories and setting	Tissue culture lab. Serology. Containment level – 3. Maximum containment level – 4. Animal house. Washing up/sterilization room.		

THIRD SCHEDULE—*continued*

	Sterilization disinfection and disposal	Sterilisation techniques. Physical. Chemical— • sterility testing, • disinfection and disinfectants, • disposal procedures. Animals. Material.		

TERM TWO

OBJECTIVES

At the end of this course unit, the trainee should be able to—

(1) Describe the principle usage of major equipments in Virology;

(2) Perform collection, processing, preservation, storage and transportation of virological specimen;

(3) Describe the epidemiological patterns of viral diseases;

(4) Participate in epidemiological surveillance of viral diseases;

(5) Describe the pathogenesis of viral diseases;

(6) Describe systematically DNA and RNA viruses;

(7) Perform laboratory diagnosis of viral diseases of medical importance;

(8) Write up a project proposal and report.

CONTENT

Term	*Topic*	*Sub-topic*	*T/P*	*Hours*
TWO	Equipments	Principles and uses of the following equipment: Microscopes-Electron Microscope, inverted, If Refrigerators/deep freezers Containers for liquid nitrogen, Carbon dioxide etc. Incubators and autoclaves De-ionizers and distillers Bio-safety cabinets and flow Cytometer Lyophiliser pH Meters, Thermocycler		
	Virological specimens	Containers. Specimen. Types: processing, preservation, storage, transportation.		

THIRD SCHEDULE—*continued*

Term	*Topic*	*Sub-topic*	*T/P*	*Hours*
	Epidemiology of viral diseases	Course of infection in an individual: Acute *latent *chronic. Routes of spread in the Community: *horizontal *vertical. Surveillance of viral diseases		
	Pathogenesis	Virulence. Localised infections.		
	Systematic Virology	Generalised infections. Systemic infections. DNA viruses. RNA viruses.		

TERM THREE

OBJECTIVES

At the end of this course unit, the trainee should be able to—

(1) Describe the role of unclassified viruses in medicine;

(2) Perform laboratory techniques used for virus isolation and identification;

(3) Escribe microbial genetics in relevance to molecular biology techniques;

(4) Describe the various methods applied in the control of viral diseases;

(5) Carry out total quality management in virology.

CONTENT

Term	*Topic*	*Sub-topic*	*T/P*	*Hours*
THREE.	Systemic virology	Unclassified viruses.		
		Tissue culture systems *1 degree *2 degree, continuous cell lines, cultivation, inoculation and harvesting. Animal techniques. Immunological/serological techniques *ELISA *IFA. Quantitation of virus litres. LDSO, TCID50, ELD59, PFU-RIA- CFT- RPHA-HAI-HAD- Immunoblot assays		
	Microbial genetics and molecular biology	DNA Cellular organisation and function. Gene mutation. Mechanisms of genetic exchange. Aspects of molecular biology.		

THIRD SCHEDULE—*continued*

Term	*Topic*	*Sub-topic*	*T/P*	*Hours*
		Techniques used in molecular virology e.g. PCR and flowcytometry.		
	Control of viral diseases	Antiviral drugs *Target sites for antiviral drugs. *Mechanisms of action of antiviral.		
	(Antiviral therapy) (vaccines, others)	Drugs. Vaccines— *live attennated, *killed vaccines, *recombination vaccine, Large and small scale vaccine production. Vaccine storage and distribution. Other control methods of viral diseases— vector control, quarantine methods, surveillances.		
	Total quality management (Tqm) in virology	Definition of TQM. Quality control. Design and benefits of quality assurance.		

IMMUNOLOGY

AIM: The course unit is intended to equip the trainee with knowledge, skills and attitudes to work manage and research to provide quality health care services in all laboratories.

GENERAL OBJECTIVES

At the end of this course unit the trainee should be able to—

(1) understand the development and scope of immunology;

(2) describe the immune defense mechanism, understand the various immuno reactions in the body;

(3) demonstrate the organs and tissues involved in immune system;

(4) describe the major histocompatibility complex and its significance;

(5) apply the skills gained in the preparation of immunoglobulins for mass production;

(6) understand the role of vaccines in the control of infections;

(7) perform immunological techniques;

(8) discuss immunity and infection;

(9) describe the various immunodeficiency states and methods of investigating them;

(10) implement total quality management as it applies in Immunology.

THIRD SCHEDULE—*continued*

TERM 1

OBJECTIVES

At the end of this course unit the trainee should be able to—

(1) Describe the milestomnes in the development of immunology.

(2) Discuss the innate and acquired immune mechanisms.

(3) Describe the cols and soluble factors and their role in immunity.

(4) Apply bio-safety techniques relevant to immunology.

(5) Prepare smears from spleen, bone marrow and lymph nodes of laboratory experimental animals and identify the cells of the immune system.

(6) Differentiate between T and B-lymphocytes.

(7) Describe the role of major histo-compatibility complex in immune responses.

CONTENT

	Topic	*Sub-topic*	*T/P*	*Hrs*
Term One 220 hours	Introduction	Historical background. Early immunology. Recent advances of immunology. Development of immunological. Techniques. Chronology of important. achievements in immunology.		
	Innate and acquired immunity	The innate immune system. The role of complement and. phagocytic cells. Soluble factors. The acquired immune system. The role of antibodies. *B Lymphocytes. *T Lymphocytes. *Phagocytic cells.		
	Biology of the immune system	The primary lymphoid organs. The secondary lymphoid organs. The lymphoid cells. *T & B Lymphocytes. *N K Cells. The mononuclear. Phagocytic system. Polymorphonuclear granulocytes platelets.		70
4.	Biosafety	Bio-safety techniques in immunology laboratory.		24
5.	The major histo-compatibility complex	The arrangement of MHC genes. Cellular distribution of MHC antigens. Structure of MHC antigens. Functions of the MHC antigens. The immuno-globulin supergene family.		40

THIRD SCHEDULE—*continued*

	Topic	*Sub-topic*	*T/P*	*Hrs*
Term Two (2) 320 Hours (T/P) 120 Hours Project	Immunochemistry	The immuno globulin structure and functions. Classes and subclasses. The generation of diversity. Theories of antibody formation. Light chain and heavy chain gene. Selection recombination. Recombination sequences. Production of immuno globulin.		

TERM II

OBJECTIVES

At the end of this course unit the trainee should be able to—

(1) Describe the structure, functions and classes of immunological molecules;

(2) Discuss mechanisms of gene segment in the generation of antibody diversity;

(3) Demonstrate the purity of antisera using gel electrophoresis techniques;

(4) Describe the complement system and its role in immunity;

(5) Investigate complement deficiencies;

(6) Carry out immunological techniques required for diagnosis of diseases and research.

CONTENT

7.	Complement system	The complement proteins. The classical pathway. The alternate pathway. The complement receptors. Complement associated diseases and deficiencies.		99
8.	Immunological techniques and instrumentation	Agglutination. Precipitation. Production of anti-sheep RBC's serum. Complement assays. Separation and purification of immunolobulins. Preparation of antisera purity check. Fluorescence techniques. ELISA. Hybridoma technology: Production of monoclonal antibodies. Electrophoresis & immuno-electrophoresis. PCR polymerase chain. Reaction.		

THIRD SCHEDULE—*continued*

		Blot immuno assays. Flow cytometry.		
Term Three (3)	Hypersensitivity reactions	Type I Immediate hypersensitivity. Concept at allergic reactions.		
440 Hours 8		Type II ADCC. Antibody dependant. Cell cytoxity. Type III Complex mediated. Hypersensitivity mechanisms at damage. Type IV Delayed hypersensitivity. Conditions manifesting Type III.		

TERM III

OBJECTIVES

At the end of course unit the trainee should be able to—

(1) Explain the various types of hypersensitivity reactions;
(2) Demonstrate hypersensitivity reactions;
(3) Explain the immuno-deficiency states;
(4) Investigate immuno-deficiency states;
(5) Comprehend autoimmunity;
(6) Investigate autoimmune diseases;
(7) Describe the concepts of transplantation and rejection;
(8) Understand histo-compatibility testing;
(9) Explain the immunology of foetal/maternal relationships;
(10) Describe immune responses to tumors;
(11) Describe principles of vaccine development;
(12) Describe immunity to pathogens;
(13) Practice Total Quality Management.

CONTENT

9.	Immuno deficiency states	Definition 1 percent Immunodeficiency 2 percent Immunodeficiency Mechanisms leading to immuno-deficiency. Methods of investigating.		
10.	Auto immunity	Self tolerance. Breakdown at self tolerance. Immuno suppresion. Auto immune disorders.		

THIRD SCHEDULE—*continued*

11.	Transplantation and rejection	Genetics of transplantation. Mechanisms of graft rejections. Clinical tissue— *Allogeneic, *Syngeneic, *Xenogeneic, Transplanatation. Immuno-suppression. Histo-compatibility testing.		
12.	Tumor immunology	Immune recognition of tumors. Immune responses to tumors (surveillance). Potential for therapy. Animals. Induction of tumors in laboratory.		
13.	Vaccines immunomodulators	Types of immunization. Types of vaccines and immunoi-modulators. Usage of vaccines. Vaccine storage and distribution.		
14.	Immunity to pathogens	Immunity to viruses. Immunity to fungi. Immunity to bacteria. Immunity to protozoa. Immunity to parasitic helminthes.		
15.	Total Quality Management	Concepts of TQM. Benefits and design.		

Appendix: 1

TRAINING STANDARDS

1. *Staff/Student Ratio*

Lecturers

Theory 1:10

Practical 1:5

2. *Academic Staff Qualifications*

Minimum HD MLS with five (5) years experience in specialist subject.

A certificate in, medical education, and good track record.

or

MSc. in Medical Laboratory Sciences (relevant subjects) and registered by K.M.L.T.T.B..

THIRD SCHEDULE—*continued*

Support staff should comprise of—

–One (1) HD Holder

–One (1) Diploma Holder

–One (1) Certificate Holder

3. *Attendance* – 90%

4. *Duration of Programme* – One (1) Year

5. *Distribution of Learning Time*

Theory – 60%

Practical – 40%

6. *Subject Taken* – One at a given time

7. *Average Pass Mark* – 50%

8. *External Examiners*

HD holder with five (5) years working experience, medical education shall be an added advantage. Proven track record.

M.Sc. and above in medical laboratory sciences with good reputation and integrity.

9. *Examination Declaration*

Common examination shall be given to all students in the Republic of Kenya.

Examination results shall be declared soonest possible.

Supplementary examination shall be given three (3) months after the declaration of the final results.

Upon unsuccessful attempt of the supplementary, the candidate shall be referred for one (1) year.

Appendix: 2

ESSENTIAL EQUIPMENT

MICROBIOLOGY

1.	Autoclave (portable)	1 between 10 students
2.	Medium water bath	1 between 5 students
3.	pH meters	1 between 5 students
4.	Anaerobic jars	1 between 5 students
5.	Incubators/hot air oven (adjustable)	1 between 10 students
6.	Distillers	2 for the whole institute
7.	De-ionizers	two small
8.	Microscopes (Binocular)	1 between 10 students
9.	Weighing balance	1 top pan load balance
10.	Woods lamp	one
11.	Centrifuge	1 between 4 students

THIRD SCHEDULE—*continued*

12. Bunsen Burner/Spirit	1 between 2 students
13. Tripod Stands/asbestos mat	1 between 10 students
14. Fridge/deepfreezer	1 between 10 students
15. Safety Cabinet	1 per laboratory
16. Teaching microscopes	1 between 10 students
17. Mechanical shaker	1 between 10 students
18. Inoculating loops	1 per student
19. Assorted microbiology glassware	adequate
21. Food masseraurs	1 between 5 students
22. Colony counters	1 between 5 students
23. Nephelometer	
24. Computer	1 per class
25. Electrophoresis equipment	1 per class

CLINICAL CHEMISTRY

1. Colorimeters	1 between 4 students
2. Analytical balance – top pan loading	
3. Sensitivity up to 1 mg.	1 between 5 students
4. Flame photometers	1 between 10 students
5. Centrifuge	1 between 4 students
6. Refrigerators/freezers	1 between 10 students
7. Water bath medium	1 between 4 students
8. pH meter	1 between 5 students
9. Mechanical mixers	2}
10. Electrophoresis equipment	2] per institution/class
11. Distiller/de-ionizer	2]
12. Hot air oven/incubator adjustable	10
13. Flame photometer	1 between 5 students
14. Selective electrodes	two of them
15. Electrophoresis equipment	1 between 10
16. One auto-analyser	1 per Institution/class
17. Fluorimeter	1–ditto–
18. Immunochemistry analyzer	1–ditto–
19. Thermocycler for PCR	1–ditto–
20. Blood gas analyzer	1–ditto–
21. High pressure liquid chromatogram	(HPLC)
22. Scintillation counter	1–ditto–
23. Nephelometer	1–ditto–
24. Computer	1–ditto–

HAEMATOLOGY

1. Haemoglobinometers	
2. Centrifuge	–ditto–
3. Microhaematocrit centrifuge	1 between 5 students
4. Microscopes – Blood mixers rollers	1 between 10 students
5. Water bath	–ditto–

THIRD SCHEDULE—*continued*

6. Incubator	–ditto–
7. Colorimeter	–ditto–
8. Electrophoresis equipment	1 between 10 students
9. Sphygmomanometer	1 between 5 students
10. E.S.R. stands	1 between 4 students
11. Deepfreezer/fridge	1 per 10 students
12. Deep freezer	1 between 5 students
13. Coulter Counter	1 for each class
14. Neubaeur Chambers	1 for each student
15. Distiller	2 per institution/class
16. Analytical balance	1 between 10 students
17. Stethoscopes	1 between 5 students
18. Spectroscope – Direct vision/revision	
19. Refrigerated centrifuge	1 per institution
20. Computer	”

HISTOPATHOLOGY

1. Microtome (Rocking/Rotary)	1 per 4 students
2. Manual tissue processing set	1 between 4 students
3. Hot plate	1 between 6 students
4. Hone and strope	1 between 4 students
5. Automatic knife sharpener	1 per class/institution
6. Water bath, medium size	1 between 4 students
7. Microscope (teaching)	1 for the institution
8. Cold plate	1 between 6 students
9. Weighing balances	1 between 1 students
10. De-ionizers	1 per class/institution
11. Fume chambers	1 per laboratory/institution
12. Automatic tissue processor	1 per class/institution
13. Automatic staining machine	1 per class/institution
14. Freezing microtone – hard set	1 per class/institution
15. Centrifuge	
17. Computer	
18. Postmortem kit	

BLOOD TRANSFUSION SCIENCE

1. Blood bank refrigerator	1 per class
2. Grouping tiles	1 per student
3. Water bath	(medium size) adjustable
4. Plasma extractors	15 students
5. Centrifuges	1 between 4 students
6. Weighing balance	1 between 5 students
7. Syphomomanometers	1 between 5 students
8. Hot air oven (adjustable)	1 in the whole institution
9. De-ionizers and stillers	1 for the whole class/institution
10. Mechanical shaker	

THIRD SCHEDULE—*continued*

11.	Blood Transfusion bleeding unit	
12.	Assorted blood transfusion glassware and adequate apparatus	
13.	Microscopes	1 per 2 students
14.	Deep freezer 70 degrees C	
15.	Automated centrifuge for blood products	
16.	Cool boxes	
17.	Microscopes	1 per 2 students
18.	Water bath	1 per 2 students

MEDICAL PARASITOLOGY

1.	Centrifuges	1 for 4 students
2.	Refrigerators	–ditto–
3.	Pestle and mortar	1 per student
4.	Teaching microscope	
5.	QBC unit	
6.	Assorted apparatus e.g. racks, test tubes, stirring rods, applicator sticks, forceps Funnels, Kato kits, hand lenses	
7.	Stereo microscope, one per class	
8.	Fluorescent microscope, one per student	
9.	Geiger Muller counter/scintillator	
10.	Microscope, binocular, one per student	1 per student
11.	Dissecting microscope, one per student	1 per student
12.	Stereo microscopes, one per lecturer	1 per lecturer
13.	Refrigerated centrifuge	
14.	Mosquito scoops	
15.	Sucking tubes	
16.	Slide boxes	
17.	Dry specimen display tubes	
18.	Traps for big mammals and small mammals	
19.	Insect traps/tubes	
20.	Ladles	
21.	Mcmaster chambers	
22.	Enamel tray	
23.	Gumboots	
24.	Knap sack/spray pumps	
25.	Computer	

VIROLOGY

1. Hepatitis screening equipment
2. H.I.V. screening equipment
   (a) Eliza
   (b) Immunoblots (Western Blot)
   (c) P.C.R (polymerase chain reaction)

THIRD SCHEDULE—*continued*

3. CD4/CD8 counting machine
4. Viral load machine
5. Tissue lines
6. Immunofluorescent equipment
7. Inverted microscopes
8. Computer

IMMUNOLOGY

1. Mechanical shakers
2. Centrifuges
3. Water baths
4. Refrigerators
5. Geiger Muller counter
6. Chromatographic sets
   (a) G.L.C Gas liquid chromatograph
   (b) H.P.L.C. High pressure liquid chromatography
   (c) T.L.C – thin layer chromatography
7. Thermocycler
8. Computer.

Appendix: 3

ESSENTIAL BOOKS

MICROBIOLOGY

	Title	Author
1.	A colour atlas of practical pathology and microbiology	Ramnia Sood
2.	A manual for laboratory and diagnostic tests	F. Fiscbaeh
3.	Clinical diagnosis and management	Method John B/Henry MD
4.	Clinical microbiology	J.J Inglis
5.	Fundamentals in microbiology	K.P. Talaro
6.	Medical immunology	Daniel/Tristram
7.	Microbiology (colour guide)	Inglis
8.	Basics of quality assurance for intermediate and peripheral laboratories.	W.H.O
9.	Principles of bacteriology and immunology Vol.I., II and III	Topley and Wilson
10.	Handbook of bacteriology techniques	Baker
11.	Microbiology including Immunology and molecular genetics	B.D. David et al.

CLINICAL CHEMISTRY

	Title	Author
1.	Physiological Chemistry	Harper

THIRD SCHEDULE—*continued*

	Title	Author
2.	Clinical Chemistry Diagnosis and Treatment	P. Mayne et al
3.	Fundamentals of Clinical Chemistry	Norbert Teitz
4.	Practical Clinical Biochemistry (Vol. I and II)	Harold Varley
5.	Biochemistry: A Case Oriented Approach	Montgomery
6.	Biochemistry	Lehninger A.L.
7.	Quantitive inorganic Chemistry	H.Vogel
8.	Clinical Diagnosis	W.B. Saunders *et al*
9.	Clinical Chemistry	Henry
10.	The living Body	Best and Taylor

HAEMATOLOGY

	Title	Author
1.	Clinical Haematology	Wintrobe
2.	Practical Haematology	Dacie et al
3.	Clinical Haematology in Medical Practice	De Crunchy
4.	Leukaemia	F. Gruz
5.	Leukaemia Diagnosis	Barbara Bain
6.	Diseases of the Bone Marrow	Witby and Briton
7.	Haematological Techniques for Medical Laboratory Technicians and Medical Students	Darmady and Davenport
8.	Bleeding Disorders	Jardisty and Ingram
9.	Haematology	William J. William
10.	Chronic Granulocytic Leukaemia	Michael T. Show

HISTOPATHOLOGY

	Title	Author
1.	Understanding Pathophysiology	Sue E. Heuther, Kathryn L. McCain
2.	Carleton's Histological Techniques	Dory and Wellington
3.	Practical Section Cutting and Staining	Clayton
4.	Cellular Pathology Technique	C.F.A. Culling et al
5.	Wheater's Functional Histology a Textbook and Colour Atlas	Young/Heath
6.	Simpson's Forensic Medicine	B Knight
7.	Mausoleum Techniques	
8.	Electron Microscopy	
9.	Cytology	

THIRD SCHEDULE—*continued*

BLOOD TRANSFUSION

	Title	Author
1.	Haematology	William J. William
2.	Techniques in blood Grouping	Ivory Dunford and C.C. Bowky
3.	Modern Blood Banking on Transfusion Services	D. Harmening and Pittiglio
4.	Blood Grouping in Man	R.R. Rale and R. Sanger
5.	Blood Transfusion in Clinical Medicine	Mollison Patrick
6.	Blood Group Serology	I. Dnford and C.C. Bowky

PARASITOLOGY

	Title	Author
1.	Textbook of Parasitology	Daniel L. Belding M.D
2.	Clinical Parasitology	Craig and Faustin
3.	Introduction to Parasitology	A.C. Chandler
4.	Tropical Diseases	Manson Barr
5.	Essential Mararіology	Bruce Chwatts
6.	Worms and Diseases	Muller R
7.	Lecture Notes of Medical Entomology	M.W. Service
8.	Insects of Medical Importance	
9.	Medical Parasitology	Markell, Vogue and John
10.	Entomology for Students of Medicine	Gordore M.M.J. Laboipierne

VIROLOGY

	Title	Author
1.	Practical Virology for Medical Students and Practitioners in tropical countries	D. Metasalaar et al
2.	Fundamentals of Medical Virology	Kucera and Louis S.
3.	Virological Procedures	Hopkins et al
4.	Virology – Practical Approach	B.S. Mahy et al
5.	Medical Virology	D. White & F. Ferner
6.	Medical Virology – a Practical approach	Editor – U. Desselberger
7.	Principles of molecular Virology	J Cann

IMMUNOLOGY

	Title	Author
1.	The Principles of Immunology	Ivan Roitt
2.	Fundamentals of Immunology	Tesdale

THIRD SCHEDULE—*continued*

	Title	Author
3.	Practical Immunology	Hudsons and Hay
4.	Practical Immunology	Talwar
5.	Basic & Clinical Immunology	Peakman & Vergains
6.	Understanding immunology	Peak Woods & Prentice-Hall

[Subsidiary]

KENYA MEDICAL LABORATORY TECHNICIANS AND TECHNOLOGISTS (FEES) REGULATIONS, 2006

[L.N. 14/2006.]

1. These Regulations may be cited as the Kenya Medical Laboratory Technicians and Technologists (Fees) Regulations, 2006.

2. The fees payable under the Act for the various activities specified in the first column of the Schedule shall be as respectively specified in the second column thereof.

SCHEDULE

Activity	*Fee in shillings*
1. For Registration of Persons to Practice	
(a) Application fee (*non-refundable*)	500
(b) Registration fee for—	
(i) Diploma	2,500
(ii) Bachelor of Science	3,500
(iii) Certificate	2,500
(c) Annual retainer fee	1,000
2. For Registration of Private Laboratory	
(a) Application fee (*non-refundable*)	500
(b) Registration fee for—	
(i) Side laboratory	2,000
(ii) Class A laboratory	2,500
(iii) Class B laboratory	5,000
(iv) Class C laboratory	10,000
(v) Class D laboratory	20,000
(vi) Class E laboratory	40,000
(c) Annual licence fee for—	
(i) Side laboratory	1,000
(ii) Class A laboratory	1,000
(iii) Class B laboratory	1,000
(iv) Class C laboratory	2,000
(v) Class D laboratory	4,000
(vi) Class E laboratory	8,000
3. For Registration of Training Institutions	
(a) Application fees (*non-refundable*)	2,000
(b) Inspection fees (*payable once*)—	
(i) Diploma	368,000
(ii) Bachelor of Science	484,000
(c) Re-inspection fees (*for colleges that fail to meet standards on initial inspection*)	
(i) Diploma	184,000
(ii) Bachelor of Science	234,000

SCHEDULE—*continued*

Activity	*Fee in shillings*
(d) Annual training licences—	
(i) Diploma	70,000
(ii) Bachelor of Science	80,000
4. For Certificate of Private Practice	
(a) Application fee	500
(b) Option I based on strength if certificate—	
(i) Certificate	1,000
(ii) Diploma	2,000
(iii) Higher National Diploma	3,500
(iv) Bachelor of Science	3,500
(v) Masters of Science	4,000
(vi) Doctor of Philosophy	5,000
(c) Option II based on level of laboratory owned—	
(i) Side laboratory	1,000
(ii) Class A laboratory	2,000
(iii) Class B laboratory	3,000
(iv) Class C laboratory	4,000
(v) Class D laboratory	5,000
(vi) Class E laboratory	6,000
(d) Annual retainer fee	1,000
5. For Student Indexing	
(a) Application fee	500
(b) Indexing—	
(i) Pre-service indexing	2,000
(ii) In-service indexing	1,000
6. For Examinations	
(a) Final exam—	
(i) Certificate	10,000
(ii) Diploma	12,000
(iii) Higher National Diploma	15,000
(b) Stage exam—	
(i) Certificate	3,000
(ii) Diploma	4,000
(c) Proficiency in theory and practicals—	
(i) Bachelor of Science practicals	15,000
(ii) All other cadres	15,000
(d) Fee per subject for supplementary exams—	
(i) Certificate	1,500
(ii) Diploma	2,500
(iii) Higher National Diploma	3,500
(iv) Practicals	¾ of the respective fees
7. For verification of documents	1,500
8. For issuance of transcript	1,000

MEDICAL LABORATORY (EQUIPMENT AND REAGENTS VALIDATION) REGULATIONS, 2011

ARRANGEMENT OF REGULATIONS

Regulation

[Subsidiary]

MEDICAL LABORATORY (EQUIPMENT AND REAGENTS VALIDATION) REGULATIONS, 2011

[L.N.113/2011.]

1. Citation

These Regulations may be cited as the Medical Laboratory (Equipment and Reagents Validation) Regulations, 2011.

2. Interpretation

In these Regulations, unless the context otherwise requires—

"equipment" means all machines, instruments, and apparatus and their accessories that are used in medical laboratory diagnosis including manual, semi-automated or fully automated medical analyzers for clinical chemistry, haematology, immunology, histology, bacteriology, parasitology, serology and related disciplines, incubators, refrigerators, water-baths, autoclave instrument, pH meter, balance, spectrophotometers, air sampler (viable, none-viable)and any other instruments that fall within this class;

"person" includes a company, association or other body of persons whether incorporated or unincorporated;

"reagents" means all chemicals either as simple strips or as finished kits, solutions or powders that are used in medical laboratory diagnosis including discs for bacterial sensitivity testing;

"samples" means representative parts of equipment, devices and reagents that is submitted for validation;

"validation" means the process of authentication undertaken by Board or its appointed agents for the purposes of confirming the quality of medical laboratory reagents and equipment by performing tests to confirm the information provided by the manufacturers relating to their precision, linearity, specificity, sensitivity and accuracy in the description of the equipment, reagents and chemicals for use within medical laboratories in Kenya.

3. Regulation of business

(1) No laboratory technician or technologist engaged in private practice shall, whether solely, or through any business arrangement with other persons, stock, use, handle, distribute or procure the supply of any equipment or reagents for use within medical laboratories in Kenya unless the equipment or reagents have been validated in accordance with these Regulations.

(2) No medical laboratory shall stock, use, handle, distribute or procure the supply of any equipment or reagents for use within medical laboratories in Kenya unless the equipment or reagents have been validated in accordance with these Regulations.

(3) No medical laboratory, laboratory technician or technologist engaged in private practice shall use donated equipment and reagents from donor agencies, partners and other stakeholders in the health service industry within their laboratories, unless the equipment or reagents have been validated in accordance with these Regulations.

(4) Nothing in these Regulations prohibits any vendors, suppliers, distributors, dealers and retailers engaged in bulk supply of laboratory reagents and equipment directly to medical laboratories in Kenya from sending samples for validation in accordance with these Regulations.

(5) A medical laboratory, laboratory technician or technologist engaged in private practice shall maintain a record, in their premises, of certificates of validation issued by the Board after the validation of any equipment and reagents used in their medical laboratories.

4. Application for validation

(1) An application for validation shall be in Form A set out in the Schedule and shall be accompanied by a sample from every batch of reagents or equipment.

(2) In addition to the information required in Form A, an applicant shall, on request, furnish such additional information and samples as may be required by the Board for the validation of the equipment and reagents in respect of which the application is made.

5. Fees

An application for validation shall be accompanied by such fees as may be prescribed by the Board from time to time.

6. Issue of certificate of validation

(1) The Board shall consider the applications made under rule 4 and carry out the necessary validation processes, and if satisfied of the safety, efficacy, quality and environmental aspects of the equipments or reagents, it shall issue a certificate of validation in Form B set out in the Schedule and submit a report on any adverse effects associated with the use or disposal of equipment and reagents in accordance with the Environmental Management and Co-ordination Act, 1999 (No. 8 of 1999).

(2) The Board shall keep a record of all the applications made for validation and all the batches of equipment and reagents that it has validated.

(3) Where the Board has requested for additional information or is querying the information provided by an applicant, the processing of the application shall be suspended until the information is provided or query responded to and the application will stand rejected if the additional information is not provided or the queries are not responded to after three months.

(4) The Board shall while undertaking the necessary validation processes on the equipment and reagents under paragraph (1), verify the specifications supplied by the applicant, and validate the reagents and equipment in respect of any the following particulars—

(a) the name under which the equipment or reagents may be sold;

(b) the labeling;

(c) the statement of the representations to be made for the promotion of the equipment and reagents in respect of—

(i) package, size, weight, dimensions and volume;

(ii) technical information including specification, methods, formulation or composition and standard operating procedures (SOP);

(iii) concentration, potency, avidity, confluence or constitution;

(iv) wavelength, resolution, linearity, voltage requirements, workload capacity and environmental stability;

(v) storage requirements, expiry date, environmental complicity; and

(vi) batch numbers or bar codes.

(5) If the Board is not satisfied of the safety, efficacy, quality or economic value of the equipment or reagents, it may, after providing an opportunity to the applicant to be heard, reject the application for the validation of the equipment and reagents and inform the applicant the reasons for rejection, in writing.

7. Duration, etc., of certificate of validation

(1) A certificate of validation issued under these Rules shall, unless earlier suspended or revoked, remain valid for every batch of reagents in relation to which it was issued or for the duration of the technological relevance of the equipment in relation to which it was issued.

(2) Where an original validation certificate is defaced, damaged or lost the Board, may, upon payment of such fees as it may determine, issue a duplicate copy of the certificate that bears the words “DUPLICATE COPY”.

8. Suspension or revocation of the certificate of validation

(1) The Board may suspend or revoke a certificate of validation issued under these Regulations, or amend the conditions of such validation for such a period as it may determine.

(2) The Registrar may upon giving a thirty days notice and reasons, in writing revoke a certificate of validation.

(3) The power conferred by paragraph (1) shall not be exercised in respect of any certificate of validation except in one or more of the following grounds—

(a) the matters stated in the application on which the certificate of validation was granted was false or incomplete in a material particular (sample particulars);

(b) a provision of the certificate of validation has to a material extent (sample extent) been contravened by the holder of the certificate;

(c) the premises on which or on part of which the equipment or reagents are manufactured, assembled or stored by or on behalf of the holder of the certificate of validation are unsuitable for the manufacturer, assembling or storage of the equipment or reagent; or

(d) new information has been discovered by the Board which renders the equipment or reagents unsafe, dangerous or scientifically and technologically obsolete.

9. Appeals

(1) A person aggrieved by a decision of the Board in relation to any application for validation of medical equipment or reagents may appeal, in writing to the Board, and pay the prescribed fee.

(2) The Board may after considering an appeal, allow or dismiss the appeal and give reasons for any rejection, in writing.

10. Conditions of validation of reagents or equipment

(1) The Board shall before registering any reagent or equipment for which the research has been conducted in another country, whose efficacy, safety and quality, has been established in that country, require an investigation, on any aspect of the reagent or equipment which are necessary to establish its quality and where applicable the standard component viability and its environmental safety and efficacy to be established under local conditions to be conducted and any modification of the equipment or reagent after validation shall require the approval of the Board.

(2) Notwithstanding paragraph (1) the Board may validate a new reagent or equipment and require the investigation and chemical trials specified in rule (1) to be conducted after validation.

11. Inspection of premises

The Board may, before issuing a certificate of validation under these Regulations, cause the premises in which the manufacturing of the equipment or reagent is being conducted, to be inspected by inspectors appointed for that purpose, and the inspectors shall have powers to enter the premises and inspect the plant and the process of manufacture employed in the manufacturing and submit a report to the Board.

12. Penalties for violating regulations

A person who contravenes any of the provisions of these Regulations commits an offence and shall be liable on conviction to a fine not exceeding one hundred thousand shillings or to imprisonment for a term not exceeding twelve months or to both.

13. Duty to ensure compliance with Regulations

(1) It is the duty of the proprietor of a medical laboratory in which equipment and reagents are procured for diagnostic purposes to take all reasonable steps to ensure that validation is undertaken in order to comply with regulation 3.

(2) It is also the duty of each of following persons to take reasonable steps to ensure that validation is undertaken in order to comply with regulation 3—

(a) the Laboratory Manager;

(b) laboratory Quality Assurance Officer;

(c) the laboratory in-charge; and

(d) any other person who is responsible for the management a medical laboratory.

(3) All medical laboratories shall use validated equipment and reagents.

SCHEDULE

FORM A **(r. 4(1))**

MEDICAL LABORATORY TECHNICIANS AND TECHNOLOGISTS ACT

[No. 10 of 1999.]

APPLICATION FOR VALIDATION OF EQUIPMENT[S] AND REAGENT[S]

PART 1

(*To be completed by the applicant in triplicate*)

The Registrar,
Kenya Medical Laboratory Technicians and Technologists Board,
P.O. Box 20889-00202
Nairobi.

1. Name of Applicant .....
   Business address (Attach a detailed bio-data of company) .....
   Telephone contacts .....
2. Name of Equipment/ Reagent (State whether for private or commercial use .....
   .....
   Type of formulation to be validated .....
   Presentation of the Equipment/Reagent .....

SCHEDULE—*continued*

3. Identification (physical appearance of the equipment/reagent) .....
   .....
   .....
4. Equipment/Reagent classification .....
5. (a) Name and business address of manufacturer .....
   (b) Country of origin .....
6. Registration Number of the product in country of origin and all other countries where it is marketed .....
7. Is the product authorized to be on the market in the country of origin? If yes, attach a legal certificate of free sale from the registering Authority. If no, state the reasons below:
   .....

PART IV

10. Specifications for all the active and non-active raw materials used in the manufacturing process are as follows—

PART V

11. Analytical control procedures which are performed on all active and non-active materials before they are used in the manufacturing process are as follows—

Part VI

12. Analytic control procedures and the frequency with which they are performed during the manufacturing process are as follows—

Part VII

13. Full specifications of final manufactured product are as follows—

Part VIII

14. The analytic control procedures which are performed on the final manufactured product are as follows—

Part IX

15. The inferred shelf-life of the product is as follows—

Part X

16. A summary of the method of manufacture and packaging—

Part XI

17. Summary of the experiments and results performed on the reagent/equipment to confirm its potency/validity—

Part XII

18. Particulars of clinical tests conducted with reference to the potency/validity of the use of the reagent/equipment with a summary of the nature of the tests, by whom conducted and where, results etc., and with special reference to comparative of controlled clinical tests, double blind tests etc.—

    The undersigned declares that all the information contained herein is correct to the best of his knowledge and belief.

Date of application ..... Signature of applicant Note: .....

1. A separate application is required for each equipment or reagent.
2. Application fees are not refundable.

Applicant to Note:

This application form must returned to the Kenya Medical Laboratory Technicians and Technologists Board within a period not exceeding three months from the date of issue. Applications which are not returned within the stipulated period shall be time barred.

SCHEDULE—*continued*

FORM B

MEDICAL LABORATORY TECHNICIANS AND TECHNOLOGISTS ACT
[No. 10 of 1999.]

CERTIFICATE OF VALIDATION FOR REAGENTS AND EQUIPMENT

It is hereby certified that the equipment and/or reagent as described hereunder has been validated subject to the conditions indicated—

1. Approved name .....
2. Trade name under which marketed .....
3. Validation No. .....
4. Active ingredients and quantities per unit .....
5. Method experiment to estimate inaccuracy /bias .....
6. Detection limit experiment and estimation of reference and or reportable range .....
7. Replication and interference experiment .....
8. Form of preparations .....
9. Condition under which equipment and/or reagent is validated .....
10. Name and business address of the vendor, supplier or distributor as appropriate .....
    .....
11. Registered Business name and address .....
12. Date of validation .....
13. Expiry date of validation .....