LEGAL NOTICE NO. 13

THE MEDICAL LABORATORY TECHNICIANS AND TECHNOLOGISTS ACT

(No. 10 of 1999)

IN EXERCISE of the powers conferred by section 5 (2) and section 40 of the Medical Laboratory Technicians and Technologists Act, the Board, in consultation with the College and with the approval of the Minister, makes the following Regulations:—

THE MEDICAL LABORATORY TECHNICIANS AND TECHNOLOGISTS (CURRICULUM AND COURSE CONTENT) REGULATIONS, 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 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.
FIRST SCHEDULE

REPUBLIC OF KENYA

MINISTRY OF HEALTH

THE KENYA MEDICAL LABORATORY TECHNICIANS AND TECHNOLOGISTS BOARD

CURRICULUM FOR CERTIFICATE IN MEDICAL LABORATORY SCIENCES
# TABLE OF CONTENTS

1.0 COURSE TITLE ................................................................. 3
1.0 RATIONALE ........................................................................ 3
1.0 ROLES AND FUNCTIONS .................................................... 3
1.0 PROGRAMME AIM .............................................................. 3
1.0 PROGRAMME OBJECTIVES .................................................. 3
1.0 ADMISSION REQUIREMENTS .............................................. 4
1.0 COURSE DURATION ............................................................ 4
1.0 ATTENDANCE PATTERN ...................................................... 4
1.0 AWARD OF CERTIFICATE .................................................. 5
1.0 TEACHING METHODS ......................................................... 5
1.0 CHEMISTRY ....................................................................... 8
12.0 COMPUTERS ..................................................................... 10
13.0 ENTREPRENEURSHIP ........................................................ 11
14.0 HUMAN ANATOMY AND PHYSIOLOGY .............................. 12
15.0 INSTRUMENTATION .......................................................... 13
16.0 MANAGEMENT/LABORATORY PRACTICE ............................ 14
17.0 MATHEMATICS AND STATISTICS .................................... 15
18.0 MEDICAL TERMINOLOGY .................................................. 16
19.0 RESEARCH METHODS AND PROJECT ............................... 17
20.0 SOCIAL STUDIES PROFESSIONAL CONDUCT, ETHICS AND LAW... 18
21.0 STERILIZATION AND DISINFECTION ................................ 19
22.0 MICROBIOLOGY ............................................................... 21
23.0 CLINICAL CHEMISTRY ....................................................... 24
24.0 HAEMATOLOGY ................................................................. 28
25.0 HISTOPATHOLOGY AND CYTOLOGY ................................ 32
26.0 BLOOD TRANSFUSION SCIENCE ....................................... 47
27.0 MEDICAL PARASITOLOGY

28.0 VIROLOGY

29.0 IMMUNOLOGY

30.0 Appendix 1 TRAINING STANDARDS

31.0 Appendix 2 ESSENTIAL EQUIPMENT

32.0 Appendix 3 LEARNING BOOKS
1.0 COURSE TITLE

INTRODUCTION

This course is intended to equip the trainee with knowledge, skills and attitudes to enable them 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

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

5.0.2 Understand the basic techniques applied in the medical laboratory.

5.0.3 Practice safety precautions in a Medical Laboratory.

5.0.4 Select, set up and operate laboratory equipment.

5.0.5 Apply standard operating procedures to obtain quality results.

5.0.6 Acquire attitude that enhances the delivery of quality service.

5.0.7 Use the appropriate knowledge and skills in problem solving in the work environment.

5.0.8 Contribute to the development of science and technology through creativity and application of acquired knowledge, skills and attitudes.
5.0.9 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.
- 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 1980 contact hours where 1320 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:

<table>
<thead>
<tr>
<th>Year</th>
<th>On-Campus</th>
<th>Clinical Attachment Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TERM ONE</td>
<td>440</td>
</tr>
<tr>
<td></td>
<td>TERM TWO</td>
<td>440</td>
</tr>
<tr>
<td></td>
<td>TERM THREE</td>
<td>440</td>
</tr>
<tr>
<td>2</td>
<td>TERM FOUR</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>TERM FIVE</td>
<td>440</td>
</tr>
<tr>
<td></td>
<td>TERM SIX</td>
<td>440</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td>1760</td>
</tr>
<tr>
<td></td>
<td></td>
<td>880</td>
</tr>
</tbody>
</table>
9.0 AWARD OF CERTIFICATE
KMLTTB or its agent shall award the certificate.

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:

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 to sit that same subject at summative level.

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

10.0.4.5 Assessment and evaluation shall be categorized as follows:

12.1.1 Continuous Assessment

(Conducted instructions)

a. Timed tests.


a. Practicals and orals.

a. Assignments.

a. Projects.

a. Oral Examinations (viva voce).

10.0.4.6 Summative Examinations.

Shall be conducted by a KMLTTB authorized examination body.

10.0.4.7 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.

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

10.0.4.8 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 The following grading system shall be used:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Score%</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>75-100</td>
</tr>
<tr>
<td>B</td>
<td>65-74</td>
</tr>
<tr>
<td>C</td>
<td>50-64</td>
</tr>
<tr>
<td>D</td>
<td>40-49</td>
</tr>
<tr>
<td>E</td>
<td>0-39</td>
</tr>
</tbody>
</table>

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 laboratory and to keep in line with the trend all over the world.

112.0.2 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.

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 system - 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 Health care 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

<table>
<thead>
<tr>
<th>Topic</th>
<th>Sub Topic</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENTREPRENEURSHIP AND SELF-EMPLOYMENT</td>
<td>• Importance of self-employment.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Entrepreneurship contribution to National development.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Requirements for entry into self-employment.</td>
<td></td>
</tr>
<tr>
<td>ENTREPRENEURIAL OPPORTUNITIES</td>
<td>• Business opportunities.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Assessing product demand.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Matching skills and resources to changing technology.</td>
<td></td>
</tr>
<tr>
<td>ENTREPRENEURIAL AWARENESS</td>
<td>• Evaluating business environment.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Type of business finance.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Contractual agreements.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Government policy on small scale enterprises.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Problems of starting a business enterprise.</td>
<td></td>
</tr>
<tr>
<td>ENTREPRENEURIAL MOTIVATION</td>
<td>• Internal motivating factors.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Techniques of self assessment.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• External motivating factors.</td>
<td></td>
</tr>
<tr>
<td>ENTREPRENEURIAL COMPETENCE</td>
<td>• Decision making in business.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Institute change.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Coping with competition.</td>
<td></td>
</tr>
</tbody>
</table>
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.
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 organize benches.

iii) Understand principles of functional units and instrument operation.

iv) Maintain daily checks, services and decontamination.
<table>
<thead>
<tr>
<th>Topic</th>
<th>Sub-Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Lab-instruments</td>
<td>Colorimeter, flame, photometer, oven, incubators, microscopes urinometers, centrifuge, ISE, Deep freezers, Refrigerators, glucometer, stills, balances.</td>
</tr>
<tr>
<td>Apparatus</td>
<td>Dilutors, Dispensers, Lab ware, Integral syringe.</td>
</tr>
<tr>
<td>2 Instrument installation</td>
<td>Size of instrument weight, voltage, ventilation.</td>
</tr>
<tr>
<td>3 Bench Organization</td>
<td>Water, volatile chemicals fumes, fire outbreak biowaste.</td>
</tr>
</tbody>
</table>
| 4 Principles of functional units | • Photometry: colorimeter  
Flame photometer  
Glucometer, ELISA  
• Heating Elements: Water bath, Incubators  
Hot air, Autoclave, Stills, Incinerators.  
• Microscopy: Microscopes-light – inverted  
• Photoelectric:  
• Centrifugal forces: Centrifuges  
• Refrigeration: Deep freezers, refrigerators, cold room.  
• Density: Urinometer  
• Measurement: Weight – Balance, Volumes-Dilutors, Dispensers, Integral syringes and reagent bottles.  
• Electrochemistry: Ion selective electrodes  
Deionizers.  
pH meter |
| 5 Daily maintenance   | • Instrument  
• Apparatus  
• Decontamination | • Dusting, covering, cleaning of instruments, daily checks, and servicing visits, trouble shooting.  
• Cleaning, drying  
• Disinfectant, anti-septic, sterilization. |
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

<table>
<thead>
<tr>
<th>Code</th>
<th>Topic</th>
<th>Sub-Topic</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Laboratory Layout</td>
<td>• Draw a simple basic laboratory layout</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Visit medical laboratories.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Safety</td>
<td>• Glass fittings.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Electrical connection heating.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Fire extinguishing and control.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Protective clothing.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Storage of chemicals, reagents and specimens cabinets.</td>
<td></td>
</tr>
</tbody>
</table>
| Cleanliness | • Carrying transporting and mixing of chemicals and reagents.  
|            | • Labeling classification.  
|            | • Cleaning of benches, floor, sink, glassware, plastic ware 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.  
|            | • Stocktaking.  
|            | • Preparation of purchase documents.  
| 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’s 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.
### CONTENTS

<table>
<thead>
<tr>
<th>Topic</th>
<th>Sub-Topics</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. ALGEBRA</td>
<td>• Indices</td>
</tr>
<tr>
<td></td>
<td>• Logarithms</td>
</tr>
<tr>
<td></td>
<td>• Applications of logarithms</td>
</tr>
<tr>
<td></td>
<td>• Linear equations</td>
</tr>
<tr>
<td></td>
<td>• Simultaneous equations</td>
</tr>
<tr>
<td></td>
<td>• Matrices</td>
</tr>
<tr>
<td></td>
<td>• Transposition of formulae</td>
</tr>
<tr>
<td>2. QUADRATIC EQUATIONS</td>
<td>• Solutions</td>
</tr>
<tr>
<td></td>
<td>• Applications</td>
</tr>
<tr>
<td>3. LINEAR AND NON-LINEAR GRAPHS</td>
<td>• Construction</td>
</tr>
<tr>
<td></td>
<td>• Solutions</td>
</tr>
<tr>
<td>4. COLLECTION, ORGANIZATION AND PRESENTATION OF DATA</td>
<td>• Data collection</td>
</tr>
<tr>
<td></td>
<td>• Data organization</td>
</tr>
<tr>
<td></td>
<td>• Data presentation</td>
</tr>
<tr>
<td>5. DATA ANALYSIS</td>
<td>Measures of central tendency</td>
</tr>
<tr>
<td></td>
<td>Measures of dispersion</td>
</tr>
<tr>
<td>6. SIMPLE REGRESSION AND CORRELATION ANALYSIS</td>
<td>• Regression analysis equivalent 2 variables only</td>
</tr>
<tr>
<td></td>
<td>• Correlation analysis 2 variables only</td>
</tr>
</tbody>
</table>

### 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.

**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.
   - Cavities.
   - 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

2) Analyze the data
3) Interpret the data
4) Prepare a project report in a structure format

19.0.3 CONTENT

<table>
<thead>
<tr>
<th>Topic</th>
<th>Sub-Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>• Projects.</td>
</tr>
<tr>
<td>Data collection</td>
<td>• Observational method.</td>
</tr>
<tr>
<td></td>
<td>• Interviews and Questionnaires.</td>
</tr>
<tr>
<td></td>
<td>• Trace measures.</td>
</tr>
<tr>
<td></td>
<td>• Content analysis.</td>
</tr>
<tr>
<td></td>
<td>• Data achieves.</td>
</tr>
<tr>
<td></td>
<td>• Measurements.</td>
</tr>
<tr>
<td></td>
<td>• Qualitative method.</td>
</tr>
<tr>
<td></td>
<td>• Data representation.</td>
</tr>
<tr>
<td></td>
<td>• Central tendency.</td>
</tr>
<tr>
<td></td>
<td>• Dispersion.</td>
</tr>
<tr>
<td></td>
<td>• Regression analysis.</td>
</tr>
<tr>
<td>Use of computer</td>
<td>• Application of spreadsheets to compiling data.</td>
</tr>
<tr>
<td></td>
<td>• Production of report.</td>
</tr>
<tr>
<td>Project write up</td>
<td>• Documentation of sources.</td>
</tr>
<tr>
<td></td>
<td>• Carrying out of project.</td>
</tr>
<tr>
<td></td>
<td>• Reporting</td>
</tr>
<tr>
<td></td>
<td>• Lay out.</td>
</tr>
<tr>
<td></td>
<td>• Data presentation.</td>
</tr>
</tbody>
</table>

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 organization.

c) Understand the Public Health Act and MLTT Act.
d) Comply with the provisions of the MLTT Act and the relevant provisions of the Public Health Act.

e) Understand the role of government.

20.0.3 CONTENT

<table>
<thead>
<tr>
<th>Topic</th>
<th>Sub-Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. SOCIAL STUDIES</td>
<td>• Basic medical psychology.</td>
</tr>
<tr>
<td></td>
<td>• Basic medical sociology.</td>
</tr>
<tr>
<td></td>
<td>• Social economics.</td>
</tr>
<tr>
<td></td>
<td>• Government.</td>
</tr>
<tr>
<td></td>
<td>• National Philosophy.</td>
</tr>
<tr>
<td></td>
<td>• Science and technology.</td>
</tr>
<tr>
<td></td>
<td>• Commerce.</td>
</tr>
<tr>
<td></td>
<td>• Personal inter-relationships.</td>
</tr>
<tr>
<td>2. ETHICS</td>
<td>• Meaning and importance.</td>
</tr>
<tr>
<td></td>
<td>• Role of religion on society.</td>
</tr>
<tr>
<td></td>
<td>• Significance of social and individual values.</td>
</tr>
<tr>
<td></td>
<td>• Constitution of Association of Kenya Medical Laboratory Scientific Officers.</td>
</tr>
<tr>
<td></td>
<td>• Technology and religion.</td>
</tr>
<tr>
<td>3. LAW</td>
<td>• Definition.</td>
</tr>
<tr>
<td></td>
<td>• Importance of law.</td>
</tr>
<tr>
<td></td>
<td>• Sources of Kenyan laws Public Health Act.</td>
</tr>
<tr>
<td></td>
<td>• Medical Laboratories Technicians and Technologists Act.</td>
</tr>
<tr>
<td></td>
<td>• Elements of law.</td>
</tr>
<tr>
<td></td>
<td>• Law in day-to-day life of an individual.</td>
</tr>
</tbody>
</table>

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 sterilization 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 sterilization and disinfection.
ii) Explain techniques used for sterility testing
iii) Explain methods and factors influencing sterilization
iv) Practice sterilization, disinfection and waste disposal in various disciplines.

21.0.3 CONTENT

<table>
<thead>
<tr>
<th>Topic</th>
<th>Sub-Topic</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terminologies</td>
<td>Sterilization, disinfection, germicides, bactericides, antiseptics, fungicides, bacteriostatics.</td>
<td></td>
</tr>
<tr>
<td>Methods</td>
<td>Physical methods:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Heat, dry heat, moist heat.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Radiation: Ultra-violet, ionization radiation, filtration.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Chemical methods.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Alcohol, chloroform, chlorine, glycerol, phenol, cresol, aldehyde, quaternary ammonium compounds.</td>
<td></td>
</tr>
<tr>
<td>Factors influencing sterilization</td>
<td>Nature, load and type of microorganisms, nature of material and containers, time and temperature, humidity and organic contaminants.</td>
<td></td>
</tr>
<tr>
<td>Sterility testing</td>
<td>Automatic process control, recording thermometer, thermocouple measurement, chemical indicators, adhesive tape (autoclave) biological control.</td>
<td></td>
</tr>
<tr>
<td>Sterilization, disinfection, and waste disposal in:</td>
<td>Microbiology, clinical chemistry, haematology, blood transfusion, parasitology, histopathology.</td>
<td></td>
</tr>
</tbody>
</table>
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 sterilization methods.

iv) Explain collection and processing of specimens.

v) Explain the various staining technique.

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, laboratory waste disposal.

22.0.4.1 Methods of Sterilization

- Definitions.
- Sterilizations.
• Disinfections.
• Antiseptic.
• Heat.
• Chemical.
• Radiation.
• Filtration.

22.0.4.2 Collection and Processing of Specimen.
• Specimen containers.
• Collection of specimen.
• Preparation and sterilization.

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.

22.0.5.0 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.
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 safety measures.

iv) Maintain and care for equipment and apparatus.

v) Store chemicals and reagents.

vi) Collect specimen.

vii) Understand basic principles of techniques.

<table>
<thead>
<tr>
<th>Year</th>
<th>Topic</th>
<th>Sub-Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Introduction</td>
<td>Clinical Chemistry.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Introduction, definition.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Physical chemistry, definition of atoms, atomic structure, elements, molecules, compounds, nails micro and organic.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bases: Strong and weak.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>pH: pH scale.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Calculations.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Preparation and importance.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Indicators: Litmus methyl orange, red Phenolphthalein.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Solutions: Standard, working, saturated, supersaturated.</td>
</tr>
<tr>
<td><strong>Organic Chemistry</strong></td>
<td>Definition, structure of carbon, homologous series.</td>
<td></td>
</tr>
<tr>
<td>-------------------------------</td>
<td>------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td><strong>Biochemistry</strong></td>
<td>Definition, Biomolecules, carbohydrates, amino acids, and proteins, lipids, vitamins, classifications.</td>
<td></td>
</tr>
<tr>
<td><strong>Basic Physiology</strong></td>
<td>Functions of the body systems:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Kidney.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Liver.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Pancreas.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Stomach, intestines.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Capillaries, arteries, veins.</td>
<td></td>
</tr>
<tr>
<td><strong>Basic Pathology</strong></td>
<td>The liver in relation to bilirubin, pancreas in relation to diabetes nephrosis</td>
<td></td>
</tr>
<tr>
<td><strong>Safety measures-chemicals</strong></td>
<td>Sources of injuries</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cacinogenic poisonous, radioactive, explosives, fuming.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Protective measures:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Protective gear:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Methods of disposal</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Decontamination</td>
<td></td>
</tr>
</tbody>
</table>
| Instruments | Types of injuries:  
| | • Mechanical, electric, thermal (hot water, hot air, steam, dry heat).  
| | Protective measures  
| | • Protective gear.  
| | • Bench organization.  
| | • Proper insulation and voltage.  
| Lab. ware | Source of injuries.  
| | Breakages, sharps.  
| | Mechanical.  
| | Protective measures.  
| | Protective gear, proper handling and disposal.  
| Maintenance and care of Lab. 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, organization, instrument installation and regular servicing.  

<table>
<thead>
<tr>
<th>Year One</th>
<th>Topic</th>
<th>Sub-Topic</th>
</tr>
</thead>
</table>
| STORAGE OF CHEMICALS AND REAGENTS | Corrosives: non-metallic containers, labelling, isolation, refrigeration expiry date. Volatile & flammables cold storage.  
| | Ventilation, isolation, fireproofing, hazard labels  
<p>| | Analytical reagents and chemicals labelling, aluminium foils and lead containers for radioactive material. |</p>
<table>
<thead>
<tr>
<th>Specimen Collection</th>
<th>Containers, anticoagulants, disposable needles, and syringes. Labels, preservatives, request form interpretation.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Topic</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Basic Principles</td>
<td>Graduated, Volumetric, Pasteur, Micropipettes, Automated, Mouth, Fillers, Capillarity, Atmospheric pressure</td>
</tr>
<tr>
<td></td>
<td>Pipettes:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Types</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Pipetting</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Qualitative and quantitative</td>
<td>Urine-Physical examination. Chemical analysis, Microscopy. Stool-Physical examination. Chemical analysis. CSF-Physical examination.</td>
</tr>
<tr>
<td>Biochemistry.</td>
<td>Separation CSF Exudate aspirates.</td>
<td></td>
</tr>
<tr>
<td>------------------------</td>
<td>----------------------------------</td>
<td></td>
</tr>
<tr>
<td>Urine-sugars.</td>
<td>Glucose.</td>
<td></td>
</tr>
<tr>
<td>Proteins.</td>
<td>Protein.</td>
<td></td>
</tr>
<tr>
<td>Clearance tests.</td>
<td>Urea.</td>
<td></td>
</tr>
<tr>
<td>Osmolarity.</td>
<td>Bilirubin.</td>
<td></td>
</tr>
<tr>
<td>pH</td>
<td>Creatinine.</td>
<td></td>
</tr>
<tr>
<td>Blood-glucose.</td>
<td>Electrolytes.</td>
<td></td>
</tr>
<tr>
<td>Uric acid.</td>
<td>Uric acid.</td>
<td></td>
</tr>
<tr>
<td>Protein.</td>
<td>Transaminases.</td>
<td></td>
</tr>
<tr>
<td>Transaminases.</td>
<td>Alkaline phosphatase.</td>
<td></td>
</tr>
<tr>
<td>Alkaline phosphatase.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

YEAR TWO (2)

23.0.3 OBJECTIVES

a) Carry out diagnostic tests.

b) Quality control measures.
<table>
<thead>
<tr>
<th>Year Two</th>
<th>Topic</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinical Placement</td>
<td>Clinical placement</td>
<td></td>
</tr>
<tr>
<td>Practicals</td>
<td>Clinical Placement</td>
<td>Volume, colour, appearance, odour, sugars, ketones, bilirubin, blood, protein, pH, crystals, casts, cells, clearance, osmolarity.</td>
</tr>
<tr>
<td>Urine Qualitative and Quantitative</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blood Quantitative</td>
<td>Glucose, urea, creatinine, electrolytes, uric acid, total protein, albumin, transaminases, alkaline, phosphatase.</td>
<td></td>
</tr>
<tr>
<td>CSF, Exudates and aspirates</td>
<td>Glucose, protein</td>
<td></td>
</tr>
<tr>
<td>Saliva and Sweat</td>
<td>Enzymes and electrolytes</td>
<td></td>
</tr>
<tr>
<td>Separation</td>
<td>Urine sugars and reducing substances (chromatographic techniques)</td>
<td></td>
</tr>
<tr>
<td>Quality control measures</td>
<td>Handling of control materials, levyn Jennings plots, units in chemical pathology and reference ranges.</td>
<td></td>
</tr>
</tbody>
</table>

### 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 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.
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.
- 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.

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.

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:
Kenya Subsidiary Legislation, 2006

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.

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.
- Celloidin.

25.0.4.32 Use of Cabinets, Files.

25.0.4.33 MICROTOMES AND MICROTONY

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.

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.
- Biconcave.
- 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% lower than the melting point of paraffin wax.
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:
   - Mayors Egg albumin.
   - Glycerine jelly.
   - Starch paste.

ii) Use.

iii) Preparation:
   • Ingredients.
   • Procedure.

8. Theory of staining.

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.


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.

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.
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.
- Papanicolaou stain.
- Haematoxyline and Eosin.
- Methylene blue.

vii) Screening and classifying Pap smears.
- CIN – I – V.
- 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) Ringsing Media:
   • Paraffin media.
   • Plasticine.

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.

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.

5) Postmortem.

25.1.13 Public Relations.

a) Handling bereaved persons.

b) Language.

c) Basic counseling.

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.

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.
<table>
<thead>
<tr>
<th>Topic</th>
<th>Sub-Topic</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTRODUCTION</td>
<td>• Importance of Histopathology and cytology.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Terminologies used.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Sources of specimens.</td>
<td></td>
</tr>
<tr>
<td>CELL AND EPITHELIUM</td>
<td>• Cell structure and division.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• The four primary tissues.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Types of epithelial cells.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Function of epithelial tissues.</td>
<td></td>
</tr>
<tr>
<td>FIXATION AND FIXATIVES</td>
<td>• Purposes of fixation.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Terminologies used.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Effects of fixatives.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Preparation.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Methods of fixation.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Storage and labelling.</td>
<td></td>
</tr>
<tr>
<td>DECALCIFICATION</td>
<td>• Definition.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Methods of decalcification.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Treatment of tissue after decalcification.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Determination end point of decalcification.</td>
<td></td>
</tr>
<tr>
<td>TISSUE PROCESSING</td>
<td>• Dehydration.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Clearing.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Wax impregnation and other common embedding media.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Storage of blocks slides and reports.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6T MICROTOMY</td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>--------------</td>
<td>---</td>
</tr>
<tr>
<td></td>
<td>Types of microtomes.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Microtomes knives.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Knife sharpeners.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Faults in sectioning.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Floating out of sections.</td>
<td></td>
</tr>
<tr>
<td>7T</td>
<td>SECTION ADHESIVES</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Types of adhesives.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Purpose of adhesives.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preparation.</td>
<td></td>
</tr>
<tr>
<td>8T</td>
<td>THEROY OF STAINING</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Definition of dyes and stains.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preparation of stains.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Types of staining reactions.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Staining methods.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Staining equipment.</td>
<td></td>
</tr>
<tr>
<td>9T</td>
<td>HISTOLOGICAL PIGMENTS</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Definition.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Types of pigments encountered.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Their identification and removal.</td>
<td></td>
</tr>
<tr>
<td>10T</td>
<td>CYTOLOGY</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Definition.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Terminologies used.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Uses of cytology.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sources of specimens and collection.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Equipments/apparatus used.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fixatives employed.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Staining methods.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Slide screening.</td>
<td></td>
</tr>
</tbody>
</table>
| 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.
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, Sensitization, 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 P 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 ANOMALITIES
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 coombs, 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.
v) Describe safety measures in Blood Bank.
vi) Describe control in Blood Transfusion Science.
vi) 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.

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 shedding.

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.

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 sterilization, disinfection and disposal procedures.

vii) Use various laboratory equipment for virology work.
<table>
<thead>
<tr>
<th>Year</th>
<th>Topic</th>
<th>Sub-Topic</th>
<th>Theory (T)</th>
<th>Practice (P)</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ONE</td>
<td>INTRODUCTION TO VIROLOGY</td>
<td>• DEFINITION OF VIRUSES</td>
<td>T</td>
<td>T</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• GENERAL PROPERTIES OF VIRUSES</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• CLASSIFICATION OF VIRUSES-(CRITERIA)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BIO-SAFETY</td>
<td>• CATEGORIZATION OF PATHOGEN RISK GROUPS</td>
<td>T</td>
<td>T</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• ACTIVITIES HARMFUL TO THE WORKER AND OTHERS IN VIROLOGY</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• OCCURRENCE OF LABORATORY INFECTIONS AND THEIR PREVENTION</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• MODE OF INFECTIONS IN AND OUT OF THE LABORATORY</td>
<td>T</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• LOCATION OF HEALTH AND SAFETY EQUIPMENT IN THE WORK PLACE (e.g. fire extinguishers)</td>
<td>T</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>PERSONAL PROTECTION: USE OF SAFETY-GEAR S.E.G.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>LAB GOWNS, GLOVES, MASKS AND GOGGLES.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• USE OF PIPELITING AIDS</td>
<td>T</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• USE OF SAFETY CABINETS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• SAFE USE OF OTHER EQUIPMENT, DEFINITIONS AND TYPES</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>STERILIZATION</td>
<td>• METHODS OF STERILIZATION, FACTORS INFLUENCING STERILIZATION AND</td>
<td></td>
<td></td>
<td>P</td>
</tr>
<tr>
<td></td>
<td></td>
<td>STERILITY TESTING</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year</td>
<td>Topic</td>
<td>Sub-Topic</td>
<td>Theory (T)</td>
<td>Practice (P)</td>
<td>Hours</td>
</tr>
<tr>
<td>------</td>
<td>------------------------------</td>
<td>----------------------------------------------------------------------------</td>
<td>-------------</td>
<td>--------------</td>
<td>-------</td>
</tr>
<tr>
<td>ONE</td>
<td>DISINFECTION AND DISPOSAL</td>
<td>* DISINFECTIONS; CIDAL' AND 'STATIC' DISPECTANTS</td>
<td>T</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>* MODE OF ACTION OF DISINFECTANTS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>* COMMON DISINFECTIONANTS AND THEIR-USE DILUTIONS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>DISPOSAL: DISINFECTION AND METHODS</td>
<td>T</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EQUIPMENT</td>
<td>USE OF THE FOLLOWING EQUIPMENT IN VIROLOGY: INVERTED MICROSCOPE AUTOCLAVE</td>
<td>T</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SPECIMEN</td>
<td>WATER BATHS, DEEP FREEZERS, REFRIGERATORS, INCUBATORS, BIO-SAFETY CABINETS</td>
<td>T</td>
<td>P</td>
<td></td>
</tr>
</tbody>
</table>
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.
  ♦ 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.

<table>
<thead>
<tr>
<th>Year</th>
<th>Topic</th>
<th>Content</th>
<th>Theory (T)</th>
<th>Practice (P)</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ONE</td>
<td>INTRODUCTION</td>
<td>Definition of Immunology.</td>
<td>T</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Brief history of Immunology</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Immunology</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Types of Immunity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>IMMUNITY</td>
<td>Innate</td>
<td>T</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Acquired</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Thin blood smear staining techniques</td>
<td></td>
<td></td>
<td>8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Identification of cells</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cells involved in immunity and their basic roles</td>
<td>P</td>
<td>P</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tissue and organs involved in Immunity and their basic roles:</td>
<td>P</td>
<td>T</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>BIOLOGY OF THE IMMUNE SYSTEM</td>
<td>Bursa of fabricus</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bone marrow</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ANTIGENS AND ANTIBODIES</td>
<td>Spleen</td>
<td>Lymph nodes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------------------------</td>
<td>--------</td>
<td>-------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dissection of a named laboratory animal (e.g., mouse, rat or Guinea pig)</td>
<td>P</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>To display the organs of the Immune system.</td>
<td>P</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disposal of the carcass</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Definition and basic structure of an antibody molecule.</td>
<td>P</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Definition and examples of antigens</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Definition of Hapten</td>
<td>T</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A brief classification of Immunoglobulins</td>
<td>T</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Principles of the techniques</td>
<td>T</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distribution of Immunoglobulins</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Principles of the techniques.</td>
<td>T</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Immunological
<table>
<thead>
<tr>
<th>techniques</th>
<th>Demonstration of procedures</th>
<th>T</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Precipitation tests</td>
<td>T</td>
</tr>
<tr>
<td></td>
<td></td>
<td>P</td>
</tr>
</tbody>
</table>

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 MLS (DIP) with three (3) years experience plus a certificate in Medical Education,

OR

MLS (DIP) with five (5) years working experience AND 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
20) CLINICAL CHEMISTRY
1) Colorimeters 1 between 4 students
2) Analytical balance – top pan loading 1 between 5 students
3) Sensitivity up to 1mg 1 between 10 students
4) Flame photometers 1 between 4 students
5) Centrifuge 1 between 10 students
6) Refrigerators/Freezers 1 between 4 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) Haemoglobinometers 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) Sphygomanometer 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) Neubauer 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
<table>
<thead>
<tr>
<th>4) Plasma extractors</th>
<th>15 students</th>
</tr>
</thead>
<tbody>
<tr>
<td>5) Centrifuges</td>
<td>1 between 4 students</td>
</tr>
<tr>
<td>6) Weighing balance</td>
<td>1 between 5 students</td>
</tr>
<tr>
<td>7) Sphygmomanometers</td>
<td>1 between 5 students</td>
</tr>
<tr>
<td>8) Hot air oven (adjustable)</td>
<td>1 in the whole institution</td>
</tr>
<tr>
<td>9) De-ionizers and stillers</td>
<td>1 for the whole class/institution</td>
</tr>
<tr>
<td>10) Mechanical shaker</td>
<td></td>
</tr>
<tr>
<td>11) Blood Transfusion bleeding unit</td>
<td></td>
</tr>
<tr>
<td>12) Assorted blood transfusion glassware and adequate apparatus</td>
<td></td>
</tr>
<tr>
<td>13) Microscopes</td>
<td>1 per 2 students</td>
</tr>
</tbody>
</table>

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) Deionizers | 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 e.g. 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)
4) CD4/CD8 Counting machine
5) Tissue lines
6) Immunoflourescent equipment
7) Inverted microscopes
8) 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
32.0 Appendix 3 LEARNING BOOKS

32.0.1 GENERAL BOOKS

<table>
<thead>
<tr>
<th>Title</th>
<th>Author</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical Laboratory Manual for Tropical Countries Part I &amp; II</td>
<td>Monica Chesbourgh</td>
</tr>
</tbody>
</table>

32.0.2 MEDICAL MICROBIOLOGY

<table>
<thead>
<tr>
<th>Title</th>
<th>Author</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colour Atlas and Text Book of Diagnostic Microbiology</td>
<td>Elmer W. Koneman et al</td>
</tr>
<tr>
<td>Short Text book of Microbiology</td>
<td>Satish Gupte</td>
</tr>
</tbody>
</table>

32.0.3 CLINICAL CHEMISTRY

<table>
<thead>
<tr>
<th>Title</th>
<th>Author</th>
</tr>
</thead>
<tbody>
<tr>
<td>A handbook of Clinical Chemistry</td>
<td>V.W. Sitati</td>
</tr>
<tr>
<td>Practical Clinical Biochemistry</td>
<td>Harold V. Valley</td>
</tr>
<tr>
<td>Essential of volumetric Analysis</td>
<td>By J. Lambert</td>
</tr>
</tbody>
</table>

32.0.4 HAEMATOLOGY

<table>
<thead>
<tr>
<th>Title</th>
<th>Author</th>
</tr>
</thead>
<tbody>
<tr>
<td>A short textbook of haematology</td>
<td>R.B. Thomson</td>
</tr>
<tr>
<td>Atlas of haematology</td>
<td>McDonald Dodds</td>
</tr>
<tr>
<td>Practical Haematology</td>
<td>Dacie &amp; Lewis</td>
</tr>
</tbody>
</table>
### 32.0.5 HISTOPATHOLOGY

<table>
<thead>
<tr>
<th>Title</th>
<th>Author</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Carlton’s Histological Techniques</td>
<td>Drowry and Wellington</td>
</tr>
<tr>
<td>2. Colour atlas</td>
<td>Irving Bernem</td>
</tr>
<tr>
<td>3. Theory and practice of histological Techniques</td>
<td>John Bancroft</td>
</tr>
</tbody>
</table>

### 32.0.6 BLOOD TRANSFUSION

<table>
<thead>
<tr>
<th>Title</th>
<th>Author</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Blood group serology</td>
<td>Cathleen E. Boorman and Barbar E. Dodd (Simplified version)</td>
</tr>
<tr>
<td>2. Blood groups in man</td>
<td>R.R. Race and Ruth Sanger</td>
</tr>
<tr>
<td>3. Techniques in Blood Grouping</td>
<td>Ivor Dunford and C. Christopher Bowky.</td>
</tr>
</tbody>
</table>

### 32.0.7 MEDICAL PARASITOLOGY

<table>
<thead>
<tr>
<th>Title</th>
<th>Author</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Basic Clinical Parasitology</td>
<td>Harold W. Brown</td>
</tr>
<tr>
<td>2. Introduction to Parasitology</td>
<td>A.C. Chandler</td>
</tr>
<tr>
<td>3. Atlas of Helminthology Protozoology</td>
<td>Leach</td>
</tr>
<tr>
<td>4. Lecture notes on Medical Entomology</td>
<td>M.W. Service</td>
</tr>
<tr>
<td>5. Tropical Diseases</td>
<td>Manson Barr</td>
</tr>
</tbody>
</table>

### 32.0.8 VIROLOGY

<table>
<thead>
<tr>
<th>Title</th>
<th>Author</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Practical virology for Medical Students and Practitioners in tropical countries</td>
<td>D. Metasalaar et al</td>
</tr>
<tr>
<td>No.</td>
<td>Title</td>
</tr>
<tr>
<td>-----</td>
<td>--------------------------------------------</td>
</tr>
<tr>
<td>2.</td>
<td>Fundamentals of Medical Virology</td>
</tr>
<tr>
<td>3.</td>
<td>Virological Procedures</td>
</tr>
<tr>
<td>4.</td>
<td>Virology – Practical Approach</td>
</tr>
<tr>
<td>5.</td>
<td>Medical virology</td>
</tr>
<tr>
<td>6.</td>
<td>Medical Virology – A Practical Approach</td>
</tr>
<tr>
<td>7.</td>
<td>Principles of Molecular Virology</td>
</tr>
</tbody>
</table>

32.0.9 IMMUNOLOGY

<table>
<thead>
<tr>
<th>No.</th>
<th>Title</th>
<th>Author</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>The Principles of Immunology</td>
<td>Ivan Roitt</td>
</tr>
<tr>
<td>2.</td>
<td>Fundamentals of Immunology</td>
<td>Tesdale</td>
</tr>
<tr>
<td>3.</td>
<td>Practical Immunology</td>
<td>Hudsons and Hay</td>
</tr>
<tr>
<td>4.</td>
<td>Practical Immunology</td>
<td>Talwar</td>
</tr>
<tr>
<td>5.</td>
<td>Basic and Clinical Immunology</td>
<td>Peakman &amp; Vergains</td>
</tr>
<tr>
<td>6.</td>
<td>Understanding Immunology</td>
<td>Peter Woods &amp; Prentice Hall</td>
</tr>
</tbody>
</table>