CURRICULUM FOR MEMBERSHIP AND FELLOWSHIP IN LABORATORY MEDICINE

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TABLE OF CONTENTS

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1. GENERAL INFORMATION

1.1 INTRODUCTION

Laboratory medicine is the branch of medicine concerned with disease processes, their causes and natural history, laboratory diagnosis, therapy where applicable, laboratory monitoring of therapy and, in some cases, surveillance of communicable disease. In the Faculty of Laboratory Medicine of the Ghana Postgraduate Medical College, four (4) branches are recognized. These are Chemical Pathology, Haematology and Blood Transfusion, Microbiology and Anatomic Pathology and Cythopathology. Immunology features to a variable degree in all four (4) branches.

1.1.1 RATIONALE FOR PROGRAMME

There is a dearth of Laboratory Medicine practitioners in Ghana. For example there are six (6) anatomic pathologists, the highest number of practitioners in any of the four (4) subspecialties, in the country. Five (5) of these are in the two (2) Teaching Hospitals with one (1) in the Military Hospital. For minimal patient care, the following would be required in the short term:

1.2.1 At least one (1) specialist in each subspecialty or one specialist Clinical Pathologist and one (1) Anatomic Pathologist in each of the eighty-five (85) District Hospitals.

1.2.2 At least one (1) consultant Chemical Pathologist, Haematologist, Microbiologist and Anatomic Pathologist in each of the eight (8) Regional Hospitals.

1.2.3 At least eight (8) Chemical Pathologists, twelve (12) Haematologists, 22 Microbiologists and twenty-four (24) Anatomic Pathologists to cover service and training in the Teaching Hospitals and service in the Military and Police Hospitals. There is, at the moment, no Specialist Pathologist of any kind in any of the Regional and District Hospitals.

1.2.4 It is estimated that we will require a minimum of two hundred and fifty (250) Laboratory Physicians to provide minimum service in the Teaching, Regional and District Hospitals. With an annual intake of ten (10) residents per year, it would take at least twenty five (25) years to achieve this without attrition.

1.3 PHILOSOPHY

In view of the very broad nature of Laboratory Medicine and the workload expected to be carried by each practitioner, the programmes are designed for full specialization in one branch. However, as monospecialists in all four (4) branches may be required in all Regional and District Hospitals, the objectives are set to also provide for specialization in Clinical Pathology which combines Haematology, Chemical Pathology, Microbiology and Anatomic Pathology. An academic or research career is also considered in the setting of the objective. There is considerable overlap among the various branches of Laboratory Medicine and specific subject areas.
Pathology residency programmes will be offered in the following areas:

1.3.1 Anatomic Pathology – five (5) year programme

1.3.2 Straight Chemical Pathology – five (5) year programme

1.3.3 Straight Haematology – five (5) year programme

1.3.4 Straight Microbiology – five (5) year programme

1.3.5 Clinical Pathology, three (3) year programme, after which the resident may specialize in one discipline after further two-year training and become a fellow for that subspecialty, or two disciplines for a further two (2) years to become a fellow Clinical Pathologist.

1.4 GENERAL OBJECTIVES

The general objectives of the residency programmes are to develop in our trainees:

1.4.1 Skills in performing laboratory tests in the area/areas of specialization.

1.4.2 Skills in investigating and diagnosing diseases in the laboratory

1.4.3 The ability to establish and/or manage a laboratory

1.4.4 The ability to perform research

1.4.5 The ability to provide excellent and skilled oral and written communication of laboratory results and interpretations to clinicians

1.4.6 The ability to be a leader in the medical laboratory

1.4.7 The ability to manage haematological disorders in the case of Haematology, microbial infections in the case of Microbiology and metabolic and toxicological problems in the case of Chemical Pathology.

1.4.8 The ability to offer intraoperative consultation in the case of Histopathology and run a FNAC clinic in the case of cythopathology

The specific objectives are set out under the individual specialties.

1.5 ELIGIBILITY

To be eligible to enter a programme, a candidate must be a registered medical practitioner. A further one-year practice in clinical medicine after registration is desirable. Candidates for admission shall complete an application form, pass an entrance examination and an interview.

1.6 TEACHING PROGRAMME

The resident will be responsible for learning the methodology and the skills of performing and interpreting routine clinical laboratory tests and is expected to work at the bench. The training programme will run for fifty two (52) weeks in a year as there may be residents at post at all times during the year. The programme will consist of the following:

1.6.1 Self learning

1.6.2 Teaching Seminars – These will be consultant-facilitated and student-based.

1.6.3 Practical Seminars – These will be Consultant-led but residents will be expected to prepare (seen all specimens and read about them) beforehand.

1.6.4 Clinico-pathological conferences including laboratory and clinical rounds

1.6.5 Journal Club – These meetings will be Consultant-facilitated and student-based

1.6.6 Case Presentations/Clinical Audit/Quality Control Review/Tutorial – These meetings shall be Consultant-facilitated and student-based.

1.6.7 Special/Guest lectures – These shall be lectures on topics given by local or visiting consultants in their areas of research/interest.

1.6.8 External Attachments – Residents shall spend a minimum of three (3) months on external attachments to cover areas where resources are not yet available in the country to provide training.

1.6.9 As part of Continuous Assessment required for admission to Part II Examination, residents shall undertake a mini-project and write a report, which shall be graded.

1.6.10 There shall be three (3) faculty level examinations: Part I, Part II and Part III.

1.7 TEACHING/PRACTICAL CONTACT HOURS

	THEORY	PRACTICAL	TOTAL	TOTAL/WEEK
WEEK DAYS	1	*6.5*	*7.5*	*38*
SATURDAYS	-	4	4	4
SUNDAYS	-	-	-	-
NIGHT COVER	-	-	12	12
TOTAL				54 HOURS

2. GENERAL LABORATORY MEDICINE (INTRODUCTORY LEVEL)

This is the study of general laboratory principles and management including collection, storage and preservation of samples, preparation of samples for transportation, laboratory safety, quality assurance, management of personnel, finance, equipment and machinery, disinfectants and sterilization.
At the end of the programme the Trainee will be able to demonstrate knowledge and understanding of:

2.1 Disease causation, pertinent changes in the body due to disease processes and how they are brought about

2.2 The basic principles of chemical analysis including photocolorimetry, spectrophotometry, flame photometry, ion electrodes, electrophoresis, centrifugation, chromatography, common immunological methods including antigen-antibody reactions, enzyme-linked immunosorbent assays and basic techniques in cytogenetics and molecular biology.

2.3 The basic principles of staining in microbiology, haematology, histopathology and cythopathology

2.4 Basic statistics

2.5 Forensic medicine including ethical considerations in laboratory medicine

2.6 Basic immunology

2.7 Clinical audit and the role of the laboratory physician in clinical audit

2.8 Principles of management

2.9 Research methodology and ethics of research

2.10 Exhibit basic computer skills

2.11 Be able to establish quality control programmes in the laboratory

2.12 Utilize problem-solving approach within the laboratory

The study of general laboratory medicine will involve a rotation in all four (4) branches for a minimum period of three (3) months in each discipline for those completing the full five (5) years in one discipline as well as those undertaking the three (3) year programme in Clinical Pathology. At the end of the first year the candidate shall be eligible for the Part I Examination.

3. CLINICAL PATHOLOGY

3.1 **Objective**:

The objective of the Clinical Pathology programme is to produce a specialist with diagnostic and interpretative ability necessary to perform as a competent Clinical Pathologist in a Regional/District Hospital in Ghana and who will be capable of serving as a leader in the laboratory. It is a three-year full-time programme with rotations in Chemical Pathology, Haematology, Microbiology and Anatomic Pathology, at the end of which the trainee will be able to:

3.1.1 Demonstrate a working knowledge and understanding of the principles of various instruments used in the clinical pathology laboratory;

3.1.2 Display a working knowledge and understanding of the principles of various methods of investigation used in the clinical pathology laboratory;

3.1.3 Properly utilize and interpret useful diagnostic laboratory procedures;

3.1.4 Advise on the management of patients with complicated haematological and/or biochemical abnormalities and/or infectious diseases;

3.1.5 Refer patients appropriately after initial management when necessary;

3.1.6 Perform surgical pathology, autopsy, forensic pathology and cythopathology to an acceptable level;

3.1.7 Lead in clinico-pathological conferences and clinical audit.

3.1.8 Assume responsibility for approval of specialized testing requiring shipment to a referral or specialty laboratory

3.1.9 Establish and manage a Clinical Pathology laboratory

3.1.10 Plan and carry out research

3.2 Syllabus

3.2.1 The first year programme consists of core training in Clinical Pathology with three (3) months each in Haematology, Blood Banking and Transfusion Medicine, Chemical Pathology, Microbiology and Anatomic Pathology.

3.2.2 The second and third years continue with the core training and consist of five (5) months each in Chemical Pathology, Haematology, Anatomic Pathology and Microbiology and four (4) months in Blood Banking and Transfusion Medicine.

3.2.3 The resident is expected, at the end of his/her training, to demonstrate knowledge and understanding of the theoretical basis of laboratory tests and exhibit skill in their performance. S/he will be able to describe and explain the disease processes and accompanying changes in the body causing derangements in laboratory tests.

The core syllabus covers both the theory and practical aspects of each specialty.

3.2.4 Core Chemical Pathology Theory

- Units, quantities, calculations and references values
- Instrumentation; instruments using light intensity, radioisotope counters, analytical balance, instruments for separative procedures work simplification instruments, automated procedures, gas analyzers etc.
- Endocrinology
- The body's metabolic response to injury
- Basic toxicology
- Critical care testing
- Quality control review

Core Chemical Pathology practical

- Specimen collection, handling and preservation
- Methodology and interpretation of routine biochemical tests including determination of various substances in body fluids, stool, urine, etc. e.g. electrolytes including heavy metals, blood gases and pH, glucose, urea, creatinine, uric acid, urates, proteins, amino acids, various lipids and lipoproteins, bilirubin, urinalysis and microscopy of urine sediment

- Tests of organ function (liver, kidney, pancreas, etc) and enzymology – kinetic and end-point

3.2.5 Core Haematology Theory

- Haematopoiesis
- Manual and automated haematology
- Red cell and red cell disorders
- White cell and white cell disorders
- Platelets and platelet disorders
- The anaemias
- Haemoglobinopathies
- Haematological malignancies

Core Haematology Practical

- Cell morphology
- Bone marrow examination
- Normal and abnormal haemostasis
- Basic Hospital Blood Transfusion
- Laboratory management

Core Haematology Clinical

- Principles of management of haematological disorders

3.2.6 Core Microbiology Theory

- Handling, collection and processing of clinical specimens
- Preparation of culture media; reagents and stains used in microbiology
- Sterilization and disinfection
- Normal and pathogenic microorganisms and their modes of identification; including principles of classification, and nomenclature
- Host resistance to infections

- Serological tests used in microbiology and their interpretation
- Antimicrobial susceptibility tests and their interpretation
- Epidemiology, prevention and control of microbial diseases
- Quality assurance in microbiology
- Laboratory management

3.2.7 **Core Microbiology Practicals**

- Media preparation and storage
- Staining techniques
- Processing of specimens
    - Microscopy, culture and identification of pathogenic bacteria
    - Sensitivity testing, disc diffusion and dilution methods
    - Techniques in microscopy and isolation of fungi
    - Basic examination techniques in parasitology
    - Basic examination techniques in virology
- Preservation and transport of clinical specimens for virological examination
- Serological tests
- Investigation of epidemics/outbreaks

3.2.8 **Core Anatomic Pathology and Cytopathology Theory**

- General pathology including cellular basis of disease, inflammation and healing, cell injury and errors of metabolism, injuries caused by physical agents, drugs and chemicals, disorders of growth and neoplasia and genetic diseases.
- Basic principles of immunology and immunopathology.
- Pathology of infectious and parasitic disease.
- Pathology of nutritional disorders.
- Basic systemic pathology: Respiratory, Gastrointestinal, Renal and urological, Gynaecological, Breast, Haematopathology, Dermatopathology.
- Tropical pathology
- Basic Forensic Pathology

Core Anatomic Pathology and Cytopathology Practical

- Histotechniques including: Principles of fixation, processing, microtomy, staining, routine decalcification, histochemistry, immunocytochemistry
- Cyto-preparatory techniques
- Reporting of Histo and Cyto slides including use of special stains and immunochemistry
- Use and care of instruments including cryostat, microtome, tissue processor, cytospin, automatic staining machine
- Basic Cythopathology:

  a. Gynaecological and

  b. Non-gynaecological including fine needle aspiration cytology.
- Autopsies

3.3 ASSESSMENT OF PROGRAMME

3.3.1 Requirements For Part I Examination

This shall be conducted at the end of year 1. Candidates for the Part I Examination shall have completed all rotations.

3.3.2 Requirements For Part II (Graduation in Clinical Pathology)

- Qualified Candidates entering for the graduation examination are required to have worked in departments recognized for training for a total period not less than three (3) years and have completed all the required rotations specified in section 3.2.

- At the time a candidate presents him/herself for the examination s/he should have satisfied the conditions under sections 3(3.1.1 to 3.1.10) and have an acceptable knowledge of the specific syllabi set out in 3.2.1 to 3.2.8. In addition the candidate should have completed the requirements listed in the relevant LOGBOOK duly signed by recognized trainers, and should have obtained 50% overall in continuous assessments.

3.3.3 Requirements For Part III (Sub specialization)

- Candidates may not enter for Part III examination until they have successfully completed Part II examination.

- Candidates for Part III exams are required to have completed the equivalent of five (5) years full time of approved training of which at least two (2) years must have been in higher specialist training in the required subspecialty (i.e. Chemical Pathology, Haematology, Microbiology, Anatomic Pathology and Cytopathology).

- The candidate must have in-depth theoretical and practical knowledge of the entire specific syllabus set within the appropriate section covering the subspecialty.

- Candidates shall present a dissertation on an approved research topic. The Faculty should receive the completed and bound dissertation at least three (3) calendar months before the date of the examination.

4. STRAIGHT CHEMICAL PATHOLOGY

4.1 Objective

This is a five-year full-time programme, the main objective of which is to produce a Specialist (Member) or a Consultant (Fellow) with in-depth theoretical and practical knowledge and skills for investigation of clinical biochemical derangements to an acceptable level (Member) and a high degree of competence (Fellow).

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

4.1.1 Display working knowledge of instrumentation including point- of- care ("bedside") testing, and understanding of concepts fundamental to any analytical procedures carried out in a modern chemical pathology laboratory.

4.1.2 Demonstrate skills in the application of the above – mentioned and other methods in the investigation and assessment of body functions in health and in disease using blood, urine, stool, CSF, saliva, etc.

4.1.3 Investigate and manage patients with biochemical derangements including the critically ill, injured, shocked or poisoned patient.

4.1.4 Demonstrate familiarity with basic pharmacokinetics as well as procedures used for therapeutic drug testing.

4.1.5 Establish and enforce laboratory safety regulations.

4.1.6 Initiate and supervise the laboratory's quality assurance system.

4.1.7 Display competence in organizing and undertaking research.

4.1.8 Establish, manage and lead a chemical chemistry laboratory.

4.1.9 Fully play the role of the laboratory physician in discussions and communication with clinicians.

4.2 Syllabus

4.2.1 THEORETICAL KNOWLEDGE

- Disorders of fluid, electrolytes, acid-base balance and their correction, the kidney and urinary tract.
- Gastrointestinal tract, the exocrine pancreas, liver, haem metabolism, porphyrins.
- Malnutrition, mineral and vitamin deficiencies, trace elements, free radicals and anti-oxidants.
- Proteins and plasma proteins, immunoglobulins and immunology.
- Lipids, lipoproteins and lipid disorders.
- Enzymology, enzymes and isoenzymes, markers of cell injury, myocardial infarction, hepatitis and pancreatitis.
- Neuroendocrinology, the hypothalamo-hypophysial tracts – thyroid, adrenal cortex and gonads, posterior pituitary and diabetes insipidus.
- Adrenal medulla, catecholamines, tumours secreting catecholamines.
- Intermediary metabolism, the body's metabolic response to injury.
- Complex carbohydrates; lysosomal storage diseases
- PTH, vitamin D and calcitonin; metabolic bone disease
- Neuromuscular system, joints and connective tissue
- CVS, hypertension and cardiac failure
- Neuropsychiatric disorders
- Biochemistry of neoplasia, cancer markers
- Pregnancy, foeto-maternal function; neonatology
- Biochemical genetics, molecular biology and inborn errors of metabolism
- Pharmacology, biochemistry and toxicology of drugs, poisons and heavy metals
- Computers, IT, automation, literature search; research methodology

- Quality assurance, accreditation

- Administration, financial and managerial skills; leadership

4.2.2 Practical

- Analytical balance; standard and working solutions.

- Instrumentation, colorimetry and spectrophotometry, ion – selective electrode technology; instruments for separative procedures, gas analyzers, point – of – care (work simplification) instruments.

- Determination of various analytes in body fluids, e.g. electrolytes, urea, creatinine, uric acid, pH, glucose, blood gases, metals, alcohols, enzymes, proteins, amino acids, lipids, lipoproteins, hormones, urinalysis

- Assessment of organ function, e.g. kidney, pancreas, cardiac, endocrine systems, liver. Diabetic clinic. Dialysis unit. Emergency ward.

- Analysis of calculi

- Investigation and management of patients in critical condition in Intensive Care - comatose, poisoned, injured or shocked. Neonatal and geriatric cases.

- Drugs and toxicological analyses.

- PCR techniques and DNA analyses.

- Choice, preparation and sampling of blood, etc to establish reference ranges; units; quantities and calculations; research

- Work in automated/computerized laboratory environment.

- Writing and maintaining the Laboratory's Handbook.

4.3 Assessment

4.3.1 Requirements For Part II

Qualified Candidates entering for Part II (Membership) examination are required to have worked in departments recognized for training for a total period not less than three (3) years of which at least two (2) years must have been in Chemical Pathology.
At the time a candidate presents her/himself for the Part I1 Examination s/he should have satisfied the conditions under section 2.1 to 2.12 and 4.1.1 and 4.1.2, and have a reasonable knowledge of the specific syllabus set out in 4.2.1 and 4.2.2. In addition the candidate

should have completed the requirements listed in the relevant LOGBOOK duly signed by recognized trainers.

4.3.2 Requirements for Part III

Candidates may not enter for Part III (fellowship) examination until they have successfully completed the Part II examination. Candidates for Part III exams are required to have completed the equivalent of five (5) years full time of approved training of which two (2) years must have been in higher specialist training and four (4) years in Chemical Pathology. Candidates shall present a dissertation on an approved research topic. The Faculty should receive the dissertation at least three (3) calendar months before the date of the examination.

5 STRAIGHT HAEMATOLOGY AND BLOOD TRANSFUSION

5.1 Objective

The objective of the haematology and blood transfusion programme is to produce a specialist competent in investigating, diagnosing and managing haematological conditions, establishing and managing a hospital blood transfusion service, investigating and managing transfusion reactions. In addition s/he will be capable as a leader in the laboratory. This is a five-year full-time programme at the end of which the trainee will be able to:

5.1.1 Demonstrate full understanding of the origin, structure and functions of the blood-forming tissues/organs.

5.1.2 Show understanding of the changes that take place in these tissues/organs in reaction to diseases in other tissues and organs.

5.1.3 Show understanding of diseases occurring in the blood-forming organs and their management.

5.1.4 Diagnose and competently manage haematological diseases.

5.1.5 Manage a haematology and blood transfusion laboratory.

5.1.6 Show understanding and management of tissue (including blood) transplantation related to haematology.

5.1.7 Perform research in haematology.

At the end of three (3) years of residency training the resident should:

5.1.8 Demonstrate full understanding of structure and function of the blood-forming organs.

5.1.9 Be able to manage a haematology and blood transfusion laboratory in a regional hospital.

5.1.10 Be able to diagnose acute haematological diseases.

5.1.11 Be competent at performing and reading bone marrow aspirate smears

5.1.12 Be able to consult easily with specialists in other medical and surgical disciplines on the common problems in haematology.

5.2 Syllabus

5.2.1 Theoretical Knowledge

- Embryology, structure, functions of the blood-forming organs e.g. yolk sac, bone marrow, spleen, liver, thymus and lymph nodes.
- Erythropoiesis and diseases affecting red cell formation and maturation including deficiency anaemia and hypoplastic anaemia.
- Red cell destruction and the haemolytic anaemias.
- The white cells: formation, function, markers, reaction to disease processes and congenital disorders of leukocytes.
- The platelets: formation, structure and function, diseases affecting them.
- Spleen: structure, function, reaction to disease and diseases affecting it.
- Haematological malignancies and pre-leukaemic conditions e.g. leukaemia, myeloma, lymphoma and refractory anaemia/myelodysplastic syndromes
- Haemostasis, physiology and diseases affecting the haemostatic process; e.g. bleeding disorders, thrombotic states, control of anticoagulant therapy
- Blood transfusion and immunohaematology including setting up of a blood transfusion service, blood donor organization, blood donor selection, blood processing, fractionation, storage and distribution; blood grouping methods, complement and antibodies, paternity testing, bone marrow transplantation and HLA system.
- Research methodology
- Laboratory management and knowledge of accreditation requirements.

5.2.2 **Practical**

- Perform, interpret and standardize simple haematology and blood transfusion tests including full blood count and platelet count, reticulocyte counts, ESR, examination of blood for malaria parasites, screening tests for haemostasis disorders, ABO, Rhesus and other blood groups, compatibility testing, antibody screening and identification.
- Perform, stain, read and interpret bone marrow aspirates
- Perform and interpret haemoglobin electrophoresis results
- Investigate and manage common haematological disorders e.g. various types of anaemias, leukaemia, lymphoma, haemolytic diseases and disorders of the coagulation system.
- Manage a haematology laboratory in a large general hospital
- Perform and interpret more complicated haematological investigations including cytochemical staining, marrow trephine, assay of coagulation factors, estimation of haemoglobins F and A2, red cell survival studies by isotopic methods, using enzyme linked immunosorbent or other methods for HBV, HCB and HIV identification.
- Establish and manage blood transfusion laboratory including investigation of immune haemolytic disorders.
- Establish and manage a diagnostic haematology laboratory.
- Diagnose and manage complicated and rare haematological disorders e.g. refractory anaemias, bone marrow transplantation, immune deficiency states, thalassaemia major etc.
- Perform research
- Interact academically with colleagues in the same and other disciplines.

5.3 Assessment

5.3.1 Requirements for Part II

- Qualified candidates entering for Part II (Membership) examination are required to have worked in departments recognized for training for a total period not less than three (3) years of which at least two (2) years must have been in haematology.

- At the time a candidate presents him/herself for the Part II examination, s/he should have satisfied the conditions under section 5.1.1 to 5.2.2 and the general and specific syllabi set in 3.2.5

- In addition the candidate should have completed the requirements listed in the relevant LOGBOOK duly signed by recognized trainers.

5.3.3 **Requirements for Part III**

Candidates shall not enter for Part III (Fellowship) examination until they have successfully completed Part II examination.

Candidates for Part III exams are required to have completed the equivalent of five (5) years full-time of approved training of which two (2) years must have been in higher specialist training and four (4) years in Haematology.

The candidate must have in depth theoretical and practical knowledge of the entire syllabus set within section 5.2.1 and 5.2.2.

Candidates shall present a dissertation on an approved research topic. The Faculty should receive the dissertation at least three (3) calendar months before the date of the examination.

6.0 STRAIGHT MEDICAL MICROBIOLOGY

TRAINING PROGRAMME IN MEDICAL MICROBIOLOGY

6.1 RATIONALE

Infections are among the major causes of morbidity and mortality in Ghana; therefore there is the need to have qualified Medical Microbiologists to contribute to their management. Unfortunately there are only a few in Ghana at the moment. This programme will therefore help to achieve the objective of having adequately trained medical microbiologists for, not only the Teaching Hospitals, but also the Regional and District Hospitals.

6.2 OBJECTIVES

This programme is to train Medical Microbiologists of competence to help in the management of infectious diseases. It will be "Resident-centred" i.e. Directed learning with minimal supervision, self-learning, and problem-solving. The training will also prepare them to be leaders in Clinical Microbiology at all levels in the GHS.

It is a five-year programme and at the end of it, the trainees will have achieved the level of competence to:

6.2.1 Establish and enforce a comprehensive laboratory safety programme including waste management.

6.2.2 Display competence in national and international packaging and postal regulations for infected materials.

6.2.3 Apply the principles of sterilization and disinfection in the formulation of a disinfection policy and guidelines.

6.2.4 Display a working knowledge of instrumentation in the microbiology laboratory.

6.2.5 Establish and manage appropriate specimen collection and storage policies.

6.2.6 Initiate investigations of infectious diseases both in the hospital and community.

6.2.7 Carry out culture, isolation and identification of pathogens.

6.2.8 Interpret and report the results of microbial investigations.

6.2.9 Demonstrate full understanding and importance of the normal flora of the host and host-parasite relationships.

6.2.10 Demonstrate full understanding of pathogenic organisms, including pathogenesis, epidemiology, prevention and control.

6.2.11 Demonstrate full understanding of the principles, actions and uses of antimicrobial chemotherapeutic agents, and the causes of antimicrobial (antibiotic, antiparasitic and antiviral) resistance in microorganisms.

6.2.12 Perform various types of antimicrobial susceptibility tests and antimicrobial assays in body fluids.

6.2.13 Display competence in the prevention, control and investigation of nosocomial infections and surveillance of microorganisms

6.2.14 Demonstrate competence in diagnostic serology.

6.2.15 Display a working knowledge of culture collection and preservation

6.2.16 Apply the principles of quality assurance in all aspects of microbiology

6.2.17 Display leadership role in clinical microbiology and offer competent advice in the management of infectious diseases and with the expected degree of urgency

6.2.18 Display leadership in management of human, financial and laboratory resources.

6.3 SPECIFIC OBJECTIVES

A. BACTERIOLOGY

6.3.1 The programme will involve lectures, seminars, participation in conferences, bench work, ward rounds, teaching of undergraduates at practical classes, and Infection control activities.

6.3.2 General Bacteriology and Mycology

1. Normal flora
2. Principles of immunology
3. Aerobic bacteria
4 Mycobacteriology
5. Anaerobic bacteria
6. Chlamydial and Rickettsial infections
7. Fungi
8. Bacterial nutrition, media and media preparation

6.3.3 Systemic bacteriology

1. Infectious diseases and syndromes
2. Diagnosis and treatment
3. Prevention and control

6.3.4 Diagnostic and typing methods

1. Specimen collection
2. Conventional biochemical methods including API
3. Immunological/Serological
4. Bacteriophage typing
5. Molecular Techniques

6.3.5 Methods of antimicrobial susceptibility tests and their limitations

1. Disc diffusion tests
2. Minimum Inhibitory Concentration (MIC)
3. Minimum Bacteriocidal Concentration (MBC)
4. Antimicrobial Assays

6.3.6 Preparation and administration of antimicrobial policies at the local, regional and national levels

6.3.7 The Microbiology of: food, water, and air

1. Air sampling to determine bacterial load
   Laboratories dealing with highly pathogenic microorganisms
2. Collection of water samples, counting and detection of indicator organisms. Water quality standards
3. Viable bacterial counts in food (raw, pre-cooked, preserved).
4. Examination of food-poisoning bacteria

6.3.8 Virology

At the end of the training, the resident will be expected to know:

1. The general properties of viruses and viral genetics
2. The classification and characterization of the major groups of viruses
3. Culture techniques in the isolation of viruses using eggs and tissue cultures
4. The pathogenesis, epidemiology, prevention and control of viral diseases, syndromes and prion diseases
5. Anti-viral chemotherapy

6.3.9 Parasitology

At the end of the training, the resident will be expected to know:

1. Structure/morphology and classifications of parasitic protozoa and helminthes of man
2. Transmission of parasites- Sources of exposure and portals of entry
3. Life cycles of medically important parasites
4. Gastrointestinal tract associated parasitic infections
5. Blood/Tissue associated parasitic infections
6. Arthropods and vectors of medical importance
7. Management, prevention and control of parasitic infections
8. Anti-parasitic chemotherapy

6.4 PRACTICALS

Bench work to include:

1. Receipt and logging of specimens as well as storage when necessary
2. Safe handling of specimens according to their biohazard level
3. Microscopy – using different staining techniques including Immunoflourescence
4. Selection of appropriate media and laboratory tests for isolation and identification of bacteria and fungi
5. Selection and use of appropriate tests for diagnosis of parasitic and virological infections
6. Immunological tests for diagnosis of various infections

6.5 ASSESSMENT

6.5.1 PART II

Qualified candidates entering for Part II (Membership) examination are required to have worked in departments recognized for training for a total period not less than three (3) years of which at least two (2) years must have been in microbiology.

At the time a candidate presents her/himself for the Part II examination, s/he should have satisfied the conditions under sections 6.2.1 to 6.2.18, and have acceptable general knowledge of the syllabus set our in sections 6.3 and 6.4

In addition the candidate should have completed the requirements listed in the relevant LOGBOOK, and have it duly signed by recognized trainers.

6.5.2 PART III

Candidates may not enter for Part III (Fellowship) examination until they have successfully completed Part II examination.

Candidates for Part III exams are required to have completed the equivalent of five (5) years full time of approved training of which 4 years must have been in Microbiology, and two (2) years in higher specialist training. The candidate must have in-depth theoretical and practical knowledge of the entire syllabus set within section 6.2.

Candidates shall present a dissertation on an approved research topic to the Faculty at least three (3) calendar months before the date of the examination.

ANATOMICAL PATHOLOGY AND CYTOPATHOLOGY

YEAR 1

1. **Rationale:**

This first year being an introductory year to the Discipline of Laboratory Medicine is designed to introduce the Resident to all 4 major branches of the specialty through rotation for a period of 3 months in each Division. The period to be spent in Anatomical Pathology and Cythopathology, should emphasise its relationship with the remaining three Divisions, while introducing the Resident to basic laboratory practice in this area. Additionally, the Resident must be introduced to specific areas of laboratory practice that make Anatomical Pathology and Cytopathology clinically relevant.

2. **Objectives**:

At the end of the 3-month period, the Resident must:

2.1 Demonstrate knowledge of basic pathological mechanisms leading to adequate understanding of disease processes

2.2 Demonstrate knowledge and understanding of various histo and cytotechnology techniques

2.3 Appreciate the importance of knowledge of technical procedures in ensuring optimum quality of output from the laboratory

2.4 Know the value of fostering good working relationship with Medical Laboratory Scientists.

2.5 Know the principles of Autopsy practice.

3. **Specific Objectives:**

3.1 The Resident should:

3.1.1 be familiar with the organization of the anatomical pathology division and its component parts, namely: Surgical pathology, Cythopathology and Autopsy pathology.

3.1.1 be familiar with activities in each section of anatomical pathology, including specific laboratory tests and their interpretation

3.1.2 detect problems related to laboratory techniques and know the relevant solutions to such problems

3.1.3 be familiar with safety issues in the anatomical pathology laboratories

3.1.4 know the rudiments of surgical pathology, cythopathology and autopsy pathology practice and appreciate their role in clinical medical practice.

4 **Contents**

4.1.1 **Theory -** Review and update their knowledge of all subjects in General Pathology as presented in Standard Textbooks of Pathology (e.g. Robbins Pathologic Basis of Disease. Eds: Cottran, Kumar, Collins – Latest edition), namely:

4.1.2 Cellular and molecular basis of disease

4.1.3 Cell response to injury, necrosis and apoptosis

4.1.4 The inflammatory process, healing and repair

4.1.5 Disorders of circulation

4.1.6 Genetic disorders

4.1.7 Disorders of growth and differentiation

4.1.8 Neoplasia

4.1.9 Environmental and nutritional disorders

4.1.10 Basic immunology and immunopathology

4.1.11 Pathology of infectious diseases

4.1.12 Basic Forensic Pathology

4.1.13 Review knowledge of normal histology and relate the features to abnormal changes that will be demonstrated in simple disease processes during surgical pathology 'sign-out' sessions

4.1.14 Review knowledge of gross pathology as presented in textbooks and other medical literature, including internet resources, as well as preserved specimens in the Pathology Museum, and relate the features to changes in disease conditions that will be demonstrated in the autopsy suite.

4.2 **Practical** – Demonstrate knowledge and, where necessary, skills in Histo and Cytotechnology, namely:

4.2.1 Principles of specimen fixation

4.2.2 Tissue sampling for processing

4.2.3 Tissue processing and types of tissue processors

4.2.4 Tissue embedding – the embedding centre

4.2.5 Microtomy, section flotation and slide warming procedures

4.2.6 Routine staining methods

4.2.7 Decalcification methods

4.2.8 Principles of histochemistry and immunocytochemistry

4.2.9 FNAC techniques and smear preparation

4.2.10 Cyto-preparatory techniques

4.2.11 Basic cythopathology – slide screening methods

4.2.12 Basic autopsy methods

4.2.13 Care of laboratory equipment

5. **Assessment**

5.1 **Theory** – Part of one assessment paper comprising MCQ questions from all 4 Divisions of the Faculty of Laboratory Medicine. The Anatomical Pathology component would be designed to test knowledge on the contents of the training stated in sections 4.1 and 4.2.

5.2 **Practical** – Part of a steeple-chase practical examination involving all 4 Divisions of the Faculty of Laboratory Medicine. The Anatomical Pathology component will test knowledge and skills required in section 4.2.

YEARS 2 & 3

1. **Rationale**

Upon successful completion of Part 1 of the training programme, the Resident is eligible to enter for further training towards the Part 2 examination. This training period of not less than 2 years is designed to train the Resident to a level of competence of a Specialist in the Specialty of Anatomical Pathology and Cythopathology. In his/her capacity as a Specialist he/she can provide service in a District or Regional Hospital setting while conferring with or referring cases to senior colleagues in Tertiary or Referral Centres in the country.

2. **Objectives**

To produce a Specialist with the requisite knowledge and skills to:

2.1 Improve his/her understanding of the principles of histo and cytotechnology as detailed in the Course contents of Part 1

2.2 Appreciate the relevance of the skills and understanding required in 2.1 above to the efficient management of the laboratory

2.3 Carry out gross and microscopic examination of tissues and generate appropriate reports for use by the attending physician

2.4 Perform Fine Needle Aspiration and examine cytological preparations to generate appropriate reports for use by the attending physician

2.5 Perform autopsies and report the findings to either the Coroner or the attending Physician

2.6 Carry out audit on cases and participate in clinico-pathological conferences and discussions

2.7 Carry out simple research and publish findings in appropriate scientific journals

3. **Contents**

3.1 **Theory**

3.1.1 In-depth knowledge of General Pathological mechanisms as listed in the Contents for Year 1

3.1.2 Theoretical basis of Surgical Pathology Practice for all the systems of the human body, including:

3.1.2.1 Cardiovascular pathology

3.1.2.2 Respiratory pathology

3.1.2.3 Gastrointestinal pathology

3.1.2.4 Hepatopathology, including biliary tract and pancreas

3.1.2.5 Renal pathology - nephropathology

3.1.2.6 Urological pathology

3.1.2.7 Male reproductive pathology

3.1.2.8 Female reproductive and Breast pathology

3.1.2.9 Haematopathology

3.1.2.10 Endocrine pathology

3.1.2.11 Neuropathology

3.1.2.12 Bone and joint pathology

3.1.2.13 Soft tissue pathology

3.1.2.14 Dermatopathology

3.1.2.15 Pathology of organs of special senses

3.1.2.16 Cythopathology, including the following:

3.1.2.16.1 Gynaecological cytology

3.1.2.16.2 Non-gynaecological cytology

3.1.3 Autopsy and Forensic pathology

3.1.4 Management of the Histopathology Laboratory, including a working knowledge of all the histo and cytotechnological procedures of the laboratory

3.1.5 Safety in the Histopathology laboratory

3.1.6 Quality Control in Histo and Cytopathology and Quality Assurance in general

3.1.7 Research methodology and writing of Research Grant Proposals

3.2 **Practical**

3.2.1 Gross examination , dissection and accurate description of specimens

3.2.2 Appropriate and adequate sampling of tissues for processing

3.2.3 Microscopic examination of slides and ordering of appropriate special stains, extra sections or other procedures necessary for diagnosis

3.2.4 Writing appropriate, informative pathological report

3.2.5 Special procedures in histopathology

3.2.5.1 Bone methods, including decalcification

3.2.5.2 Resin methods

3.2.5.3 Histochemistry and immunohistochemistry

3.2.5.4 Introduction to molecular techniques in histopathology

3.2.5.5 Electron microscopy

3.2.5.6 Organ preservation and museum technology

3.2.6 Discussion of cases with other clinical colleagues, including requesting further information necessary for accurate diagnosis

3.2.7 Fine needle aspiration and where necessary, collection of other cytological specimens for processing

3.2.8 Microscopic examination of cytological preparations and generation of appropriate reports

3.2.9 Full autopsy examination of bodies (permission and Coroner's cases), including requests for further investigations (e.g. toxicological)

3.2.10 Writing of full autopsy reports with appropriate causes of death

3.2.11 Research using histopathological and cytopathological materials and techniques.

4. **Examinations (Membership)**

4.1. **Theory**

4.1.1.	Paper I	MCQ	3 hours	50 Marks
4.1.2.	Paper II	Essays	3 hours	50 Marks
4.1.3.	Total Marks			100

4.2. **Practical**

4.2.1.	Autopsy examination	3 hours	50 Marks
4.2.2.	Surgical pathology	3 hours	50 Marks
4.2.3.	Cytopathology and Special slides	3 hours	50 Marks
4.2.4.	Total Marks		150

4.3. **Oral (Viva)** 50 Marks

4.4. Pass Mark

Candidates must obtain at least 50% in the practical examinations. Candidates must obtain at least 50% in the Theory component made up of both theory papers and the oral, with a minimum of 46% in the written papers.

YEARS 4 & 5

1. **Rationale**

The training of the Anatomical Pathologist to the Consultant level requires a further training period beyond the Specialist stage. This must be the Exit qualification at which stage the Trainee has achieved a high enough level of competence to function as a consultant either in Histo and Cytopathology in general, or in any of its sub-specialties (such as Dermatopathology, Neuropathology, Forensic Pathology etc.). In addition, he must demonstrate competence as the leader in the Anatomical Pathology Laboratory, and be able to set up, run and supervise such laboratories.

2. **Objectives:**

To produce a Consultant Anatomical Pathologist with the competence to

2.1. Set up, supervise and ensure the smooth running of a comprehensive Histo and Cytopathology service in the Ghana Health Service

2.2. Establish and run an efficient FNAC clinic in the Ghana Health Service

2.3. Offer Consultant level service in the following areas:

2.3.1. Surgical pathology

2.3.2. Cytopathology

2.3.3. Autopsy Pathology, including Forensic Pathology

2.4. Carry out quality control and other audit procedures in the laboratories

2.5. Ensure safety practices in the laboratories

2.6. Carry out scientific research.

3. Content

3.1. **Theory**

3.1.1. In-depth knowledge of **General Pathological Mechanisms** and application of this knowledge in the understanding of pathological processes in the Human Body.

3.1.2. In depth understanding of the theoretical basis of **Surgical Pathology** of all the Systems of the Human Body (see 3.2 under Years 2 & 3 above)

3.1.3. Recent advances in Histopathology and Cythopathology

3.1.4. Extra knowledge and expertise in the following sub-specialties as expertise and resources become available for training sub-specialists in these areas:

3.1.4.1. Forensic Pathology

3.1.4.2. Paediatric Pathology

3.1.4.3. Dermatopathology

3.1.4.4. Neuropathology

3.1.5. Laboratory management, including the following:

3.1.5.1. Personnel management

3.1.5.2. Procurement and stock management

3.1.5.3. Laboratory safety

3.1.5.4. Specimen storage and disposal

3.1.5.5. Quality control and Quality assurance methods in Histo and Cytopathology

3.1.5.6. Importance of turnaround time.

3.1.5.7. Pathology Laboratory Information Management Systems

3.1.4. Research methodology and research grant application methods.

3.2. **Practical**

3.2.1. Surgical Pathology techniques including the following

3.2.1.1.Gross examination, dissection and adequate sampling of surgical specimens for processing

3.2.1.2. Detailed description of gross morphological features of specimens

3.2.1.3. Examination of slide preparations and generation of appropriate reports

3.2.1.4. Request for appropriate procedures including special stains, extra sections etc

3.2.1.5. Application of immunocytochemistry and molecular pathology techniques for diagnosis and management

3.2.1.6. Communication of reports to treating physicians and the importance of turnaround time.

3.2.1.7. Communication of information of management and prognostic significance to treating physician

3.2.1.8. Establishing a channel of communication with treating physician to ensure useful discussion of cases.

3.2.2. Cytopathology techniques including the following:

3.2.2.1. Setting up and efficiently running a FNAC clinic

3.2.2.2. Collection and preparation of cytological specimens

3.2.2.3. Generation and discussion of appropriate cytopathological reports with treating physicians

3.2.3. Establishing and running an efficient intraoperative consultation service, with appropriate channel for communicating with surgeon intraoperatively.

3.2.4. Knowledge of emerging techniques in Diagnostic Histo and Cytopathology

3.2.5. Performing detailed autopsies on the following categories of cases

3.2.5.1. Hospital cases to establish cause of death and for medical audit

3.2.5.2. Coroner's medico-legal cases, with requests for additional investigations where necessary.

3.2.6. Leading or participating in **Clinico-pathological Conferences and Seminars**

3.2.7. Carry our scientific research and be able to apply for a research grant.

3.2.8. Prepare a dissertation arising out of a scientific study, towards the Part III (Fellowship) Examination.

3.2.9. Present research findings at scientific meetings and conferences and be able to publish results of research in Scientific Journals

3.2.10. Participate in teaching or demonstration to undergraduate medical students.

4. **Examination (Fellowship)**

4.1. **Theory**

4.1.1.	Essay (3 Hrs)	General Principles and Laboratory Management	50 Marks
4.1.2.	Essay (3 Hrs)	Clinical Application	50 Marks
4.1.3.	Total Marks		100

4.2. Practical

4.2.1.	Surgical Pathology	(3 hours)	50 Marks
4.2.2.	Special Slides and Cythopathology	(3 hours)	50 Marks
4.2.3.	Total Marks		100

4.3. **Dissertation**

4.3.1.	Dissertation	100 Marks
4.3.2.	Defence of dissertation	50 Marks

4.4.	***Viva voce***	(30 Min)	50 Marks

4.5. **Pass Mark** Candidate must obtain at least 50% in all three components of the examination. The *viva voce* will be considered as part of the theory assessment

8. FORMAT OF EXAMINATIONS

8.1 ENTRANCE EXAMINATION

8.1.1 FORMAT

The examination shall take the form of a two (2) - hour paper of multiple-choice (MCQs) questions covering all four (4) specialties. This will be followed by an interview the next day.

8.1.2 PASS MARK

The pass mark shall be 50%.

Successful candidates shall progress to training for the Part I Examination

8.2 PART I EXAMINATION

8.2.1 FORMAT

The examination shall take the form of a three (3) - hour paper of multiple-choice questions (MCQs). There shall be four (4) sections, one for each specialty.

There shall also be a practical steeple chase paper of three (3) - hour duration covering all disciplines.

The log book and the portfolio may be assessed.

8.2.2 PASS MARK

The pass mark shall be at least 50% of the total marks for theory and at least 50% of the total marks for the practical.

8.2.3 REFERRAL

Any candidate failing the examination shall retake the whole paper within six (6) months. Candidates will normally be allowed three (3) attempts at this examination. Failure to pass after three (3) attempts or within the first two (2) years of entry into training program shall result in withdrawal from the programme. Extenuating circumstances preventing candidate from completing the examination within the two-year period shall be referred to the Board of Examiners for consideration.

Successful candidates shall progress to training for the Part II examination.

8.3 PART II (MEMBERSHIP) EXAMINATION

8.3.1 FORMAT

THEORY: There shall be two (2) written papers:

Paper I	MCQ	Three- hour paper
Paper II	ESSAYS	Three-hour paper
	Total Marks:	100

PRACTICAL:

There shall be a three-hour practical examination in the chosen Specialty. For Clinical Pathology, the exam shall comprise of a three-hour 'steeple-chase practical' in Haematology, Chemical Pathology, Microbiology and Anatomic Pathology.

Total Mark: 100

For candidates doing Anatomic Pathology and Clinical Pathology, there shall also be a three-hour post mortem examination. For candidates doing Haematology and Blood transfusion, there shall be a clinical exam.

Total Mark: 100

ORAL (VIVA VOCE):

This shall last for not less than 30 minutes per candidate.
Equal time shall be allocated to each section of laboratory medicine for candidates in clinical pathology.
The log book and portfolio will be assessed.

Total Mark: 50

8.3.2 PASS MARK

The pass mark shall be at least 50% of the mark in each section of the examination. For this purpose the oral examination mark shall be added to the practical examination mark.

8.3.3 REFERRAL

Candidates who pass either theory or practical very well i.e. 55% and above and score at least 48% in the other (i.e. practical or theory) shall be credited with the section in which s/he does well and referred only in the section in which s/he fails. Candidates not meeting these requirements shall retake the exam in whole.

Candidates will normally be allowed four (4) attempts at the examination in whole or in part after which they may re-enter only for a specific number of attempts to be decided by the Board of examiners.

A candidate successfully completing the Part II examination comprising written, practical and oral components will be offered the membership of the Ghana College of Physicians and Surgeons (Laboratory Medicine) and qualifies for appointment to Specialist grade in the chosen subspecialty.

8.4 PART III (FELLOWSHIP) EXAMINATION

A candidate successfully completing the Part III examination comprising written, practical and oral components will be offered Fellowship of the Ghana College of Physicians and Surgeons (Laboratory Medicine) and qualifies for appointment to Consultant grade. S/he should have completed two (2) years full training post part II and then spent time writing the dissertation e.g. three (3) months before the exam.

8.4.1 FORMAT

THEORY: There shall be two (2) three-hour papers

Paper I: General Principles and Laboratory Management

Paper II: Clinical Application

Total Mark: 100

PRACTICAL: There shall be two (2) three-hour practical examinations

Total Mark: 100

ORAL (VIVA VOCE):

There shall be an oral examination for each candidate lasting one hour including 30 minutes for defence of dissertation.

Total Mark: Oral: 50
Defence of Dissertation shall be marked: Pass, Conditional Pass or Fail.

Clinical examination in the case of haematology and blood transfusion

Total mark: 100

PASS MARK:

The pass mark shall be at least 50% of the mark for each part of the examination. For this purpose the oral examination mark shall form part of the practical examination mark.

8.4.2 REFERRAL

A candidate who passes either theory or practical very well i.e. 55% and above and scores at least 48% in the other (i.e. practical or theory) shall be credited with the section in which s/he does well and referred only in the section in which s/he fails. Candidates not meeting these requirements shall retake the exam in whole.

Candidates who fail to pass the Part II examination in whole or in part after two (2) attempts will only be permitted to re-enter after a review of their training programme. Extenuating circumstances supporting the readmission after four (4) failed attempts to any part of the Part II exams must be referred to Council of the College.

8.5 ADMISSION TO FELLOWSHIP BY SUBMISSION OF PUBLISHED WORKS

Fellowship of the College may be granted to persons who have passed the Part I exams and have worked for not less than ten (10) years who submit published works in Pathology and related subjects adjudged by Board of Examiners to be of sufficient distinction.

The Board of Examiners shall have absolute power and discretion in deciding any application and its decisions will be final. It shall not be bound to give any reasons for its decisions.

8.6 ADMISSION TO FELLOWSHIP BY ELECTION

Fellowship of the College may be granted to persons who have obtained Fellowships of other Colleges recognized by the appropriate College body after recommendation by Faculty Board of Examiners.