MASTER OF PATHOLOGY (CHEMICAL PATHOLOGY)

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TRAINING CURICULUM FOR TRAINEES AND SUPERVISORS
UNIVERSITI SAINS MALAYSIA
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MASTER OF PATHOLOGY (CHEMICAL PATHOLOGY)

1. BACKGROUND

Chemical Pathology or Clinical Biochemistry is a discipline of pathology. It is a medical discipline devoted to obtain, explore and employ chemical knowledge and chemical methods of investigation, in order to procure knowledge about normal and abnormal chemical processes in man. These processes are studied on a general level, in order to get insight into human health and disease and on a patient-specific level for diagnostic or monitoring purposes. Other main task of chemical pathologists is direction and supervision of a laboratory department in a hospital or health service, where the role involves bridging the gap between rapidly developing laboratory technology and the growing knowledge on characteristics of disease. The Master of Pathology (Chemical Pathology) programme involves supervised apprenticeship training in diagnostic chemical pathology.

2. VISION

To produce high quality postgraduate Master's course, centre of academic excellence and a leader in research and innovation in the field of Chemical Pathology.

3. MISSION

To impart graduates with wide spectrum of knowledge and skills providing exemplary services in medical care meeting the requirements of the nation.

4. STRUCTURE OF COURSE (Appendix 1)

This is a 4-year programme, which is divided into Stage 1 and Stage 2:-

Stage 1: A one-year course of general pathology embarking in 4 major sub-disciplines of pathology (Chemical Pathology, Anatomic Pathology, Haematology Microbiology) and 2 minor sub-disciplines (Medical Genetics, Immunology)

Stage 2: A 3-year course in the discipline of Chemical Pathology.

4.1 CURRICULUM STRUCTURE

4.1.1 STAGE 1 (Chemical Pathology):

Stage 1 is of one year course before embarking into becoming a chemical pathologist. Its syllabus is composed of fundamental biochemical knowledge which, will enable candidates to use most appropriately as applied to clinical requirements, i.e. diagnosis of disease and planning and monitoring of therapy. They will acquire knowledge of the common clinical disorders and understand the basic pciples of laboratory utilization in the diagnosis and management of disease. They will also be taught on some of the common methods and instruments.

4.1.1.1 LEARNING OBJECTIVE

General objective:
To acquire knowledge on clinical and laboratory aspect of chemical pathology in relation to common disorders

Specific objectives:

- To acquire knowledge and understanding in the clinical aspects of chemical pathology
- To acquire knowledge on the principles and applications in analytical techniques and instrumentation in chemical pathology
- To acquire basic knowledge in the management of chemical pathology laboratory

4.1.1.2 COURSE CONTENT

The course consists of 3 major areas i.e Clinical, Technical and Laboratory Management. These 3 major areas are covered theoretically and practically.

4.1.2 STAGE 2

In stage 2, the candidates will be trained based on in-depth the knowledge in clinical biochemistry, analytical techniques and laboratory management. They will acquire detail knowledge of the common clinical disorders and the role of laboratory utilisation in the diagnosis and management of disease. They will also be taught on setting the standard of patient care through the diagnostic and monitoring services of their laboratory and practicing effective laboratory utilisation. They will be exposed to critical appraisal, management, budgetary and administrative skills and knowledge of automation, electronic data processing, laboratory information systems and acquire knowledge in accreditation throughout their training.

4.1.2.1 LEARNING OBJECTIVE

General objectives

- To acquire knowledge in basic and specialized Chemical Pathology testing
- To apply the knowledge on clinical aspects and management of patient
- To apply knowledge and be competent in techniques/methodologies and instrumentation
- To apply knowledge and skill in the management of the laboratory

Specific objectives

- To attain competence in employing best practices in the selection and utilisation of routine and specialised assays.
- To attain competence in the appropriate interpretation and reporting of assay results in the context of optimised patient care.
- To attain competence in techniques and assays in Chemical Pathology.
- To attain competence in conducting method validation and method verification.
- To acquire competence in the management and organisation of the diagnostic chemical pathology laboratory services.
- To acquire competence in the planning, conduct and write-up of a simple research project.
- To understand quality assurance and how to implement it.

- To participate in Quality Assurance Programs (QAPs).
- To behave as a competent chemical pathologist in training; in diagnosis and clinical pathology consultations.

4.1.2.2 COURSE CONTENT

The course covers the chemical pathology areas in depth i.e physiology and clinical biochemistry of various body systems, analytical biochemistry, assays, laboratory processes, clinical utility of laboratory investigations, quality assurance and quality management.

5. MODE OF TEACHING AND LEARNING

5.1 STAGE 1

5.1.1 TEACHING PROGRAMME*:*

a. Orientation and intensive courses

b. Supervision from the in-house chemical pathologist and biochemist through informal and formal teaching sessions (Topics that are not well-covered during the course will be addressed in the intensive course).

c. Teaching methods will be student-centered and teacher-centered consisting of:

- Lectures
- Seminar
- Clinical cases studies
- Journal club
- Lab postings
- Practical
- Submission of a satisfactorily completed log book

5.1.2 LEARNING OUTCOME

At the end of the module, candidates will

a. Understand the basic concept in Chemical Pathology
b. Understand the common principles of laboratory techniques in producing precise and accurate Chemical Pathology results.
c. Able to analyze and interpret biochemical tests.
d. Understand the strategies for investigations of diseases.
e. Understand the basic principles of laboratory quality management

5.2 STAGE 2

5.2.1 TEACHING PROGRAMME

a. The teacher: student ratio will be 1:2 or 1:3
b. There will be student-centered learning. The student is expected to learn primarily through in-service in an independent and self-directed manner through reading, bench work, patient management and patient consultation.
c. There will be formal sessions in the form of seminar, journal review, laboratory rounds and case discussion on selected topics.
d. Candidates shall undertake postings/rotations in research and other centers away from the university or hospital. The recommended postings /rotations are as below:
    - Drug and Toxicology Laboratory, HKL
    - Endocrinology, Putrajaya Hospital– clinical / laboratory based
    - Nephrology – clinical / laboratory based
    - Paediatric – clinical / laboratory based
    - ICU – clinical / laboratory based (POCT)
    - IMR – IEM and others

e. Apart from postings / rotations mentioned above, the candidate is also encouraged to do an external posting in the field he/she is interested in within the scope of Chemical Pathology for a further period of 4-6 weeks eg. Proteomics, Inborn error of metabolism (IEM), Endocrinology, Molecular Medicine, Drug & Toxicology etc.
f. Special clinical rounds: Candidates are encouraged to attend ward rounds and specialist

clinics of selected specialties e.g. CICU, renal dialysis unit, ICU, SCN, neonatal and pediatric units, metabolic and endocrine units.

g. Candidates are expected to undertake all routine duties of a chemical pathologist including clinical duties, screening, validation and on-call duties.
h. For students in the open system, the host universities shall conduct visits at least once every 3 months for 2-3 days duration to conduct seminars, result interpretation sessions, tutorials, problem oriented case-studies, clinical presentations and check on the student's progress advise and check on the progress of the research report organize intensive course
i. The student is also required to plan, undertake and write up a research project which has to be submitted by end of the 3rd year.
j. The candidate is also required to submit 6 case reports over the three year as schedule:
    - 2nd year – 2 cases
    - 3rd year – 2 cases
    - 4th year – 2 cases
    -

To be eligible to sit the Stage 2 Examination, the candidates must fulfill these criteria:

- Submission of satisfactorily completed log book
- Submission of 6 case write up: 2 cases per year
- Submission of Research project by end of 3rd year

Upon failure to fulfill the above criteria, the candidate is barred from sitting the final exam and will sit for the examination the following academic session provided satisfactory submission.

5.2.2 RESEARCH PROJECT

It is absolutely necessary that the student should have knowledge on conducting research. He / she should be familiar with the research methodology, literature review, ethics in research and application of biostatistics in research. Each student will be assigned a dissertation work in the field of Chemical Pathology. The content of the dissertation shall be evaluated before the final examination.

5.2.3 LEARNING OUTCOMES

At the end of the course candidates will:

a. Understand the medical, scientific and technological principles of Clinical Biochemistry and its interrelationship with other disciplines.

b. Have a detailed knowledge of the applications of Clinical Biochemistry for the diagnosis and monitoring of human disease and its contribution to biomedical research.
c. Be able to assess the effectiveness of individual tests, strategies and protocols for the investigation of disease
d. Acquire a detailed knowledge of laboratory techniques, instrumentation and informatics
e. Understand and apply the principles of laboratory management.
f. Update knowledge of new trends in methodologies, molecular diagnostics and total laboratory automation.
g. Developed skills in laboratory, clinical and, scientific research.

6. EXAMINATION AND ASSESSMENT

6.1 *STAGE 1*

6.1.1 CONTINUOUS ASSESSMENT

For purposes of continuous assessment:

a. In Stage 1, the candidate is required to maintain a log book to record all procedures performed and level of competence achieved.The log book is to be signed by Medical laboratory technologist, scientific officer (where relevant) or a supervising pathologist.

b. The log book/ final progress report shall be submitted to the Head of the Department of Pathology/Program Coordinator at the end of the last posting in Stage 1.

c. Unsatisfactory performance or non-fulfillment of requirements of Stage 1 training are grounds for barring a candidate from sitting the Stage I examination. Candidates found unsuitable for further training will be counselled to leave the Programme

6.1.2 PREREQUISITES FOR SITTING THE PART 1 EXAMINATION:

To be eligible to sit the Part 1 Examination the candidate must have:

a. Satisfactorily completed all postings in Stage I (Year 1). The supervisor is required to certify that the progress of the candidate has been satisfactory throughout the Stage and that the candidate is eligible to sit for the Stage I Examination.

b. Satisfactorily completed all the required tasks as set out in the log book to the supervisor's satisfaction. The log book must be submitted to the Head of Department of Pathology/Program Coordinator for inspection at the end of the last rotation posting.

c. Satisfactorily completed all assignments [where applicable].

6.1.3 PROFESSIONAL PART 1 EXAMINATION

a.The Part 1 examination comprises:

- Theory papers
- Practical papers

b.The allocation of marks in the Part 1 examination shall be as follows:

- Theory 50% (MCQ = 70% and Essay = 30%)
- Practical 50%

c.The theory examination per each module is for 60 minutes:

- Anatomic Pathology (20 MCQ and 1 essay)
- Medical Microbiology (20 MCQ and 1 essay)
- Hematology (20 MCQ and 1 essay)
- Chemical Pathology (20 MCQ and 1 essay)

d.The MCQ will be of the standard format (a statement followed by 5 True/False responses) with negative marking for incorrect responses. The minimum mark for a question is zero.

e.Format of the Practical Component:

OSPE 1: Anatomic Pathology (10 stations) and Medical Microbiology (10 stations) OSPE 2: Haematology (10 stations) and Chemical Pathology(10 stations)

The time allocated for each station is between 5 - 10 minutes. Every station carries equal marks.

f.Allocation of marks in the Theory &Practical component

Anatomic Pathology	100
Medical Microbiology	100
Chemical Pathology	100
Hematology	100
Total mark	400

g.Criteria for pass**:**

The candidate must obtain an overall score of 50% AND

- score ≥ 50% for the theory components and obtain ≥ 50% for the
- practical components AND
- obtain a score for the theory of each discipline of not less than 40% AND
- obtain a score for the practical of each discipline of not less than 40%

h. Repeat examinations:

A candidate who has failed may be allowed to repeat the examination after one year.

A candidate is allowed a maximum of one repeat examination

6.2 STAGE 2

6.2.1 CONTINUOUS ASSESSMENT

a. Daily routine work in the laboratory is a form of continuous assessment. Students who do not perform routine work satisfactorily may be barred from progressing to the subsequent year.

b. The candidate is required to maintain a log book to record all procedures performed and the level of competence achieved.

c. The log book is to be signed by the MLT or scientific officer in charge (where relevant) or the respective lecturer/specialist.

6.2.2 PREREQUISITES FOR SITTING THE PART 2 EXAMINATION

To be eligible to sit for the Part 2 Examination the candidate must have:

a. satisfactorily completed all postings in Years 2, 3 and 4. The supervisor is required to certify that the progress of the candidate has been satisfactory throughout Stage 2 and that the candidate is eligible to sit for the Part 2 Examination.

b. completed all the required tasks to the supervisor's satisfaction. Submitted a research project report/dissertation accompanied by the supervisor's report. The research project report should be submitted at the end of Year 3 but not later than 6 months before the Part 2 Examination. A revision of the research project report may have to be undertaken if necessary.

c. submitted log book or any other assignments required by the relevant discipline. The deadline for submission ese reports shall be submitted 1 month before the Part 2 examination

6.2.3 PROFESSIONAL PART 2 EXAMINATION

a.The Part 2 examination will be held at the end of Year 4 and comprises:

- theory papers
- practical papers
- *viva-voce*

b**.**Allocation of marks:

The allocation of marks in the Stage II examination shall be as follows:

Theory	45%
Practical	45%
Viva-voce	10%
Total	100%

Criteria for pass**:**

- Candidate must obtain an overall score of 50%
- Candidate must pass BOTH the theory and practical components (The pass mark for each component is 50%).
- Attending the viva is COMPULSORY

c. Repeat examinations:

- Repeat examination after six months

A candidate may be allowed to repeat the examination after six months if he or she has an overall score of 50% or more but has failed either the theory OR the practical component

In this repeat examination, the candidate will be examined in the failed component and be given a *viva-voce*. The student must achieve satisfactory continuous assessment to be eligible to sit for examination.

The candidate is only allowed to repeat examination twice consecutively for the same component (theory or practical). Upon failure of the second repeat attempt, the candidate is required to repeat both theory and practical components after a period of 6 months to 1 year based on conjoint exam board decision.

- Repeat examination after one year.

A candidate may be allowed to repeat the examination after one year if he has obtained an overall score of less than 50% OR has failed BOTH the theory and practical components of the Part 2 examination.

A candidate may be allowed to repeat the examination after one year if:

i. obtained an overall score of less than 50% OR
ii. failed BOTH the theory and practical components OR
iii. an overall score of 50% or more, but has failed either the theory or the practical component and the conjoint exam board found that overall performance of the candidate is not satisfactory.

In this repeat examination, the candidate will be examined in the theory and practical components and be given a viva-voce. The student must achieve satisfactory continuous assessment to be eligible to sit for examination

- A candidate is allowed a maximum of four repeat examinations.

7. DURATION OF TRAINING

The minimum duration of training is four (4) years with a maximum of seven (7) years.

8. CURRICULUM AND SYLLABUS

Syllabus that will be used is attached (appendix II). However, the syllabus will be updated from time to time in view of the progress in this field of specialty.

9. ACADEMIC AND TEACHING STAFFS

Stage I involves academic staffs from all the sub diciplines of pathology.

Stage II will be particularly involved Chemical Pathologists.

Honorary lecturers will be appointed in running the teaching packages and supervision of the students

Appendix 1

STRUCTURE OF COURSE

Stage	Year	Curriculum
1	1	Major subdiciplines: * Chemical Pathology * Haematology * Anatomic Pathology * Microbiology Minor subdiciplines: * Medical genetics * Immunology
Professional Examination I		
2	2,3 & 4	Chemical Pathology
Professional Examination II		

Appendix 2

SYLLABUS

STAGE 1

The syllabus is composed of fundamental biochemical knowledge which, will enable candidates to use most appropriately as applied to clinical requirements. The course consists of 3 major areas i.e Clinical, Technical and Laboratory Management.

a. CLINICAL ASPECTS

Competencies in the chemical pathology of diseases:-

- Generic aspects
- Biological variability
- Gastrointestinal tract
- Hepatobiliary system
- Renal System
- Acid Base Imbalance
- Water and Electrolytes
- Proteins
- Cardiovascular System
- Metabolic and endocrine
- Endocrinology – Pituitary, thyroid, adrenal, reproductive system
- Calcium, magnesium, phosphate and metabolic bone disorders
- Clinical Enzymology
- Biochemical genetic
- Toxicology
- Cancer

b. LABORATORY TECHNICAL COMPETENCIES

- Basic laboratory techniques
- Factors influencing laboratory results
- Laboratory instrumentation

- Laboratory automation
- Spectrometric methods
- Osmometry
- Electrometric methods
- Electrophoresis
- Chromatography
- POCT

c. LABORATORY MANAGEMENT COMPETENCIES

- General
- Total Quality Management (QA/QC/QMS)
- Laboratory Safety

STAGE 2

The course covers the chemical pathology field in depth i.e physiology and clinical biochemistry of various body systems, analytical biochemistry, assays, laboratory processes, clinical utility of laboratory investigations, quality assurance and quality management

Physiology and clinical biochemistry:

- Water, sodium & potassium
- Acid-base balance & blood gases
- Renal system
- Hepatobiliary system
- Gastrointestinal system
- Endocrine system
- Hypothalamus & pituitary gland
- Adrenal gland
- Thyroid gland
- Reproductive system
- Carbohydrate metabolism
- Calcium, phosphate & magnesium
- Musculoskeletal system

- Plasma proteins & enzymes
- Lipid metabolism
- Cardiovascular system
- Nervous system
- Clinical nutrition
- Clinical chemistry at the extremes of age.
- Clinical chemistry of pregnancy.
- Haematological biochemistry and coagulation
- Genetics
- Immune system

b. Analytical biochemistry

- Principles and applications of analytical techniques in chemical pathology

c.Assays

- Principles of various assays and interpretation of biochemical investigation results

d. Laboratory process

- Knowledge and identification of the pre-analytical, analytical and post-analytical factors affecting laboratory test results

e.Method validation and method verification

- Principles and applications of method verification / method validation and able to conduct them

f.Clinical utility of laboratory investigations

- Principles and applications of calculations and statistical analyses in chemical pathology laboratory

g.Quality assurance

- Knowledge and implementation of quality assurance measures i.e quality control. Measurement if uncertainty, between reagent lot variation, risk assessment and accreditation.

h.Laboratory management

- Knowledge and practice of laboratory management aspects i.e organisation of laboratory services, personnel management, facilities and safety, resourcing and finances, purchasing and inventory, laboratory information system (LIS), risk management, laboratory quality management system and lab accreditation.