MASTER OF MEDICINE
(ANAESTHESIOLOGY & CRITICAL CARE)

Department of Anaesthesiology & Intensive Care
School of Medical Sciences
Universiti Sains Malaysia
Health Campus
16150 Kubang Kerian
Kelantan

TRAINING CURRICULUM FOR TRAINEES AND SUPERVISORS
UNIVERSITI SAINS MALAYSIA

-2021-

OVERVIEW OF THE COURSE

1. General Objectives

The aim of the 4 years Master of Medicine (Anaesthesiology & Critical Care) program is to impart knowledge and skills to candidates enabling them to function as safe and competent Anaesthesiologist who

- has the basic specialist skill in the administration of anaesthesia and to carry out all the duties expected of a clinical consultant in the specialty of anaesthesiology in any hospital in Malaysia
- are competent in handling acute critical situation
- can perform routine practical procedures
- are competent in resuscitation and in the management of acute emergencies
- possess a strong knowledge of the physiology and pharmacology
- are responsible and compassionate and guided in decision making by ethical principles
- recognize their limitations and seek help when appropriate
- are capable of critical appraisal, and self-directed learning to keep pace with new developments and advances
- are skilled in communicating with patients, parents and colleagues, and can work as a member of a team
- understand the principles and importance of medical audit
- have leadership qualities and skills to manage operation theater and intensive care unit
- recognize the importance of conducting and facilitating research
- have a commitment to teaching and training junior colleagues
- possess knowledge in computing necessary for communication, literature searches and research
- understand the basic principles of health service management and health economics

2. Course Duration and Structure

The duration of the course is four (4) years and is divided into three (3) phases as shown below. However, under certain circumstances, the duration may be extended to a maximum period of 7 years.

PHASES	COURSE CONTENT	
Phase I (Year 1)	i.	Basic Science (Physiology-Clinical Measurement and Pharmacology)
	ii.	Basic Clinical Anaesthesia- comprising of clinical training in basic technical skills in anaesthetic management for operative procedures
Phase II (Year 2 & 3)	i.	Clinical Rotations in operation rooms of various surgical subspecialties
	ii.	Dissertation
	iii.	Cardio thoracic Anaesthetic posting
	iv.	Neuroanaesthesia Posting
	v.	Paediatric anaesthesia posting
	vi.	Intensive care posting
	vii.	Remote anaesthesia
	viii.	Peripheral nerve block posting
	ix.	Pain (acute and chronic pain) posting
	x.	Other posting (obstetric, hepatobiliary, vascular etc.)
Phase III (Year 4)	i.	Clinical Training in specialised fields of anaesthesiology and intensive care
	ii.	Consultant in Training (registrar posting)
	iii.	Submission of Dissertation

2.1 Phase I (Year 1)

The general objective is to enable students to acquire knowledge of the basic science relevant to anaesthetic practice in order to understand and correlate with clinical conduct of anaesthesia. During the first year students are also expected to familiarise themselves with the diagnosis and management of common medical and surgical conditions. Clinical training in the first year should consist of conducting anaesthesia for general surgical, orthopaedic, gynaecological, obstetric, ENT, opthalmology, neurosurgery, paediatric surgery and dental surgery.

The candidates should use the syllabus guide provided in the manual for self-study. Two intensive courses will be conducted during this phase where formal lectures, tutorials and clinical teachings are organized. These formal intensive courses will be followed by end-of-package examinations. The end of package examination consists of theory paper and viva examination. For theory paper, the examination consists of two main components, i.e. Physiology & Clinical Measurement AND Pharmacology. The theory marks for both papers will be combined as one written paper. Those candidates who pass the theory exam are required to sit for separate viva examination for Physiology & Clinical Measurement AND Pharmacology. The candidates who fail any of the viva examination are required to sit for viva examination ONLY in the next exam. If the candidates failed the viva examination after 2 consecutive attempts, he/she will be required to retake the theory examination again. The candidates must pass both physiology and pharmacology subject before entering the Phase II.

2.2 Phase II (Year 2 and 3)

During Phase II students continue to undergo rotational clinical postings in operation rooms of various surgical specialties. The general objective is to enable students to acquire knowledge, skills and attitudes appropriate for the management of patients in the various anaesthetic subspecialties which will be useful in their general anaesthetic practice.

In Phase II, candidates are posted in the various disciplines of clinical anaesthesia where they will manage patients at the level of junior registrar under supervision.

Students also start their dissertation at the beginning of year 2. The complete report of the dissertation needs to be submitted 6 months before the Phase III examination

PHASE II		PHASE III
Year 2	Practical training in anaesthesiology with activities in different surgical specialties. Practical training in Intensive Care Unit, Accident & Emergency Unit	Dissertation
Year 3	Practical training in anaesthesiology with activities in different surgical specialties, Practical training in Intensive Care Unit, Accident & Emergency Unit	
Year 4		Completion of Dissertation. Consultant-in-training. Clinical training in specialised fields of anaesthesiology, intensive care unit and one month neonatology posting
		Phase III Professional Examination

2.3 Phase III (Year 4)

The candidate is subjected to department assessment before getting to the Phase III. The assessment includes MCQ, oral examination and assessment of 'dissertation progress' and log book. Candidates who enter the final year will function as consultants-in-training in the anaesthesiology department of a hospital, managing patients, guiding the juniors in training as well as assisting the anaesthesiologist managing the operation theater. Candidates should begin to develop skills in the subspeciality area

they have an interest in. Even though a candidate has had some training in a subspeciality, he/she shall not be considered subspecialist but as a general

anaesthesiologist. During the first 6 months of year 4 candidates have to complete and submit their dissertations.

3. Leave of Absence

A candidate can apply for leave of absence with or without penalty based on acceptable reasons only twice for the duration of the course. The total period of leave must not be more than twelve (12) months.

4. Award of Masters in Medicine (Anaesthesiology & Critical Care)

A candidate will be eligible for the award of M.Med (Anaesthesiology& Critical Care) upon successful completion of the course, and on fulfillment of all the requirements of the School and of the University.

5. Course Suspension

The Senate of the University can suspend a candidate from a course or from sitting the end of phase professional examinations, with or without penalty on the advice from the Board of the School of Medical Sciences.

6. Course Dismissal

The Senate of the University can dismiss a candidate from a course on the advice of the Board of the School of Medical Sciences if the candidate

- has not satisfied the course requirements
- contravenes the rules of the University or Hospital
- commits a criminal offence or malpractice
- fails to register every year without University approval
- fails a given examination more than three times
- has his/her registration with the Malaysian Medical Council withdrawn
- suffers from a physical or mental illness which interferes with his/her ability to function effectively

A candidate can withdraw from the course by issuing a written statement to the Board of the Medical School via the appropriate head of department.

7. Examination Board

The examination board will be determined by the Senate, on the recommendation of the School of Medical Sciences and according to University regulations. All professional exams will be conducted with the aid of external examiners.
Conduct of the exam will be done together with other universities (UM, UKM, UIA, UPM) via “conjoint board examination.

8. Entry Requirements

- A candidate must have a medical degree (MD, MBBS, MBChB or equivalent)
- A candidate must also have at least 2 years’ experience after their first degree, either in hospital or other institutions recognized by Senate
- A Malaysian candidate must have a credit in Bahasa Malaysia at SPM level or its equivalent. Foreign candidates are required to pass the Bahasa Malaysia (national language) test during their candidature
- Candidates are required to attend an interview prior to the final selection

- Candidates must provide evidence that they are in good physical and mental state

9. Candidature Period

The minimum candidature period is 4 years and the maximum candidature period is 7 years. However, for a particular candidate, allowance may be given according to the particular case concerned.

10. Interpretation

Any point that is ambiguous or not clearly stated herein will be decided upon by the University Senate on the advice of the Board of the Medical School. All information provided in this booklet is subject to changes from time to time - June 1999.

SPECIFIC OBJECTIVES AND SYLLABUS GUIDE

1. Phase I (Year 1)

The general objective is to enable students to acquire knowledge on basic science relevant to anaesthesiology and to apply it in clinical situation, decision-making and management of patient under their care.

Candidates will be posted for 12 months in the Operation Theater, intensive care unit and accident & emergency unit. There are two (2) study packages during Phase I. They are intended to provide a broad outline of knowledge in basic sciences and basic clinical anaesthesia. Candidates are expected to apply this basic knowledge to clinical situations. The systems covered by the study packages are as follow: -

<table>
<tr><th colspan="3">Phase I (Year 1)</th></tr>
<tr><td rowspan="2">PACKAGE I</td><td>Physiology:
Cell physiology
Cardiovascular
Respiratory
Neuromuscular.</td><td>Pharmacology:
Pharmacokinetics
Pharmacodynamics. Intravenous
Induction agents
Inhaled anaesthetic agents,
Analgesics and narcotics
Sedatives
Muscle relaxants
Local Anaesthetics</td></tr>
<tr><td colspan="2">End of Package Examination 1</td></tr>
<tr><td>PACKAGE II</td><td>Physiology:
Nervous systems, maternal, foetal and neonatal physiology.
Nutrition, metabolism, endocrine, haematologic, alimentary, hepato-biliary systems</td><td>Pharmacology:
Antihypertensive
Cardiac glycosides
Drugs and sympathetic system
Drugs and Parasympathetic system
Diuretics
Neuroleptics
Antihistamines
Oxytoxics
Antimimetics</td></tr>
</table>

		Antibiotics and microbial agents Steroids Insulin Hypoglycaemics Thyroid and antithyroid drugs Anti-coagulants and antagonists
	End of Package Examination 2	
END OF PHASE I PROFESSIONAL EXAMINATION		

Two intensive courses of, 2 weeks each, will be organized. The first intensive course will be in the School of Medical Sciences, Universiti Sains Malaysia, Kubang Kerian and the second conjoint intensive course will be conducted for all candidates. The venue for second intensive course is subjected to decision by 'conjoint board'. The course consists of lectures, tutorials, clinical teaching, and practice sessions on the theory papers. The lecture topics and tutorials are selected according to the study packages mentioned above. This intensive course will be followed by an end of package examination which consists of theory papers, short cases and viva-voce. The marks for the theory component of the end of package examination is part of continuous assessment and is a prerequisite to qualify for the end of year 1 professional examination. Lectures on general basic sciences will also be given through teleconference (½ day a week) for all masters' students

Objectives of Phase I

The following are the objectives of Phase I

- To understand the physiology of the important body organ system and to understand the normal structure and function of each system included in the study packages.
- To know the effect of disease processes on normal structure and function
- To gain expertise in the pharmacology and use of commonly used drugs
- To become competent in history taking and clinical examinations and in initiating relevant investigations, and management
- To gain competence in choosing investigations that facilitate the diagnosis and treatment of common diseases
- To be able to perform common procedures independently or under supervision

I. CURRICULUM FOR PHASE 1

1. CLINICAL MEDICINE

- Basic Clinical examination
- Interpretation of laboratory result
- Interpretation of x-rays
- Interpretation of ECG
- Respiratory disorders
    - ❖ Respiratory failure
    - ❖ COAD
    - ❖ Bronchial Asthma
    - ❖ *ARDS*

- ❖ *Lung Tumours*
- ❖ *Pneumonias*
- ❖ *Structure disorder of the* thoracic
- ❖ Cage and Lungs

- Cardiovascular disorders
  - ❖ Congenital heart disease
  - ❖ Valvular diseases
  - ❖ Ischaemic heart disease
  - ❖ Hypertension
  - ❖ Cardiomyopathies
  - ❖ Disorder of the pulmonary circulation
  - ❖ Cardiac arrythmias
  - ❖ Cardiac failures

- Endocrine and metabolic Disorders
  - ❖ Diabetes Mellitus
  - ❖ Hypoglycaemia
  - ❖ Thyroid disorders
  - ❖ Disorder of calcium metabolism
  - ❖ Adrenocortical diseases

- Nephrology
  - ❖ Acute and chronic renal failure
  - ❖ Water and electrolyte disturbance
  - ❖ Nephrotic syndrome
  - ❖ Glomerulonephritis

- Diseases of the blood
  - ❖ Anaemias
  - ❖ Haemostasis and thrombosis
  - ❖ Blood transfusion
  - ❖ Polycythaemia
  - ❖ Thrombocytopaenia
  - ❖ Leukaemias/Lymphomas

- Gastroenterology
  - ❖ Peptic ulcer
  - ❖ Stress ulcer
  - ❖ Acute hepatitis and fulminant hepatic
  - ❖ Failure
  - ❖ Chronic hepatitis
  - ❖ Drug and liver damage
  - ❖ Jaundice
  - ❖ Pancreatitis

- Neurology
  - ❖ Disturbance of higher cerebral function
  - ❖ The autonomic nervous system
  - ❖ Lesions of the cranial nerve
  - ❖ Peripheral neuropathy

- ❖ Lesions of the spinal roots
- ❖ Tetanus
- ❖ Cerebrovascular disease
- ❖ Head Injury
- ❖ Epilepsy
- ❖ Bacterial meningitis

- Disease of the voluntary muscle
  - ❖ Myasthenia gravis
  - ❖ Muscular dystrophies
  - ❖ Periodic paralysis syndrome

- Infections
  - ❖ Septicaemias
  - ❖ Hepatitis viruses
  - ❖ AIDS
  - ❖ Tetanus

2. PHYSIOLOGY

- o Cellular physiology
- o Immune responses
- o Body fluids and electrolytes
- o Acid base regulation
- o Renal system
- o Respiratory system
- o Basic anatomy of the lung including
  - ❖ Structures and functions of alveolar and conducting airways
  - ❖ Anatomy and functions of the upper respiratory tracts
  - ❖ Broncho pulmonary segments architecture
  - ❖ Humidification and heat exchange
  - ❖ Non respiratory functions of the lung
    - filtration
    - release or modification of hormones and enzymes
  - ❖ Lung volumes and capacities
  - ❖ Anatomical and physiological dead space including apparatus dead space
  - ❖ Alveolar ventilation
    - Bohr equation
  - ❖ Composition of:
    - inspired gas

- alveolar gas
- expired gas

o Lung mechanics of breathing
  - ❖ Muscles of respiration
  - ❖ Control and regulation of respiration
  - ❖ Respiratory reflexes
  - ❖ Pressure, flow, work of breathing
  - ❖ Compliance
    - Static compliance
    - Dynamic compliance
    - Factors affecting
    - Clinical significance
  - ❖ Airway resistance
  - ❖ Time constants and gas distribution
  - ❖ Regional compliance
    - Methods of measurement
    - Factors affecting
    - Clinical significance
  - ❖ Surfactant
    - Composition
    - Properties
    - Effects
    - Alterations
    - Clinical significance

o Ventilation – Perfusion relationships

  - ❖ Distribution of ventilation
    - Stratification
    - Non – Stratification

  - ❖ Closing volume and capacity
    - Definition
    - Factors affecting
    - Measurement
    - Clinical significance

  - ❖ Effect of time constants on gas distribution, gas flow and mixing in the pre-terminal and terminal bronchioles

  - ❖ Ventilation/perfusion ratios
    - High, normal low V/Qs
    - Effects of posture, anaesthesia, ages, respiratory and circulatory changes

  - ❖ Sources and effects of turbulence
    - Significance
    - Measurement

- ❖ Alveolar – Arterial oxygen difference
  - Factors affecting
  - Significance
  - Clinical applications

- ❖ Physics of gas flow
  - Solution
  - Diffusion

o Gas transport in blood

- ❖ Carriage and transport
  - Body stores of oxygen
  - Oxyhemoglobin dissociation curve
  - Bohr effect
  - 2,3 diphospho glycerate (DPG)
  - Oxygen delivery to the tissue and oxygen cascade
  - Hypoxia and types

- ❖ Closing volume and capacity
  - Body stores of carbon dioxide
  - Carboxy haemoglobin dissociation curve
  - Haldane effect
  - Hypercarbia and types

- ❖ Blood tissue gas exchange

- ❖ Haemoglobin
  - Structure
  - Types and significance
  - Effects of blood storage
  - Recent advances in enchancement of quality

o Control of Respiration

- ❖ Organisation of respiratory control mechanism
- ❖ Central control
- ❖ Chemical influences
- ❖ Reflex influences
- ❖ Somatic influences
- ❖ Effects of control
- ❖ Respiratory changes at high and low barometric pressures
  - Acute
  - Chronic
  - Adaptation mechanism

o Pulmonary Circulation

- ❖ Architecture of the pulmonary vascular system
- ❖ Blood distribution through the lung

- ❖ Pulmonary vascular resistance
- ❖ Factors affecting the pulmonary circulation
- ❖ Effects of changes in pulmonary circulation on gas uptake and elimination

- ❖ Clinical significance and measurement of pulmonary circulation
  - Anatomical – shunts
  - Physiological
  - Venous admixture effect
  - Dead space effect
- ❖ Pulmonary interstitial space and Lymphatic function
  - Artificial ventilation
  - Effects of artificial lung ventilation
  - Types of controlled (conventional) mechanical ventilation
  - Ventilatory support modes
  - Types of high frequency ventilation
  - Principles and techniques off humidification and nebulization

o Respiratory and pathysiological changes during:
- ❖ Exercise
- ❖ Old age
- ❖ General anaesthesia
- ❖ Posture
- ❖ Disease processes

o Hyperoxia, Hypoxia and asphyxia
- ❖ Types
- ❖ Effects
- ❖ Hyperbaric chamber
- ❖ Oximetry

o Hypercapnia/carbia and Hypocapnia/carbia including capnography

o High altitude sickness and decompression sickness (Caisson's Disease)

o Hypoventilation and Hyperventilation

o Respiratory inadequacy and failure
- ❖ Definition
- ❖ Criteria
- ❖ Causes
- ❖ Patho-physiology
- ❖ Principles of therapy

o Measurement of respiratory parameters and factors affecting them

o Evaluation of respiratory function
- ❖ Gas flow
- ❖ Ventilation
- ❖ Blood flow
- ❖ Diffusion

- ❖ Compliance
- ❖ Resistance
- ❖ Gas transport
- ❖ Gas concentrations and pressure in ventilating gas mixture and body fluids

- o Physiology of neuromuscular junction

- o Cardiovascular system
  - ❖ Properties of cardiac muscle, nodal and conductive tissue
  - ❖ Contractility and starlings laws and the heart
  - ❖ Chronotrophy
  - ❖ Inotropy
  - ❖ Dermotropy
  - ❖ Bathmotropy
  - ❖ Lusiothropy

- o Mechanical and electrical changes in the contraction of the heart
  - ❖ Events of the cardiac cycle
  - ❖ Synchronization of pressure
  - ❖ Blood flow
  - ❖ Heart sounds
  - ❖ E.K.G
  - ❖ Value activity
  - ❖ Architecture of the conducting system and its blood supply
  - ❖ Propagation of impulse and factors affecting

- o Einthoven triangle and principles of electrocardiography
  - ❖ Characterisation of the EKG in health and disease

- o Control of the heart and circulation

  - ❖ Ventricular function curves

    - Isometric and isotonic contraction
    - Factors modifying dp/dt
    - Foresters prediction Quandrants
    - Preload and afterload effects
    - Ionic disturbances

- o Blood pressure and blood flow factors affecting

- o Cardiac output and factors affecting

- o Cardiac cycle

- o Anatomy of the vascular system
  - ❖ Arterial tree and venous systems
  - ❖ Capillary circulation
  - ❖ Arrangement of the vascular bed
  - ❖ Lymphatic formation and circulation

- ❖ The micro circulation
- ❖ Arterial
- ❖ Capillary
- ❖ Venule
- ❖ Peripheral A-V Shunts
- ❖ Pre and post capillary control and factors affecting
- ❖ Blood rheology
- ❖ Blood viscosity
- ❖ Sludging
- ❖ Reynolds number
- ❖ Rheologic factors
- ❖ Extra cellular fluid formation
- ❖ Starlings forces

o Fluid exchange in tissue and control of blood volume
- ❖ Changes with common circulatory derangement

o Central and autonomic nervous control of circulation
- ❖ Vasomotor centre
- ❖ Vasomotor tone
- ❖ Cardiac centre
- ❖ Factors affecting
- ❖ Baroreceptor and chemoreceptor reflexes
- ❖ Effect of sympathetic and parasympathetic overactivity and underactivity

o Physiologic anatomy of regional circulation, arrangement of specific vascular beds:
- ❖ Cerebral
- ❖ Coronary
- ❖ Renal
- ❖ Pulmonary
- ❖ Hepatic portal
- ❖ Skin
- ❖ Muscle
- ❖ Splanchnic
- ❖ Special, features, autoregulation
- ❖ Factors controlling/modifying
- ❖ Regulation limits
- ❖ Clinical significance and applications

o Circulatory effects of
- ❖ Posture
- ❖ Age
- ❖ Exercise
- ❖ Altitude
- ❖ Artificial ventilation
- ❖ Valsalva maneuver
- ❖ Muller's maneuver

o Pathophysiology of

- ❖ Blood loss
- ❖ Shock
- ❖ Cardiac failure
- ❖ Embolism
- ❖ Ischaemia
- ❖ Infarction

- o Nervous system
- o Maternal, foetal and neonatal physiology
- o Nutrition and metabolism
- o Endocrine system
- o Blood/haematologic system
- o Alimentary system
- o Hepato-biliary system

3. PHARMACOLOGY

- o Pharmacokinetics of anaesthetic drugs:
  - ❖ Uptake
  - ❖ Distribution
  - ❖ Transport
  - ❖ Lipid solubility: oil/gas solubility constant
  - ❖ Blood/gas coefficient
  - ❖ Pk and ionisation and clinical applications
  - ❖ Regional uptake
  - ❖ Enzymes induction
  - ❖ Drug elimination
  - ❖ Detoxification and metabolism of drugs

- o Sedatives:
  - ❖ Definition of sedation, narcosis, addiction, habituation
  - ❖ Classification
  - ❖ Non-barbiturates
  - ❖ Tranquillisers
  - ❖ Pre-medication, principles and problems
  - ❖ Compare and contrast

- o Analgesics and narcotics, structure activity relationship (SAR)
  - ❖ Common uses
  - ❖ Interaction, problems, antagonists

- o Drugs and parasympathetic systems:
  - ❖ Acetylcholine – SAR, effects
  - ❖ Cholinergic and anti-cholinergic compunds
  - ❖ Organophosphate poisoning

- o Drugs and Sympathetic system:

- ❖ Sympathomimetics – SAR, & adrenergic receptors and compounds
- ❖ Antagonists + blockers
- ❖ Effects of monoamine oxidase inhibitors

- o Anti-hypertensive drugs:
  - ❖ Central
  - ❖ Ganglion blocker
  - ❖ Drugs affecting sympathetic nerve storage synthesis and release of catecholamine
  - ❖ Smooth muscle relaxant

  - ❖ Hypotensive agents in GA – Sodium Nitroprusside
  - ❖ Pharmacology and physiology of induced hypotension

- o Cardiac Glycosides:
  - ❖ Digitalis
  - ❖ Onset and duration
  - ❖ Modifying factors
  - ❖ Toxicity and management

LOCAL ANAESTHETIC (LA)

- o Classification
- o Ideal characteristics required
- o Usage
- o Prolongation of action
- o Interaction
- o Effects and treatment of overdosage
- o Inhalational Anaesthetic Agents:

  - ❖ Ideal characteristics
  - ❖ Pharmacokinetics
  - ❖ Physical properties/potency: Minimum alveolar concentration (MAC)
    - N_2O
    - Ether
    - Halothane
    - Trilene
    - Methoxflurance
    - Enflurane
    - Isoflurane
    - Desflurane
    - Sevoflurane
    - Pollution
    - Metabolism
    - Renal and liver toxicity
    - Interaction under GA

- o Intravenous (I.V) Agents:

- Ideal characteristics required
- Distribution, elimination and excretion
- Drug interaction
- pH, effects, storage
- Thiopentone
- Methohexitone
- Propanidid
- Ketamine
- Althesin
- New agents
    - Propofol

- Neuroleptic drugs:
    - Definition
    - Systematic effects
    - Side effects
    - Neuroleptic – analgesia combination

- Histamine and anti – histamines:
    - Phenothiazines effects
    - Side effects
    - Use in anaesthestic practice

- Analeptics, usage and complications

- Oxytoxics:
    - Uses
    - Complications
    - Interaction under GA

- Muscle relaxants:
    - SAR, classification, electropotential studies
    - Normal mechanism of muscle contraction
    - Depolarisers
    - Non-depolarisers
    - Complications, problems, drug interaction
    - Factors affecting and modifying response
    - Specific agents
    - Newer agents
    - Recurarisation
    - Dual block
    - Muscle twitch studies
    - Dantrolene Na
    - Malignant Hyperprexia
    - Cholinesterase variants

- Diuretics:
    - Site of action
    - Clinical usage
    - Interactions
- Antibiotics and microbial agents

- Endocrine:
  - Steroids
  - Insulin and hypoglycemic drugs
  - Thyroid and antithyroid drugs

- Cellular effects of drugs:
  - Membrane effects

- Theories of Anaesthesia

- Drug interaction

- Pharmacogenetics:
  - Kinetics/Dynamics

- Anti-coagulants and antagonists:
  - Heparin
  - Coumarins and indanediones
  - Fibrinolytic and anti-fibrinolytic agents

- Adverse reactions to drugs

- Postaglandins

Candidates are expected to have a detailed knowledge of the pharmacology of drugs used in anaesthetic practice. Particular attention should be paid to the principles involved in their uptake, distribution and clearance from the body. In addition to the principles of general pharmacology, detailed knowledge of the therapeutic substances which may be expected to complicate anaesthesia is considered essential.

II. CURRICULUM FOR PHASE II
(2nd and 3rd YEARS)

2.2 Year 2 and 3

The general objective is to enable students to acquire knowledge, skills and attitude appropriate for the management of patients in the various anaesthetic and intensive care subspecialties which will be useful in their general anaesthetic and intensive care practice. They will manage patients under supervision at the level of the junior registrar.

Objectives of Phase II

By the end of Phase II the student should

- understand the principles of pharmacology, physiology, clinical measurement, physic and statistic in relation to anaesthetic and intensive care practice.

- able to perform a thorough preoperative preparation of patient for surgery - perform a complete physical examination, requests relevant investigations, and prescribe premedications appropriately
- be able to perform common diagnostic and therapeutic procedures in operation theater and intensive care
- be able to plan in consultation with senior colleagues, the further management of the patient in a multidisciplinary intensive care setting
- be able to apply rules of evidence to clinical, investigational and published data in order to determine their applicability and validity in reviewing various aspects of anaesthetic and intensive care management

1. CLINICAL MEDICINE

2. BASIC ANAESTHESIA

STATISTICS

Sampling
Selection
Types of trial
- blind
- double blind
- cross-over

Design of clinical trial
Ethical consideration
Sequential analysis
Measures of dispersion and central tendency
Frequency distribution
Standard deviation, range, coefficient of variation
Linear regression
Null regression
Student's T Test
Chi-square test
Confidence limits

An elementary appreciation of the statistical and mathematical methods is also required

B. CLINICAL MEASUREMENTS

B.1 GENERAL PRINICIPLES

Candidates should understand the basic principles of measurements used in clinical practice for the evaluation of:
- Body fluids and constituents
- Respiratory function
- Gas concentrations and pressures in gas mixtures and solutions
- Cardiovascular function
- Temperature
- Biological potentials

a. A general knowledge is required of:
   - The available and basics of methods of measurement
   - The general features and problems of performance of measurements
   - The evaluation of measurements

B.2 PHYSICAL PRINCIPLES AND MATHEMATICAL CONCEPTS

2.1 As applied to physiological functions:

A general knowledge is required of those physical terms and principles and mathematical concept, which are necessary for an understanding of physiological functions and their measurement in clinical practice

2.2 As applied to the use of Radioactive Materials: -

A general knowledge is required of the principles of radioactivity, the clinical application of diosotopes and the Hazards of ionizing radiation

B.3 SCOPE OF CLINICAL MEASUREMENTS AND PHYSICAL PRINCIPLES

An appreciation of the scope of this section is given by the following examples which should only be considered as representative of the areas to be studied

3.1 Principles of the measurement and the mathematical Derivation of Physiological Dead Space, alveolar ventilation, pulmonary shunt, cardiac output, etc

3.2 The physical principles of heat transfer and the principles of devices used by sensing heat the measuring temperature

3.1 The basic of electrocardiography, electro-encephalography, electromyoneurography and evoked potentials; and the significance of the used of its various forms in clinical medicine

3.2 The concept of Hydrostatic pressure and its significance in measuring cardiovascular pressures

3.3 The physio-chemical basis of the measurement of osmotic forces and colloid oncotic pressure and the significance of the use of its various forms in Clinical Medicine

3.4 The relationship of density and viscosity to the flow of liquids, gases and vapours and measurement of flow of liquids, gases and vapours

3.5 The principles of electron transfer, of electrical potentials, and the significance of electrical fields in biology

3.6 The effects of temperature on physical and physico-chemical factors

3.7 The principles of ultrasonography and Doppler effects and the significance of the use of its various forms in Clinical Medicine

3.8 A knowledge of system international (S.I) units and either units of measurement that are of importance to the Anaesthetist and intensivist

B.4 **MEASUREMENT OF CARDIOVASCULAR FUNCTION**

- arterial blood pressure
- pulse and plethysmography
- cardiac output
- regional flow
- blood volume
- invasive and non invasive methods of assessment of Myocardial functions:
  - ultrasonography
  - doppler
  - radionucleide
  - magnetic resonance
  - electrophysiology
  - cardiac catheterization

B.5 Ventricular Assist Device
(Intra Aortic Ballon Pump)

B.6 Principles of instrumentation including

- tonometry
- volumetric and monometric analysis
- spectrophotometry
- gas chromatography
- paramagnetic analysis
- electrode systems
- photo-accoustic and magneto-accoustic spectroscopy

B.7 Nerve stimulator usage and interpretation (tetanic stimulation, single stimulus, train of four, double burst stimulation)

III. CURRICULUM FOR PHASE 3 (FINAL YEAR)

Year 4

The general objective is to enable the candidate to function as a consultant-in-training, in managing patients as well as assisting the consultant manage the activities in operation theaters and intensive care unit, and to begin to develop skills in the subspeciality area they have an interest in.

Objectives of Phase III

The objectives of phase III are:

- to be a role model in the teaching and training of junior doctors and other health personnel
- to assist in performing the managerial duties of the operation theaters intensive care, maintenance of discipline and unit cohesiveness, arranging duty rosters and when relevant ensure that academic activities are conducted for example journal club, seminars, mortality conference, case presentations at CME, grand ICU rounds, conference, CPC etc.
- to apply rules of evidence to clinical, investigational and published data, in conducting research, scientific writing and audit
- to identify the areas of deficiency in their performance and to rectify these by utilising appropriate clinical and educational resources, so as to bring new knowledge and skills to the care of anaesthesiologist (self audit)

Examination Syllabus for Final year

- Cover all aspects of the theory and practice of anaesthesia and have specific sections relating to medicine, surgery and related pathology and anatomy as applied to the practice of anaesthesia.

- The examination in anatomy covers those aspects which are relevant to regional, local, general anaesthesia and management of intractable pain and the complications of anaesthetic techniques. In addition, candidates should study the theory and practice of intensive care resuscitation

- The following is the syallabus to a general scope of preparation necessary for the examination

Applied Anatomy

a) upper respiratory airways and lungs
b) vertebral column
c) cranial nerves and their ganglia
d) cervical and brachial plexus
e) nerves of the upper extremities
f) laryngeal nerves
g) diaphragm and the phrenic nerves
h) vertebra; canal and related structures
i) nerves of the lower extremities including nerve of the perineum
j) Anatomy of the lower respiratory tract
k) Anatomy of the autonomic nervous system-including sympathetic ganglion

Anaesthetic Equipments

a) anaesthesia machine
b) flow meters
c) compressed gases, gas laws and manufacture of anaesthetic gases
d) reducing valves
e) gas pipe-lines
f) fire hazards, explosion and electrical safety in operation theatre and intensive care units
g) fluid dynamics
h) monitoring systems in operation theatres and intensive care units
i) vaporizers and vaporization of volatile agents
j) bheat loss in anaesthesia
k) hazards of operation theatre pollution
l) scavenging systems for exhausted anaesthetics gases and vapours
m) surgical diathermy
n) electrical defibrillators
o) sterilization and disinfection of anaesthestic equipment
p) airway adjuncts

Clinical Anaesthesiology

1. history of anaesthesia
2. theories and stages of general anaesthesia
3. preanaesthetics evaluation and premedication
4. clinical pharmacology of drugs
5. IV anaesthesia
6. inhalational anaesthesia techniques and breathing systems
7. preparation for anaesthesia-central and regional conduction
8. airway problems
9. endotracheal procedures
10. techniques of intubation-endotracheal, naso-tracheal, endobronchial, difficult intubation
11. anaesthesia for general surgical procedures
12. anaesthesia for orthopaedic cases and related problems
13. anaesthesia for eye and ENT cases
14. anaesthesia for urological cases
15. anaesthesia and analgesia in obstetric and gynaecological practice
16. paediatric anaesthesia
17. geriatric anaesthesia
18. anaesthesia for open heart surgery
19. anaesthesia for other cardiovascular surgery
20. anaesthesia for thoracic surgery
21. anaesthesia for neurosurgery and neuroradiodiagnostic procedure
22. anaesthesia for outpatient or day care surgery
23. anaesthesia for out patient dental procedures and dental surgery
24. anaesthesia for surgical emergencies
25. anaesthesia and liver disease
26. anaesthesia and endocrine disease
27. anaesthesia and renal disease
28. anaesthesia and lung disease including airway disease

29. anaesthesia for ECT
30. clinical uses of muscle relaxants
31. neurolept anaesthesia
32. clinical uses of local analgesics
33. regional conducting block anaesthesia
34. post-operative complications secondary to general and regional anaesthesia
35. care of the unconscious patient
36. management of patients in recovery room
37. use of blood and substitutes and principles of iv infusions
38. mechanical ventilation of lungs
39. extra corporeal circulation
40. induced hypotension
41. induced hypothermia
42. post-operative care
43. fundamentals and technique of cardiac pacing
    - temporary
    - permanent

Intensive Care and Resuscitation

Basic knowledge in theory and practice of intensive care is required. Candidates are expected to have intensive knowledge of cardio-pulmonary resuscitation including resuscitation of the newborn. The scope of preparation should include the following which is by no means comprehensive

a) cardiopulmonary and neonatal resuscitation
b) selection of patients for intensive care
   TISS, APACHE scoring system
c) transport of gravely ill patients
d) practice of acute medicine and surgery

Cardiovascular System

- Assessment
- Shock
- Managmenet of cardiac failure and cardiogenic shock
- Managament of haemorrhage
- Drug therapy
- Fluid and electrolyte balance
- Use of cardiac pacemakers
- Swan Ganz catheter,
- Cardiac output measurement

Respiratory System
- Assessment of respiratory failure- acute and chronic
- Oxygen therapy
- Clearanceof secretion, suction
- Physiotherapy
- Inhalational therapy
- Humidification and nebulization
- Hyperbaric oxygen

- Ventilators – design, functions
- Artificial airway including tracheostomy
- Prevention of infection
- Treatment of respiratory infection and sepsis
- Drug therapy
- Management of pulmonary complications
- Bronchoscopy
- HFV, Dual lung ventilation/independent lung ventilation

Hepatobiliary disorders
- Assessment
- Management

Renal system
- Assessment
- Acute and chronic renal failure
- Basic concepts of peritoneal and haemodialisis

Haematology
- Haemoastatis
- Intravascular thrombosis
- Rheology
- Anaemia

Management of neuro-muscular disease e.g:
- Myasthenia gravis
- Tetanus
- Polliomyelitis
- Gullain-Barre syndrome etc

Trauma
- Multiple injuries
- Head injuries
- Chest tube insertion, venous cutdowns
- Chest injury
- Injuries to neck and face
- Burns
- Spinal injuries

Poisoning

Infection, septicaemia, multiple organ failure

Pain relief

Nutrition

Other medical emergencies

General Care

Monitoring (Invasive and non- invasive)

Psychological care of:

- Patient and relative
- Staff

Basic nursing care ICU

Principles of infection control in ICU

Brain stem death: criteria and testing

Management of patients for organ retrievals

APACHE scores
Clinical Medicine and Surgery: -

All aspects of clinical medicine and surgery including interpretation of ECG and radiographs (especially chest radiograph) and other laboratory investigations

Miscellaneous: -

1. Design of operation theatres and recovery rooms
2. Design of intensive care units, staffing facilities
3. Medico-legal aspects of anaesthesia and surgery
4. Ethical considerations in resuscitation, intensive care and research
5. Disaster planning and organisation of emergency medical system
6. Basic knowledge of administration e.g
   - Setting up an anaesthesia department
   - Equipment ordering, maintenance
   - Scheduling of operation lists
   - Staff management
   - Inter-departmental relationship, etc

Trainees are also encourage to acquire the techniques and skills

a) General ultrasonography
   - Abdomen }
   - Chest } for rapid diagnosis
   - Heart }
b) TEE (transesophageal echocardiography) as applied in operation theatre and ICU
c) -detection of air embolism
   -heamodynamic monitoring in cardiac surgery
d) Fiberoptic laryngoscopic endotracheal intubation
e) Bronchoscopy & bronchial lavage
f) Fine needle biopsy under ultrasound guidance

ASSESSMENT AND EXAMINATION

Components of Assessment:

The assessment of candidates is divided into 3 components:

a. Continuous assessment
b. Theory component of the Professional examination
c. Clinical component of the Professional examination

Prerequisite for End-of-Phase Examination

A candidate must obtain a satisfactory report from the supervisor(s) before being allowed to sit for the end-of-phase examination.

The following criteria will be used for assessment: -

(i) Attitude and integrity
(ii) Attendance
(iii) Clinical competence and theoretical knowledge

The supervisors are expected to submit progress reports to the School on the prescribed form

I. Phase I Assessment (End of First Year):

1. Continuous Assessment **Prerequisite**

i) Clinical Supervisor's Report every 3 months
ii) End of package examination
iii) CME presentation

2. Professional I Exam (End of Year I) **100%**

a) Theory **60%**

1. MCQ 30%
2. SAQ 30%

If a candidate passes the repeat examination, he/she will be allowed to continue with the course

Exemptions

A candidate who has passed FRCA Part I or its equivalence may apply to be exempted from the end of phase I professional examination. Exemption will only be considered at the time of entry to the course and not during the course.

b) Clinical **40%**

i) Viva-Voce 40%

Total **100%**

Criteria for Passing End-of-Phase 1 Examination

1. Overall total mark must be 50% and above
2. Candidate must pass both parts (theory and clinical) separately with the mark 50% and above
3. Only candidates who passed the theory paper with marks more than 50% can sit for viva examination
4. The candidates must pass both paper (physiology & pharmacology) to be accepted to Phase II

II. Phase II Assessment (2nd and 3rd years)

There will be no formal examination during second and third year. The criteria for promotion to the following year is based on the satisfactory report(s) from supervisor(s), dissertation progress and continuous assessment.

III. Phase III Assessment (End of Year 4)

1. Continuous Assessment

2. Professional II Exam (Final Examination)
(Conjoint Examination USM/UKM/UM) 100%

a)	**Theory**	**40%**
b)	**Clinical**	**60%**
i)	Clinical (Medical)	20%
ii)	Viva-voce	40%
Total		**100%**

Criteria for Passing End-of-Phase III Examination

The theory examination will be held **4 weeks** before the clinical examination. Candidates must pass the theory component before being allowed to sit for the clinical component. Candidates who fail the clinical examination will have to repeat the whole examination.

Overall total mark must be 50% and above

Candidate must pass all two components as below separately with each component more than 50%

- Theory
- Clinical

Grading System:

The grading system for a pass and fail are as below: -

Grade	Marks	Pass/Fail
A	70% and above	Distinction
B	60-69%	Good pass
C	50-59%	Pass
F	49% and below	Fail

Repeat Examination

A candidate who fails the end-of-phase examination will be allowed to sit for the repeat examination after a period of 6 months or one year depending on the recommendation of the examination board. If the candidate fails after 4 attempts (for Part 1) or more than seven years of study in total (for Part 2), he/she will be requested to leave the course. The candidate can appeal to Vice Chancellor if he/she requested to have more attempts to examination.

If a candidate passes the repeat examination, he/she will be allowed to continue with the course.

SUPERVISION AND ROLE OF THE SUPERVISOR

Supervision is the dynamic process in which the supervisor encourages and participates in the development and training of the candidate. Supervision is fundamental to the educational process and is imperative in the open learning program.

The two major roles of supervision are:

1. objective evaluation of candidate's performance using appropriate methods of assessment, and
2. establishng a relationship that will help the candidate to self-actualise and become self-directed learners and highly motivated individuals.

Accreditation of Consultant/Specialist in the Ministry of Health

Accreditation is based on commitment to teaching and evidence of teaching activities at departmental and hospital levels. To be a supervisor, the consultant/ specialist must possess M.Med (Anaesthesia), FRCA degree or its equivalent.

Supervisors at the Ministry of Health Hospitals

The Hospital Postgraduate Training Committee

- ensures that the accredited hospitals fulfil requirements in terms of physical facilities and human resources
- reviews the number of training posts
- keeps a registry of the trainees and the supervisors

- provides feedback to MOH coordinating committee regarding placement and transfer of trainees and supervisors
- coordinates the training programme in the hospital
  provides the necessary assistance

The Programme Supervisor

Is the head of the Anaesthesiology Department and is appointed as the programme supervisor in each accredited hospital in the Ministry of Health. The programme supervisor is expected to:

- coordinate the training of candidates in their respective disciplines
- collect 3 monthly reports from candidate supervisors
- serve as the liaison officer for the programme director at the
  University
- assist the candidate supervisor and the candidates if problems occur
- arrange clinical rotations for the candidates in consultation with the course supervisor and as required by the programme
- ensure that reports of candidates are submitted to USM through the head of department

Candidate Supervisor

A supervisor will be appointed for each student working in the Ministry of Health. The candidate supervisor is expected to:

- implement the training programme
- ensure that adequate time is provided to trainees for studying and fulfilling requirements of the training programme
- provide guidance and supervision for candidates assigned to them
- liaise with the programme supervisor regarding candidate
  performance
- submit an assessment report at the end of a clinical posting
- assist the candidate in the preparation of the dissertation

Supervisors at Universiti Sains Malaysia

Course Supervisor

The head of the Department of Anaesthesiology, USM is the course supervisor and is responsible for the smooth implementation of the M.Med programme. The head of department is also responsible for conducting regular meetings with the other supervisors to assess the progress of the candidates and to make appropriate recommendations for further improvement in training.

Phase Supervisor/Coordinator

A phase supervisor/phase coordinator is a lecturer in the Department of Anaesthesiology, USM. Phase supervisors will be elected by the course supervisor to oversee and coordinate each phase of the course. The Phase coordinators are expected to:

- schedule lectures and clinical postings
- conduct and attend to matters pertaining to examination
- collect clinical supervisors' reports, case reports, log books and dissertations
- visit candidates and their supervisors whenever possible
- be a liaison officer for the course
- participate in programme evaluation

Personal Supervisor

A candidate's personal supervisor is a lecturer working in the Department of Anaesthesiology, USM. The personal supervisor is elected by the course supervisor and he/she will supervise the candidate through all the phases of the course until graduation. The personal supervisor are expected to:

- act as a liaison officer between the candidate and the course supervisor
- be advise the candidate regarding career development
- participate in programme evaluation
- help the candidate plan and complete the dissertation
- encourage and assist the candidate to write papers and attend seminars/conferences

Clinical Supervisor

A clinical supervisor is the lecturer whom the candidate is working with during the 3 monthly clinical rotation. The clinical supervisor plays a major role in the supervision of the candidate's clinical training and is responsible for evaluating the candidate using the supervisor's report form. The clinical supervisor is expected to:

- supervise the candidate's clinical work
- ensure that the candidate keeps up with the literature, attends hospital teaching activities (e.g. CPC) and maintains a professional attitude toward patients
- ensure satisfactory completion of candidate's case reports
- assess the case reports of the candidate
- submit reports regarding candidate's clinical competence

Evaluation Tools

The tools used to assess the knowledge, attitude and skills of candidates include:

- Supervisors report
- Dissertation
- Log book
- End of package examination

End of Phase Professional examination

Dissertation

The objective of the dissertation is to introduce the candidate to research methodology, data analysis and journal writing. Candidates will be given the opportunity to participate in a workshop on Research methodology in Phase II, where they will be taught skills in preparing a research protocol, in conducting research and in reporting research findings. A candidate is required to start a research project in the 2nd year. This research project, which will be the dissertation, is to be completed in Phase III (year 4) and submitted as part of assessment at the end of Phase III

Stages of the Dissertation

- Identify a suitable topic: This should be done as soon as the candidate is successful in the Phase I professional examination
- Review the literature on the topic
- Develop a research protocol
- Approval of research protocol by the department and research ethical committee if necessary
- Submit the research protocol to the Department of Anaesthesiology, USM for final acceptance
- Data collection, entry and analysis
- Complete writing of dissertation

The dissertation must be submitted to the School of Medical Sciences, USM not later than 6 months before the end of the 4th year for evaluation by assessors. The dissertation should contain about 15,000 words (excluding diagrams, tables or references) and should contain the following headings

- Title
- Abstract (not more than 300 words)
- Introduction
- Material and methods
- Results
- Discussion
- Conclusion
- Acknowledgements
- References
- Act as a mentor/academic adviser to the candidate in matters pertaining to academic performance

Student can choose to submit conventional format for dissertation submission or by using new manuscript format. Details regarding format of dissertation can be acquired from the postgraduate office.
Students are encouraged to publish their dissertation before end of four years study period.

Supervisor's Evaluation Report

All candidates will be closely observed by the clinical / candidate supervisor throughout the clinical posting. The competencies and attitudes observed, as well as the criteria for evaluation are described in the evaluation form.
The candidates should endeavour to develop the competencies and qualities listed, aiming for excellence in all dimensions. The candidate is encouraged to discuss his/her progress with the supervisor throughout the posting. The supervisor is also expected to provide continual formative feedback to the candidate.
All completed evaluation report should be sent to the Head, Department of Anaesthesiology, USM. It is advised that the personal supervisor should meet the candidate at the end of every clinical rotation to review the candidate's progress. Problems should be identified early to allow appropriate remedial measures to be taken.

Log Book

A log book will be given to candidates at the beginning of Year 1. The log book serves as a training record for the candidate throughout the course. The log book serves as a check list for candidates in performing general and regional anaesthesia, certain diagnostic and therapeutic procedures, performing ICU and pain managements. It also keeps a record of case presentations, courses/conferences attended and papers presented or published.

End-of-Posting/Package Examination

An examination is conducted at the end-of-each 2-week intensive course. This end of package examination consists of theory papers and viva-voce examination. These marks also contribute to the total marks for the end of Phase I Professional examination