HKCA Anaesthesia Training Curriculum

for trainees starting 1 July 2018

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PRESIDENT'S MESSAGE

Prior to 1990, anaesthetists practiced in Hong Kong obtained their specialist qualification from overseas, mostly Commonweath countries. With its establishment in 1989, The Hong Kong Colleges of Anaesthesiologists (HKCA), under the Hong Kong Academy of Medicine, has taken up the role and responsbility for the specialist anaesthesiologist training in Hong Kong. The Board of Education (BoED) had its inaugural meeting in August 1992 with the first HKCA Vocational Training Programme implemented in 1994 and our first batch of fellows by examination in 1997. Although some minor modifications were taken in 2004, the current training program has been in its original format for more than 2 decades and was largely adopted from Australian & New Zealand College of Anaesthetists (ANZCA) training programme. The Council and BoED have been considering the need to revamp the training programme to suit the increasingly demand from the community and the rapid advancement in the medical technology.

On the other hand, there have been a major revolution in medical training and teaching globally in last 2 decades towards a competency-based training (CBT). The CBT consists of functional analysis of the occupational roles, translation of these roles ("competences") into outcomes, and a set of standards each broken down into elements by which performance in the workplace can be assessed. This new approach in training and teaching has been adopted by most of the international anaesthesia colleges, such as Royal College of Anaesthetists of United Kingdom, Royal College of Physicians and Surgeons of Canada, and ANZCA.

Hong Kong, being an international city, is also influenced by this global movement. The Hong Kong Academy of Medicine has advised all her 15 constituent colleges to consider introducing CBT into their respective vocational training programmes in 2011. Hence, A Competency-based Training Sub-Committee was formed in 2012 and was later changed its name to Curriculum & Examination Review Working Group (CER) in 2014 to review and revise the existing training program. After a comprehensive review and 3 years of hard work by CER and expert team from the Royal College of Anaesthetists, the Hong Kong College of Anaesthesiologists will be unveiling our new curriculum for anaesthesia trainees commencing training on 1st July 2018.

There are a number of important changes in the new curriculum. In the past, our training has mainly been time and volume based, and not formally structured with defined attainment aims. In line with current international trends and best assessment practice, we will be moving to competency, workplace based assessments using a variety of recognised formats, with emphasis on the trainees demonstrating they have acquired the appropriate knowledge, skills, behaviours and attitudes. Together with the 6-monthly In-Training Assessment, this will enable formal assessment of the trainees' progress and performance at the workplace, but also act as an

opportunity for feedback for both the trainees and the training departments. In addition, with the advent of portable echocardiography machines, and emerging evidence that focused transthoracic echocardiography (FTTE) is a useful tool for improving clinical diagnosis and decision making, structured FTTE training will be formally incorporated into the training program.

The implementation of the major changes can be stressful time for all involved. The College will endeavour to provide support for both trainers and trainees. For trainers, our Train-the-trainers workshops will guide them through the complexities of the various workplace based assessments and curriculum changes. A comprehensive document - the Vocational Training Guide - detailing the various administrative issues related to the training program is also available to view.

Whilst the curriculum implementation is still in its infancy, we anticipate there will be many queries from all interested parties. The College is keen to hear feedback from all concerned so that any difficulties, inconsistencies and problems can be resolved early. Together, we approach a new era in Hong Kong anaesthesia training, one that will elevate the quality of our training program as amongst one of the best and most up-to-date in the world.

Finally, a very big thank you to the Curriculum and Examination Review Working Group led by Dr Simon Chan and Dr CH Koo, and group members whose hard work and dedication have made this new curriculum possible. At last, special thanks to Ms Kristy Cheung for her excellent support for the workgroup and coordinating activities with all parties, including overseas Colleges.

Associate Prof Chi-wai Cheung
President

FOREWORD

Since early 2016, the Curriculum and Examination Review (CER) Workgroup has been working towards a competency-based anaesthesia training curriculum to replace the existing one, which is essentially time-based and volume-based. At the same time, the content of the curriculum has been extensively reviewed and updated, to ensure that it appropriately covers the majority, if not all areas of contemporary anaesthesia practice.

The workgroup members consist of representatives from various Boards of HKCA, advisors with extensive experience in teaching and training, Supervisors of Training from all training hospitals, and Hospital Authority representative. Representatives from the newly formed Trainees Committee are also invited to join the workgroup in early 2017. Despite the inclusion of major stakeholders in the workgroup, the community of anaesthetists in Hong Kong is small and our expertise in modern medical education is limited. Therefore, it is imperative to learn from the experience of curriculum development and implementation outside Hong Kong. With the signing of the Memorandum of Understanding with the Royal College of Anaesthetists (RCoA) in 2016, experts from the United Kingdom have contributed significantly to our curriculum development, and shared with us the precious experience of implementing their new curriculum over the last 10 years. On the other hand, the training and examination system in Hong Kong has been more closely affiliated with the Australian and New Zealand College of Anaesthetists (ANZCA) in the past. As a result, the framework of our new curriculum is largely constructed with reference to ANZCA's 2013 curriculum (communication with courtesy from the President of ANZCA).

A summary of the major differences of the new curriculum compared to the existing one is provided at the end of this section. Quite a number of elements are newly introduced, including the Provisional Fellowship Year (PFY), Workplace Based Assessments (WBAs), and Focused Transthoracic Echocardiography (FTTE) training. At the same time, some previously optional elements have become mandatory, notably cardiac anaesthesia and pain medicine. More mandatory courses are incorporated to ensure that the training is more structured and standardized. Moreover, trainees need to achieve certain milestones in order to progress from one stage of training to the next. All the new changes are introduced with the intention to strengthen the clinical armamentarium of our future generation of anaesthetists, and to address some of the shortcomings of our existing curriculum, such as inconsistencies in the breadth of clinical exposure among different trainees in different hospitals, feedback from some new fellows that they are not ready to practice independently as specialists in the public and private settings, and the issue of trainees who only focus on passing examinations but neglect the fact that anaesthesia is a lifelong career, taking care of patients' needs and maintaining safety and quality in clinical practice.
While the College is responsible for setting the standard for future anaesthesia training, the CER

Workgroup has made significant effort to ensure that the training requirements (including the Volume of Practice and other new training requirements) are appropriately set and pragmatically achievable. A separate document, the Vocational Training Guide (VTG), provides guidance to various administrative issues related to the training program. It is anticipated that trainees should read the curriculum and the VTG carefully at the beginning of their training, and be responsible for the planning of their own training pathways together with Supervisors of Training.

Last, but not the least, we look forward to seeing fellow trainers in our Train-the-Trainers workshops, which are organized with the intention to facilitate trainers' understanding of the new curriculum and the use of the Workplace Based Assessment tools. The interactions between trainers and trainees in the clinical environment are the most precious moments for learning, and the CER workgroup strongly encourages the timely provision of high-quality feedback by the trainers.

At the time of implementation of the new curriculum, there may be queries raised by trainees, trainers, and even department/hospital managers. Technology support may be imperfect and administrative issues may not be ideally sorted out. The College would love to hear feedback and suggestions from all stakeholders and make appropriate amendments as necessary.

Desmond Lam
Training Officer, Board of Education
Chair of Curriculum Subgroup, Curriculum and Examination Review Workgroup

SUMMARY OF THE MAJOR CHANGES IN THE NEW CURRICULUM

	Old Curriculum	**New Curriculum**
Format of the curriculum	**Time-based, Volume-based:** A trainee is expected to perform up to standard after certain duration of clinical exposure.	**Competency-based:** Knowledge, skills and behavior are specifically defined. Each learning outcome is linked to possible assessment strategies. **Outcome-based:** Learner can focus on what to achieve, discuss with supervisors and plan the learning activities. Duration of training and amount of exposure to achieve the competencies can be variable.
Non-Anaesthesia exposure	A **compulsory** component	**NO compulsory requirement.**
Elective training	**Elective training:** Allow up to **6 months in any one *non-anaesthesia/pain/ICU* specialty**	**Elective training:** Allow up to **12 months in any one *non-anaesthesia/pain/ICU* specialty.** Allow generic training in other specialties.
Core versus non-core exposure	Some elements are considered non-core	**All contents in the curriculum are core.** The previously non-core elements which has now turned core are: **Ophthalmic anaesthesia** **Peripheral anaesthesia** **Cardiac anaesthesia** **Vascular anaesthesia** **Pain Medicine** Day surgery will be incorporated into various subspecialties training Neonate anaesthesia will be incorporated into paediatric anaesthesia
Pain medicine training	Pain medicine training is not mandatory.	Pain medicine training is **mandatory**. **Block training for Pain medicine is recommended.** 48 sessions within maximum of 6 months.
Focused Transthoracic Echo training	No structured Echo training	**Focused Transthoracic Echocardiography is formally incorporated into training program**
Formative assessments	No formative assessments at the workplace	Formative **Workplace based Assessments mandatory.** Emphasis on **feedback for learning.**
Volume of	VOP reflects the expected	VOP requirements exist for certain components of

Practice (VOP)	case load a trainee may encounter throughout training.	the curriculum. This is the **minimum cases required to achieve competency.** It is not the average or the ultimate number of cases that a trainee will need to do to achieve competency. The VOP in the new curriculum has been extensively discussed and revised, based on consensus of the curriculum review workgroup, literature review, and analysis of local case mix.
Mandatory courses	1. EASE 2. EMAC or ATLS 3. ADAM-A	1. EASE 2. EMAC 3. ADAM-A 4. HKCA FTTE 5. UGRA
	Notes: **EASE** Exposure to Anaesthetic Safety & Emergencies **EMAC** Effective Management of Anaesthesia Crisis **ADAM-A** Advanced and Difficult Airway Management for Anaesthetists **HKCA FTTE** HKCA Focused Transthoracic Echocardiography Course **UGRA** Ultrasound Guided Regional Anaesthesia	
Stages of training	Stages of training poorly defined	Clear definition of **Basic training , Higher training and Provisional Fellowship Year**
Progression	Passing examination not a pre-requisite for progression of training years	**Passing examination is a must for progression** from Basic to Higher training, and from Higher training to Provisional Fellowship Year
Provisional Fellowship Year	No Provisional Fellowship Year	Trainees must do **one year** of **Provisional Fellowship** after completing all the training requirements of Higher Training. There are specific learning objectives and there are requirements for submission of reports before Exit assessment.
Extension of training duration	No limit to the total duration of training	**Maximum duration of training is 12 years.**

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SECTION 1 OVERVIEW: CURRICULUM STRUCTURE, DURATION, CONTENT AND PROGRESSION

The Hong Kong College of Anaesthesiologists (HKCA) provides a six-year anaesthesia training program in accredited training hospitals in Hong Kong leading to the Fellowship of Hong Kong College of Anaesthesiologists (FHKCA).

1.1 Aim of the Curriculum

The training curriculum aims to

- Define the general scope of practice of a specialist anaesthetist working in the clinical settings in Hong Kong
- Guide trainers on the selection and provision of suitable learning experience for trainees
- Guide trainees self-directed learning
- Align learning outcomes with Volume of Practice (VOP) requirements and Assessment strategies
- Provide a reference for goal setting and review between trainee and Supervisor of Training (SOT)
- Enable comparison with anaesthesia training programs of different countries

1.2 Scope of the Curriculum

The scope of training is broadly divided into 2 categories: the “Clinical Fundamentals”, and the “Specialty Modules”.

Clinical Fundamentals

The Clinical Fundamentals refer to the essential and generic knowledge and skills of anaesthetists applicable to all areas of practice. They include

- General anesthesia and sedation
- Regional anaesthesia
- Airway management
- Acute pain management
- Perioperative medicine
- Trauma, crisis management and resuscitation

- Safety and quality in anaesthesia

The Clinical Fundamentals are developed as the trainee goes through different periods of the training program. For each of the above areas, the required competency at the end of Basic and Higher training is defined in the corresponding sections of the curriculum.

Specialty Modules

The Specialty Modules define the subsets of knowledge and skills required for the anaesthetic management of patients in specific contexts. They include

- Anaesthesia for general surgery / urology / gynaecology and endoscopic procedures
- Anaesthesia for head and neck and otorhinolaryngology procedures
- Anaesthesia for orthopaedic surgery
- Paediatric anaesthesia
- Obstetric anaesthesia and analgesia
- Neuroanaesthesia
- Ophthalmic anaesthesia
- Anaesthesia outside the operating theatre
- Anaesthesia for cardiac surgery and interventional cardiology
- Anaesthesia for thoracic surgery
- Anaesthesia for vascular surgery
- Pain medicine
- Intensive care medicine

Depending on the training materials available in different training hospitals, trainees may spend a variable duration of training in each of the above specialty, except

(1) For Intensive Care Medicine where the minimum duration of training is 6 months; and

(2) For Pain Medicine Module where 48 dedicated sessions have to be completed over a maximum period of 6 months (Please refer to section on Pain Medicine for details).

Trainees may start their Specialty Modules any time during their training, subjected to the arrangement by the Supervisor of Training.

At the end of the module, trainees are expected to demonstrate competency and achieved the minimum Volume of Practice as listed in the corresponding section of the curriculum.

1.3 Duration and Periods of Training

The minimum duration of full-time anaesthesia training is 6 years, after full registration with the medical registration authority.

Within the 6-year training program the minimum duration in each of the following categories of training has to be completed:

- Clinical anaesthesia 48 months
- Intensive Care 6 months
- Elective training 18 months

  Trainees may undertake the following or a combination of the following as part of their elective training: -

  - Clinical anaesthesia
  - Intensive Care Medicine
  - Pain medicine
  - Other hospital-based clinical specialties except pathology
    - Not more than 12 months may be spent in any one clinical specialty under this category as an elective option
  - Research related to Anaesthesia, Pain or Intensive Care Medicine
    - Not more than 12 months may be spent in research as an elective option

The 6-year training program is divided into 3 periods: Basic Training (BT), Higher Training (HT), and Provisional Fellowship Year (PFY).

The minimum duration of training of each period is as follows:

- Basic Training 3 years
- Higher Training 2 years
- Provisional Fellowship 1 year

During Higher Training and Provisional Fellowship year, at least 24 months must be spent in Clinical Anaesthesia, Intensive Care or Pain medicine.

Basic Training

During Basic Training, trainees are expected to

- Develop the ability to manage low-to moderate risk and complexity cases with level 2 or level 3 supervision (refer to section 1.7 on levels of supervision)
- Acquire and apply knowledge of basic sciences (physiology, pharmacology, clinical measurements and statistics) into clinical practice

- Participate as a team member in pain, trauma and resuscitation
- Commence some of the Specialty Modules as appropriate

Higher Training

By the end of Higher Training, trainees are expected to

- Have acquired essential knowledge and skills pertinent to the provision of safe patient care in the intraoperative and perioperative settings
- Demonstrate competency in the majority, if not all, areas listed under "Clinical Fundamentals" and "Specialty Modules"
- Be ready to practice under Level 4 supervision (refer to section 1.7 for levels of supervision), depending on complexity of cases and individual hospital settings in which they work

Provisional Fellowship

During the Provisional Fellowship Year (PFY), trainees are expected to

- Complete all the minimum Volume of Practice (VOP) requirements specified under "Clinical Fundamentals" and "Specialty Modules"
- Explore and develop further interests in clinical subspecialties
- Develop and strengthen their "Non-technical skills" as a team member in the perioperative care of the patient, with particular emphasis on leadership, communication skills and strategies, and situation awareness
- Undertake non-clinical responsibilities, such as operating list management, duty rostering, quality assurance activities, teaching or research

Trainees are required to submit a study plan as approved by his/her SOT to the College within 2 months of the start of the PFY. The activities of the PFY will need to be documented (as specified in the section on PFY in the curriculum), and submitted to the College at the end of the PFY.

1.4 Assessments

Four types of assessments are employed to monitor the progression of the trainee, namely Volume of Practice (VOP), Workplace Based Assessments (WBAs), In-Training Assessments (ITAs), and Examinations.

Volume of Practice (VOP)

- A minimum Volume of Practice (VOP) is provided for some of the elements in the curriculum.
- This represents the minimum that is required to achieve the learning outcomes specified in the curriculum. It does not represent the ultimate number of cases/procedures required to achieve competence. As such, the VOP should be interpreted as one component of a broader assessment strategy of the curriculum.

- The VOP requirements to be completed at each stage of training and for each section of the curriculum are summarized in Appendix 1, and also listed at the end of the corresponding section of the curriculum.

Workplace Based Assessments (WBAs)

- Workplace Based Assessment (WBA) involves an assessor observing a trainee in the workplace, as he/she provides clinical care to patient(s).
- It is adopted as a strategy for "formative assessment" (assessment for learning). The assessor formulates a view of the performance of the trainee, identifies deficiencies if any, and gives feedback to the trainee with the aim of improving his/her subsequent performance.
- A variety of formats for WBAs can be adopted. These include
  - Direct Observation of Procedural Skills (DOPS)
  - Clinical Evaluation Exercise (CEX)
  - Case-Based Discussion (CBD)
  - Anaesthesia List Management Tool (ALMAT)
  - Multi-Source Feedback (MSF)
- Detailed description of each mode of WBAs can be found in Appendix 2.
- By tracking the records of repeated WBAs over time, a picture of the development or progression of the trainee can be established.
- The minimum number and type of WBAs to be completed at each stage of training and for each section of the curriculum is summarized in Appendix 3, and also listed at the end of the corresponding section of the curriculum.

In-Training Assessments (ITAs)

- An In-Training Assessment (ITA) is conducted at least every 6 months, or at the end of hospital rotation if the rotation is less than 6 months, between the trainee and the Supervisor of Training (SOT), throughout the training program. Additional review exercise(s) may be arranged at the instigation of either the trainee or the SOT.
- The ITA is an occasion for review of the progress of training. Possible items to be reviewed include the WBAs performed during the period, completion of cases/procedures versus VOP requirement, knowledge and skills attained, clinical attitudes and behavior, and comments from other trainers.
- The SOT will provide a summative and global assessment of the trainee's performance during the period of attachment.

Examinations

Intermediate Examination

- This is taken during Basic Training.
- The purpose of the exam is to assess the scientific foundations of clinical anaesthesia, including physiology, pharmacology, clinical measurements, and statistics.

Final Examination

- This is taken during Higher Training.
- The focus of the examination is on the practical integration and application of knowledge and skills in clinical practice.

1.5 Progression

Progression from Basic to Higher Training

The following must be achieved for a trainee to progress from Basic to Higher Training:

- Passing the Intermediate Examination
- Completion of the VOP and WBA requirements as specified in the curriculum
- No more than one FAIL in the In-Training Assessments throughout the training years (remedial actions to be decided by the Board of Education on an individual basis)

Progression from Higher Training to Provisional Fellowship Year

The following must be achieved for a trainee to progress from Higher Training to Provisional Fellowship Year:

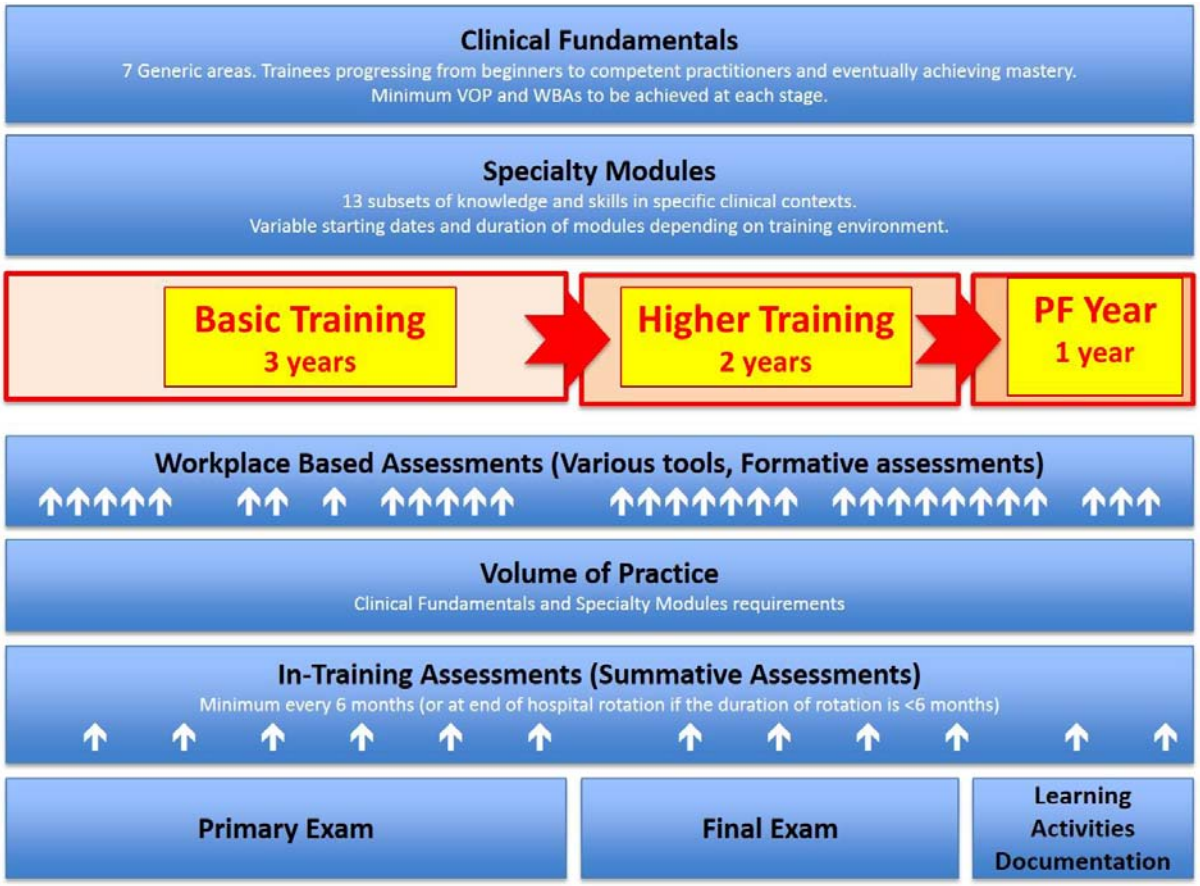
- Passing the Final Examination
- Completion of the VOP and WBA requirements as specified in the curriculum
- No more than one FAIL in the In-Training Assessments throughout the training years (remedial actions to be decided by the Board of Education on an individual basis)

Presentation for Exit Assessment after PFY

The following must be achieved for a trainee to present for Exit Assessment after the PFY:

- Completion of all WBAs and VOP requirements
- No more than one FAIL in the In-Training Assessments throughout the training years (remedial actions to be decided by the Board of Education on an individual basis)
- Submission of reports of learning activities during the PFY
- Completion of all mandatory courses as specified in Vocational Training Guide [HKCA-E02]
- Completion of a Formal Project (refer to separate document on Guidelines for Completion of Formal Project [HKCA-E03])

1.6 Curriculum Diagram



1.7 Levels of Supervision

A separate guideline on trainee supervision exists which describes in detail the levels of supervision required for trainees in relation to their clinical experience and the complexity of cases. Below is a summary of the convention used for denoting the different levels of supervision.

Level 1

The supervisor is rostered to supervise one trainee and available solely to that trainee.

Level 2

The supervisor is rostered to supervise 2 trainees who are in anaesthetizing locations which are in close proximity. The supervisor must be fully conversant with the nature of the patients in both locations and able to provide one-to-one supervision of each as appropriate.

Level 3

The supervisor is available in the institution but is not exclusively available for a specific trainee.

Level 4

The supervisor is not in the institution but is on call within reasonable travelling time and is exclusively rostered for the period in question. This level of supervision applies mainly to cases that are outside normal working hours. Consultation must be available at all times.

1.8 Format of the Curriculum

The main bulk of the content of Sections 2 to 4 of this curriculum is written in a table format which links the intended learning outcomes with possible assessment strategies. The columns of the table (from left to right) are:

Learning outcome

- This describes what the trainee will learn as a result of a period of study and clinical exposure. The learning outocmes are usually defined in terms of knowledge, skills or behavior.
- **Code of the Learning Outcome:** Each learning outcome is given a specific code for easy referencing.
-

Assessment strategies

- Each learning outcome is matched to some kind of assessment strategy.
- Examinations:
  - **IE**: Intermediate Examination
  - **FE**: Final Examination
- Workplace Based Assessments:
  - **DOPS**: Direct Observation of Procedural Skills
  - **CEX**: Clinical Evaluation Exercise
  - **CBD**: Case Based Discussion
  - **ALMAT**: Anaesthesia List Management Assessment Tool
  - **MSF**: Multi-Source Feedback

SECTION 2 CLINICAL FUNDAMENTALS

The Clinical Fundamentals refer to the essential and generic knowledge and skills of anaesthetists applicable to all areas of practice. They include

2.1 General anaesthesia and sedation
2.2 Regional anaesthesia
2.3 Airway management
2.4 Acute pain management
2.5 Perioperative medicine
2.6 Trauma, crisis management and resuscitation
2.7 Safety and Quality in anaesthesia

Trainees will start to accrue experience in each of these aspects of anaesthesia care from the beginning of Basic Training, be proficient in most of not all areas by the end of Advanced Training, and achieve mastery at the end of the Provisional Fellowship Year.

For each of the above areas, the learning outcomes and the methods of assessment are listed in a table format for easy reference. The minimum of Volume of Practice (VOP) and Workplace Based Assessments (WBAs) required are listed at the end of each section.

2.1 General Anaesthesia and Sedation

Basic Training

By the completion of Basic Training, trainees are expected to

- **Be able to anaesthetise or sedate low-risk patients having surgery of moderate complexity with distant supervision, applying an appropriate technique for the clinical situation.**
- **Have acquired knowledge of applied physiology and pharmacology, and basic principles of clinical measurements underpinning anaesthesia practice.**
- **Be familiar with the common approaches to vascular access, such as internal jugular vein cannulation and radial artery cannulation**

	Learning outcomes	Assessment
General Knowledge		
2.1.1	Outline the process of induction, maintenance and emergence from anaesthesia.	CEX/CBD
2.1.2	Explain the techniques of intravenous and inhalational induction and describe clinical indications and advantages and disadvantages of both techniques.	CEX/CBD, FEx
2.1.3	Outline preoperative fasting requirements, identify patients at risk of aspiration and outline common measures employed to decrease the risk of pulmonary aspiration.	CEX/CBD, FEx
2.1.4	Discuss the indications for rapid sequence induction. Outline the essential preparation and steps of rapid sequence induction.	CEX/CBD, FEx
2.1.5	Describe the synergism between anaesthetic agents, opioids and regional blockade and how this is used clinically	CEX/CBD, FEx
2.1.6	Discuss proposed mechanisms of anaesthesia and the sites of action of anaesthetic agents including the physiology and pharmacology of neurotransmitters and their receptors.	IEx
2.1.7	Describe the physiological effects of anaesthesia on the cardiovascular and respiratory system and its clinical management.	IEx
2.1.8	Discuss the physiological effects of anaesthesia on liver and kidney	IEx

	functions.	
2.1.9	Discuss the physiological effects of anaesthesia on immune, haematological and endocrine systems.	IEx
2.1.10	Outline the principles of perioperative fluid therapy.	CEX/CBD, IEx, FEx
2.1.11	Outline the physiological changes that occur with and the implications for anaesthetic management of pneumoperitoneum.	CEX/CBD, IEx, FEx
2.1.12	Outline the physiological changes that occur with and the implications for anaesthetic management of the following patient positions: - Supine - Trendelenberg and reverse trendelenberg - Sitting - Lateral - Lithotomy - Prone	CEX/CBD, IEx, FEx
2.1.13	Describe the clinical features that indicate a patient can be extubated safely.	CEX/CBD, FEx
2.1.14	Discuss the management of failure to wake up from anaesthesia.	CEX/CBD, FEx
2.1.15	Discuss the management of postoperative delirium.	CEX/CBD, FEx
Essential Pharmacodynamics		
2.1.16	Explain the concept of drug action with respect to: - Receptor theory - Enzyme interactions - Physico-chemical interactions	IEx

2.1.17	Explain receptor activity with regard to: - Ionic fluxes - Second messengers and G proteins - Nucleic acid synthesis - Evidence for the presence of receptors - Regulation of receptor number and activity	IEx
2.1.18	Define and explain dose-effect relationships of drugs with reference to: - Graded and quantal response - Therapeutic index - Potency and efficacy - Competitive and non-competitive antagonists - Partial agonists, mixed agonist-antagonists and inverse agonists - Additive and synergistic effects of drug combinations	IEx
2.1.19	Describe efficacy and potency with reference to dose response curves.	IEx
2.1.20	Explain the law of mass action and describe affinity and dissociation constants.	IEx
2.1.21	Describe the mechanisms of adverse drug effects.	IEx
Essential Pharmacokinetics		
2.1.22	Explain the concept of pharmacokinetic modelling of single and multiple compartment models and define: - Half life - Clearance - Zero and first order kinetics - Volume of distribution - Bio-availability - Area under the plasma concentration time curve	IEx

	- Extraction ratio	
2.1.23	Describe absorption and factors that will influence it with reference to clinically utilised sites of administration.	IEx
2.1.24	Describe factors influencing the distribution of drugs (for example, protein binding, lipid solubility, pH, pKa) and their alteration in physiological and pathological disturbance.	IEx
2.1.25	Describe the mechanisms of drug clearance and how physiological and pathological disturbance may affect these.	IEx
2.1.26	Describe the mechanisms of non-hepatic and hepatic metabolism of drugs including: - Phase one and phase two reactions - Hepatic extraction ratio and its significance - First pass effect, enzyme induction and inhibition	IEx
2.1.27	Explain and describe the clinical application of concepts related to intravenous and infusion kinetics including: - Effect-site and effect-site equilibration time - Concept of context sensitive half time - Calculation of loading and maintenance dosage regimens	IEx
2.1.28	Describe the pharmacological principles of and sources of error with target controlled infusion (TCI).	IEx
2.1.29	Explain clinical drug monitoring with regard to peak and trough concentrations, minimum therapeutic concentration and toxicity.	IEx
Variability in Drug Response		
2.1.30	Develop an understanding of variations in individual drug responses together with clinical application of this knowledge.	IEx
2.1.31	Define tachyphylaxis, tolerance, addiction, dependence and idiosyncrasy and describe mechanisms of tolerance.	IEx
2.1.32	Describe alterations to drug response due to physiological change with particular reference to extremes of age.	IEx

2.1.33	Describe alterations to drug response due to pathological disturbance with particular reference to cardiac, respiratory, renal and hepatic disease.	IEx
2.1.34	Describe the mechanisms of drug interaction.	IEx
2.1.35	Describe and give examples of the clinical importance of pharmacogenetic variation, for example, atypical cholinesterase, codeine metabolism.	IEx
2.1.36	Describe and give examples of the clinical importance of isomerism.	IEx
2.1.37	Describe the mechanisms of action and potential adverse effects of buffers, anti-oxidants, anti-microbial and solubilising agents added to drugs.	IEx
Pharmacology of Specific Agents		
Inhalational Agents		
2.1.38	Describe the physical properties of inhalational agents, including the: - Principles of vaporisation of inhalational agents - Properties of an ideal inhalational anaesthetic agent - Structure-activity relationships of inhalational agents	IEx
2.1.39	Describe the uptake, distribution and elimination of inhalational anaesthetic agents and the factors which influence induction and recovery from inhalational anaesthesia, including the: - Concepts of partition coefficients, concentration effect and second gas effect - Relationships between inhaled and alveolar concentration - Significance of the distribution of cardiac output and tissue partition coefficients on uptake and distribution of volatile agents	IEx
2.1.40	Describe the concept and clinical application of Minimum Alveolar Concentration (MAC) in relation to inhaled anaesthetic agents.	IEx

2.1.41	Describe the effects of inhalational agents on the cardiovascular, respiratory and central nervous systems.	IEx
2.1.42	Describe the toxicity of inhalational agents.	IEx
2.1.43	Describe the pharmacology of nitrous oxide.	IEx
2.1.44	Describe the comparative pharmacology of nitrous oxide, halothane, enflurane, isoflurane, desflurane, sevoflurane, xenon and ether.	IEx
Sedative and Hypnotic Agents		
2.1.45	Describe the physical properties of sedative/hypnotic agents, including: - Formulation - Properties of an ideal agent - Structure-activity relationships	IEx
2.1.46	Describe the clinical situations when anxiolytic or sedative premedication may be indicated or contraindicated.	CEX/CBD, IEx, FEx
2.1.47	Define levels of sedation and outline the requirements for safe practice of procedural sedation.	CEX/CBD, FEx
2.1.48	Describe and compare the pharmacokinetics of intravenous induction and sedative agents, the factors which affect recovery from intravenous anaesthesia and the clinical implications of these differences.	IEx
2.1.49	Describe and compare the pharmacodynamics of intravenous induction and sedative agents and in particular the effects on the cardiovascular, respiratory and central nervous systems.	IEx
2.1.50	Describe the adverse effects of individual induction, sedative and premedicant agents.	IEX
2.1.51	Describe how physiological and pathological disturbance can alter the pharmacology of intravenous anaesthetic agents.	IEx
2.1.52	Outline the pharmacology and clinical use of flumazenil.	IEx

Neuromuscular Blocking Agents and Monitoring		
2.1.53	Describe the physiology of the neuromuscular junction and the mechanism of action of neuromuscular blocking agents.	IEx
2.1.54	Describe the pharmacokinetics of neuromuscular blocking agents.	IEx
2.1.55	Discuss the indications for muscle relaxation in anaesthesia.	IEx
2.1.56	Describe the pharmacological differences between neuromuscular blocking agents and the clinical importance of these differences.	IEx
2.1.57	Describe the adverse effects of neuromuscular blocking agents and factors that may modify responses to muscle relaxants.	IEx
2.1.58	Describe the concept of depth of neuromuscular blockade and explain the use of neuromuscular monitoring using the peripheral nerve stimulator..	IEx
2.1.59	Describe the reversal of neuromuscular blockade using anticholinesterase agents, anticholinergics and sugammadex and the physiological effects of reversal.	IEx
2.1.60	Describe the adverse effects of anticholinesterase agents.	IEx
2.1.61	Describe the clinical features and management of inadequate reversal of neuromuscular blockade.	CEX/CBD, IEx, FEx
Analgesics (also refer to section 2.4 Acute Pain Management)		
2.1.62	Describe the clinical application of opioids to anaesthesia and sedation.	IEx
2.1.63	Describe the pharmacokinetics of intravenous opioids.	IEx
2.1.64	Outline a strategy for the management of post operative analgesia for patients in their care.	CEX/CBD, FEx
Postop Nausea and Vomiting and Antiemetics		
2.1.65	Outline the physiological basis of vomiting.	IEx
2.1.66	Describe the clinical pharmacology of dopamine antagonists, anti-cholinergic agents, serotonin antagonists, antihistamines	IEx

	pro-kinetics and steroids relevant to premedication and the management of nausea and vomiting.	
2.1.67	List the risk factors, and outline a strategy for the prevention and management of postoperative nausea and vomiting.	CEX/CBD, IEx, FEx
Depth of Anaesthesia and Monitoring		
2.1.68	Describe the concept of depth of anaesthesia and how this may be monitored.	CEX/CBD, IEx, FEx
2.1.69	Outline the aetiology of and measures to prevent intraoperative awareness under general anaesthesia.	CEX/CBD, FEx
2.1.70	Explain the principles involved in the electronic monitoring of depth of sedation and anaesthesia, including the use of EEG analysis.	IEx, FEx
2.1.71	Describe techniques to balance anaesthetic depth with changing surgical stimulus.	IEx, FEx
Temperature Homeostasis and Anaesthesia		
2.1.72	Describe the mechanisms by which heat is produced by the body and transferred between the body and its environment.	IEx
2.1.73	Describe the physiological effects of hypo/hyperthermia.	IEx
2.1.74	Describe the energy requirements for maintenance of normal body temperature.	IEx
2.1.75	Describe the physiological responses to lowered and raised environmental temperature, and the effects of anaesthesia on these responses.	IEx
2.1.76	Discuss methods of maintaining body temperature during anaesthesia and sedation, including active warming of patients.	CEX/CBD, IEx, FEx
2.1.77	Describe how a patient's temperature is monitored and discuss the indications for temperature monitoring with the advantages and disadvantages of particular sites and methods.	CEX/CBD, IEx, FEx
Vascular Access		

2.1.78	Outline measures to increase the rate of successful intravenous cannulation and to minimise patient discomfort during this procedure.	DOPS, FEx
2.1.79	Describe the anatomy and anatomical relations of the great veins relevant to performing central venous cannulation, including the ultrasound anatomy	FEx
2.1.80	Describe central venous cannulation by the jugular, subclavian and femoral routes, including: - Indications and contraindications - Possible complications, including measures to reduce these - Steps involved - Documentation required	DOPS, FEx
2.1.81	Describe the anatomy of the radial, brachial, femoral and dorsalis pedis arteries and their anatomical relations relevant to arterial cannulation including the ultrasound anatomy.	FEx
2.1.82	Describe arterial cannulation, including: - Indications and contraindications - Possible complications, including measures to reduce these - Steps involved - Documentation required	DOPS, FEx
Fluid Therapy (also refer to section 2.5 Perioperative Medicine on cardiovascular physiology)		
2.1.83	Define body fluid compartments and outline the physiological basis of distribution of body fluid among different body compartments.	IEx
2.1.84	Describe the composition of different body fluid compartments.	IEx
2.1.85	Outline factors determining perioperative fluid requirements and choice of fluid therapy.	IEx, FEx
2.1.86	Describe the chemical composition of crystalloids and colloids used in clinical practice and their effects / side effects when used in volume replacement.	IEx, FEx

2.1.87	Discuss the physiological principles of assessment of preload, contractility, afterload, and responsiveness to fluid challenge.	CEX/CBD. IEx
2.1.88	Discuss the appropriate choice of monitoring devices to guide fluid management in the perioperative period.	FEx
2.1.89	Discuss the indications for and complications of invasive blood pressure monitoring and the interpretation of the data.	FEx
Skills		
2.1.90	Understand the knobology of ultrasound machine and be able to obtain an optimal image to guide vascular access.	DOPS
2.1.91	Perform central venous cannulation.	DOPS
2.1.92	Perform arterial cannulation.	DOPS
2.1.93	Set up a transducer system for invasive pressure monitoring and correct equipment related problems.	DOPS
2.1.94	Prescribe appropriate fluid therapy for patients in their care.	CEX/CBD

Higher Training

By the completion of Higher Training, trainees are expected to

- **Be able to provide appropriate sedation and general anaesthesia for high-risk patients having complex procedures with distant supervision, taking into account the clinical situation including patient and procedural factors and patient co-morbidities and the trainee's experience.**

Learning outcomes		**Assessment**
Applied Clinical Pharmacology		
2.1.95	Evaluate the place of premedication and the utility of the available agents, particularly with reference to their safety in high risk patients.	CEX/CBD, FEx
2.1.96	Evaluate the merits of intravenous and inhalational induction.	CEX/CBD, FEx

2.1.97 Evaluate the use of Total Intravenous Anaesthesia (TIVA) and Target Controlled Infusion (TCI) in comparison with inhalational anaesthesia.	CEX/CBD, FEx
2.1.98 Describe the use of pharmacological models to achieve optimal sedation and anaesthesia, using a combination of drugs.	CEX/CBD, FEx
2.1.99 Evaluate the methods available for monitoring depth of anaesthesia and sedation, including the role of electronic monitoring of depth of sedation and anaesthesia.	CEX/CBD, FEx
2.1.100 Discuss the aetiology of and measures to prevent intraoperative awareness under general anaesthesia.	CEX/CBD, FEx
2.1.101 Discuss the management of a patient who complains of intra-operative awareness under general anaesthesia.	CEX/CBD, FEx
2.1.102 Discuss the potential causes and management of failure to wake up from anaesthesia.	CEX/CBD, FEx
2.1.103 Discuss the potential causes and the prevention and management of postoperative delirium.	CEX/CBD, FEx
2.1.104 Discuss the potential causes and the prevention and management of postoperative cognitive dysfunction.	CEX/CBD, FEx
2.1.105 Outline the pathophysiology of drug abuse and discuss the potential interactions with perioperative anaesthetic management.	CEX/CBD, FEx
2.1.106 Describe the clinical signs and outline the factors that may predispose to residual neuromuscular blockade.	CEX/CBD, FEx
2.1.107 Discuss the risk factors for postop nausea and vomiting and evaluate the prophylaxis and treatment strategies.	CEX/CBD, FEx
Vascular Access	
2.1.108 Describe the insertion of Peripherally Inserted Central Catheters (PICCs).	FEx

2.1.109 Discuss the advantages and disadvantages of PICCs versus Central Venous Catheters.	CEX/CBD, FEx
2.1.110 Evaluate the place of ultrasound in vascular access.	CEX/CBD, FEx
2.1.111 Discuss the advantages and disadvantages of the internal/external jugular, subclavian and femoral routes for central venous access.	CEX/CBD, FEx
Fluid Therapy	
2.1.112 Discuss factors determining perioperative fluid requirements and choice of fluids.	CEX/CBD, FEx
2.1.113 Discuss Goal Directed Fluid Therapy for complex surgical procedures.	CEX/CBD, FEx
2.1.114 Evaluate the place of CVP measurement in perioperative fluid management.	CEX/CBD, FEx
2.1.115 Describe the technique of insertion of a Pulmonary Artery catheter	CEX/CBD, FEx
2.1.116 Describe the principles of haemodynamic measurements using the Pulmonary artery catheter and evaluate its role in the perioperative settings.	CEX/CBD, FEx
2.1.117 Discuss the priniciples of Cardiac Output monitoring devices (such as Pulse Contour Analysis, and Transesophageal Doppler) and evaluate their roles in perioperative haemodynamic monitoring.	CEX/CBD, FEx
2.1.118 Discuss the role of Echocardiography in perioperative haemodynamic management	CEX/CBD, FEx
2.1.119 Critically evaluate the strategies to minimise blood loss and blood transfusion requirements.	CEX/CBD, FEx
Temperature Homeostasis and Monitoring	
2.1.120 Evaluate methods of manipulating body temperature during	FEx

	anaesthesia and sedation, including active warming and cooling of patients.	
Skills		
2.1.121	Choose a technique of anaesthesia and sedation which demonstrates integrated knowledge of the interaction of anaesthetic agents and patient and surgical factors.	CEX/CBD
2.1.122	Provide anaesthesia using TIVA	CEX/CBD
2.1.123	Perform inhalational induction of general anaesthesia in an adult.	CEX/CBD, DOPS
2.1.124	Perform central venous cannulation via Internal Jugular, Subclavian or Femoral routes.	DOPS

Volume of Practice and Workplace-Based Assessment Requirements for General Anaesthesia and Sedation

Minimum VOLUME OF PRACTICE

	DURING BASIC TRAINING	TOTAL BY THE END OF HIGHER TRAINING
Anaesthesia using TIVA	10	50
Monitored Anaesthesia Care (MAC) or Sedation (with or without neuraxial/regional block)	10	50
Central Venous Cannulation	10	50
Arterial cannulation	10	50

Minimum WORKPLACE-BASED ASSESSMENTS

	FOCUS	DURING BASIC TRAINING	DURING HIGHER TRAINING
CEX/CBD	Themes focusing on learning outcomes listed above	1	1
DOPS	Ultrasound guided Central Venous Cannulation	1	---
	Arterial cannulation	1	---
	Transducer set up and problem solving	1	---

2.2 Regional Anaesthesia

Basic Training

By the completion of Basic Training, trainees should

- **Have sound basic science knowledge and technical skills for the safe conduct of spinal anaesthesia, in anatomically easy patients**
- **Have initial exposures to epidural anaesthesia and analgesia, both intraoperatively and postoperatively**
- **Have initial exposures to major plexus blocks**
- **Have general understandings of relevant issues related to regional anaesthesia, such as patient selection, proper consent, appropriate theatre and equipment preparation, aseptic technique, detection and management of complications, and proper documentation**

Learning outcomes		Assessment
General Knowledge		
2.2.1	Describe the principles for the safe conduct of regional anaesthesia.	CEX/CBD, FEx
2.2.2	Outline the pre-operative assessment of patients specifically focusing on cencerns of regional anaesthesia.	CEX/CBD, FEx
2.2.3	Describe the absolute and relative contraindications to regional anaesthesia.	CEX/CBD, FEx
2.2.4	Articulate the indications, benefits, risks and potential complications of regional anaesthesia to obtain proper informed consent from patients.	CEX/CBD, FEx
2.2.5	Describe the necessary theatre preparation before conducting regional anaesthesia, including equipment, drugs, assistance, positioning, and proper time-out.	CEX/CBD, FEx
2.2.6	Discuss the use of sedation to alleviate pain and anxiety during performance of regional anaesthesia.	CEX/CBD, FEx
Applied Pharmacology		
2.2.7	Discuss the pharmacology of Local Anaesthetics (LA). Including:	IEx

	- Classification - Mechanism of actions - Pharmakokinetics including factors affecting systemic absorption - Concept of "Toxic dose" and manifestations of LA Toxicity	
2.2.8	Outline the clinical features and management of LA toxicity.	CEX/CBD, IEx
2.2.9	Discuss the use of adjuvant pharmacological agents in regional anaesthesia.	CEX/CBD, IEx
Central Neuraxial Blockade		
2.2.10	Describe the anatomy of the vertebrae, spinal cord and surrounding meninges.	FEx
2.2.11	Describe the absolute and relative contraindications of central neuraxial block.	CEX/CBD, FEx
2.2.12	Describe the physiological consequences of a central neuraxial block.	CEX/CBD, FEx
2.2.13	List and discuss on the management of minor and major complications of central neuraxial block.	CEX/CBD, FEx
Peripheral Plexus / Nerve Blocks		
2.2.14	Describe the relevant anatomy of the block.	CEX/CBD, FEx
2.2.15	Outline the potential complications of the block.	CEX/CBD, FEx
Skills		
2.2.16	Perform preop assessment and obtain informed consent for patients undergoing regional anaesthsia.	DOPS
2.2.17	Prepare the theatre for the safe performance of regional anaesthesia.	DOPS
2.2.18	Perform spinal anaesthesia for patients with up to moderate anatomical difficulties.	DOPS

2.2.19	Perform lumbar epidural anaesthesia for patients with up to moderate anatomical difficulties.	DOPS
2.2.20	Optimizing image on ultrasound machine for peripheral plexus / nerve blocks.	DOPS, FEx
2.2.21	Demonstrating proper needling technique with real-time ultrasound guidance including the in-plane and out-of plane approaches.	DOPS, FEx
2.2.22	Using the nerve stimulator to guide peripheral plexus / nerve block.	DOPS, FEx

Higher Training

By the completion of Higher Training, the trainee will

- **Be able to apply knowledge and skills of regional anaesthesia in various clinical situations.**
- **Be competent in performing central neuraxial blocks**
- **Be equipped with sound anatomical knowledge and technical skills of ultrasound-guided needle insertion, for the safe performance of peripheral nerve blocks**

Learning outcomes		**Assessment**
General Knowledge		
2.2.23	Describe the selection and performance of regional techniques, taking account of patient factors, co-morbidities and surgical procedure.	CEX/CBD, FEx
2.2.24	Describe the relevant anatomy of the following blocks and the use of ultrasound and nerve stimulator to facilitate the blocks: - Brachial plexus block – interscalene, supra and infraclavicular, axillary approaches - Femoral nerve / Fascia iliaca block - Obturator nerve block - Popliteal nerve block - Sciatic nerve block - Subgluteal and popliteal approaches - Ankle block - Penile block - Inguinal block	CEX/CBD, DOPS, FEx

	- Transversus Abdominus Plane (TAP) block - Rectus sheath block - Quadratus Lumborum block - Intercostal nerve block - Pectoral nerve block - Superficial and deep cervical plexus blocks - Scalp blocks - Paravertebral block	
2.2.25	Discuss the choice of drugs for regional anaesthesia using continuous catheter technique for post-operative pain.	CEX/CBD, FEx
2.2.26	Discuss the indications and contraindications, risks, benefits and possible complications of various regional anaesthesia techniques.	CEX/CBD, FEx
2.2.27	Discuss the investigation and management of patients with complications after central neuraxial block and regional techniques.	CEX/CBD, FEx
2.2.28	Describe the technique of Intravenous Regional Anaesthesia (IVRA) and outline strategies to prevent complications from IVRA.	FEx
Skills		
2.2.29	Perform central neuraxial blocks, including spinal anaesthesia, lumbar and thoracic epidural block, and caudal block.	DOPS, FEx
2.2.30	Perform the following common plexus / nerve blocks: - Brachial plexus block - Femoral nerve / Fascia iliaca block - Ilioinguinal block - Penile nerve block	DOPS, FEx

Volume of Practice and Workplace-Based Assessment Requirements for Regional Anaesthesia

Minimum VOLUME OF PRACTICE

	DURING BASIC TRAINING	TOTAL BY THE END OF HIGHER TRAINING
Spinal blocks	50	100
Epidural or Combined Spinal Epidural Blocks (non-Obstetrics)	---	15
Major plexus blocks or peripheral nerve block	---	50

Minimum WORKPLACE-BASED ASSESSMENTS

	FOCUS	DURING BASIC TRAINING	DURING HIGHER TRAINING
CEX/CBD	Themes focusing on learning outcomes listed above	1	1
DOPS	Spinal	1	---
	Epidural or Combined Spinal Epidural Blocks (non-Obstetrics)	---	1
	Peripheral plexus / nerve block (sites and approaches not specified, with or without catheter)	1	1

2.3 Airway Management

Basic Training

By the completion of Basic Training, trainees are expected to - Be able to accurately assess and formulate a reasonable plan for airway control for operations under general anaesthesia, sedation and resuscitation - Be able to master the basic airway skills, including manual ventilation with the bag-valve-mask assembly, laryngeal mask insertion, and endotracheal intubation in patients with simple or moderately difficult airway.	
Learning outcomes	**Assessment**
General Knowledge	
Basic Sciences	
2.3.1 Describe the anatomy of the airway, including innervation and endoscopic anatomy.	CEX/CBD, IEx, FEx
2.3.2 Discuss the respiratory physiology related to airway management, including changes with pregnancy, at extremes of age, and in pathological conditions.	CEX/CBD, IEx, FEx
2.3.3 Discuss the pathophysiology of pulmonary aspiration, methods of minimizing aspiration, and the role and timing of pre-operative fasting.	CEX/CBD, IEx, FEx
2.3.4 Outline the pharmacology of premedications used to decrease gastric acidity.	CEX/CBD, IEx
Airway Assessment and Plan	
2.3.5 Describe assessment of the airway during preop visit, including assessment of risk of aspiration, predictors of difficult intubation and mask ventilation, and formulation of an airway management plan.	CEX/CBD
2.3.6 Discuss the objectives and choice of methods for airway control, including manual manoevure, supraglottic devices, intubation and surgical airways.	CEX/CBD

2.3.7	Outline the options available for relieving airway obstruction in an unconscious patient.	CEX/CBD
2.3.8	List the indications for endotracheal intubation.	CEX/CBD
2.3.9	Outline the rationale and physiology behind pre-oxygenation.	CEX/CBD, IEx, FEx
2.3.10	Assess for readiness, and outline a plan for extubation / removal of supraglottic device.	CEX/CBD
Skills		
2.3.11	Accurate and complete preop airway assessment	CEX/CBD, DOPS
2.3.12	Effective manual ventilation using the Bag-Valve-Mask (BVM) assembly and the circle breathing system, demonstrating the following: - Appropriate adjustments of fresh gas flow, APL valve, and mask seal - Use of adjuncts such as oral or nasal airway - Detection of leak versus obstruction causing ineffective ventilation and institute corrective measures - Detection of abnormal compliance and/or resistance and institute appropriate therapy.	DOPS
2.3.13	Smooth insertion of supraglottic devices, demonstrating the following: - Appropriate selection of supraglottic device - Atraumatic insertion, with or without insertion aids - Early detection of problems such as airway obstruction (e.g. laryngospasm) and institute measures to alleviate it	DOPS
2.3.14	Direct laryngoscopy and endotracheal intubation, demonstrating the following: - Proper patient positioning - Optimal insertion of blade - Optimal lifting and use of external laryngeal manipulation such as the BURP maneovre - Appropriate use of intubation aids such as stylet and bougie	DOPS

2.3.15 Perform rapid sequence induction, demonstrating the following: - Preparation of appropriate equipment, suction, drugs, assistance, and positioning - Proper instructions to assistance for cricoid pressure - Appropriate selection of induction agent and relaxant - Confirmation of endotracheal intubation	DOPS
2.3.16 Perform a nasal intubation (exclude flexible bronchoscopy) under general anaesthesia	DOPS
2.3.17 Use of Videolaryngoscopes in patients with features of difficult intubation.	DOPS

Higher Training

By the completion of Higher Training, trainees are expected to - **Apply knowledge and skills for airway management in clinical practice, in relation to the specific needs in different clinical settings** - **Be aware of advanced airway management techniques, such as the use of video laryngoscopes, flexible bronchoscopic intubation though a supraglottic device, and various techniques of surgical airway**	
Learning outcome (Please refer to Section 3 Specialty modules for learning outcomes related to airway management in ENT, Paediatric and thoracic cases)	**Assessment**
General Knowledge	
Airway Equipment	
2.3.18 Describe the design features of modified laryngoscopes and blades, indications for their use, and potential limitations.	CEX/CBD, FEx
2.3.19 Describe the design features of videolaryngoscopes available in local institutional settings, and outline the pros and cons of their use.	CEX/CBD, FEx
2.3.20 Describe the design features of endotracheal tubes and their modifications, such as the reinforced tube, foam-cuff tube, laryngectomy tube, laser-resistant tube, micro-laryngoscopy tube,	CEX/CBD, FEx

	and tubes for monitoring recurrent laryngeal nerve function.	
2.3.21	Describe the design features of the Bag-Valve-Mask assembly.	CEX/CBD, FEx
2.3.22	Describe the design features of the supraglottic airway devices.	CEX/CBD, FEx
2.3.23	Describe the design features of tracheostomy tubes.	CEX/CBD, FEx
Difficult Airway Algorithms		
2.3.24	Describe the international difficult airway algorithms and evaluate its application in the local institutional settings.	CEX/CBD, FEx
2.3.25	Describe the different techniques of surgical cricothyroidotomy and evaluate the pros and cons of each technique.	CEX/CBD, FEx
2.3.26	Discuss the complications of airway management, including oropharyngeal, laryngeal and dental injuries.	CEX/CBD, FEx
Flexible Bronchoscopic Intubation		
2.3.27	Outline the techniques for providing anaesthesia of the upper airway for the performance of flexible bronchoscopic intubation.	CEX/CBD, FEx
2.3.28	Discuss the use of sedation during awake flexible bronchoscopic intubation.	CEX/CBD, FEx
2.3.29	Describe the technique of performing flexible bronchoscopic intubation through a supraglottic airway device	CEX/CBD, FEx
Tracheostomy		
2.3.30	Discuss the airway management plan for tracheostomy under general anaesthesia.	CEX/CBD, FEx
2.3.31	Discuss the immediate and long term complications of tracheostomy.	CEX/CBD, FEx
Airway Challenges		
2.3.32	Describe the airway management for patients with - Acute infective conditions, such as epiglottitis - Oropharyngeal tumour - Facial scarring, fibrosis or contractures	CEX/CBD, FEx

	- Vocal cord palsies - Head and neck trauma including laryngeal injury, cervical spine injuries and severe facial burns - Systemic illness such as morbid obesity, ankylosing spondylitis, rheumatoid arthritis and craniofacial abnormalities	
Skills		
2.3.33	Use of videolaryngoscope in patients with difficult airway	DOPS, FEx
2.3.34	Performing fibreoptic intubation, demonstrating the following: - Appropriate selection of bronchoscope and endotracheal tubes - Appropriate preparation of equipment - Adequate local anaesthesia of the airway for awake intubation - Judicious use of sedation - Advancement of bronchoscope according to endoscopic views - Smooth railroading of endotracheal tube over bronchoscope - Confirmation of position of endotracheal tube	DOPS, FEx

Volume of Practice and Workplace-Based Assessment Requirements for Airway Management

Minimum VOLUME OF PRACTICE

	DURING BASIC TRAINING	TOTAL BY THE END OF HIGHER TRAINING
Insertion of Supraglottic devices	50	---
Direct Laryngoscopy and Intubation	50	---
Video Laryngoscopy and Intubation	10	20
Flexible bronchscopic Intubation (awake or asleep, oral or nasal)	3	10

Minimum WORKPLACE-BASED ASSESSMENTS

	FOCUS	DURING BASIC TRAINING	DURING HIGHER TRAINING
CEX/CBD	Themes focusing on learning outcomes listed above	1	1
DOPS	Elective airway management in an adult (BVM/LMA/ETT)	1	---
	Rapid sequence induction in an adult	1	---
	Flexible bronchoscopic intubation (including LA of the airway)	1 (CAN BE DONE IN BT OR HT YEARS)	
	Provision of airway management for patient with potential or actual cervical spine instability	1 (CAN BE DONE IN BT OR HT YEARS)	
	Provision of anaesthesia for tracheostomy in an adult	1 (CAN BE DONE IN BT OR HT YEARS)	

2.4 Acute Pain Management

Basic Training

By the completion of Basic Training, trainees are expected to

- **Understand the neurobiology of pain**
- **Understand the clinical pharmacology of analgesic agents**
- **Be able to assess pain in the perioperative settings and initiate appropriate treatment**

Learning outcomes		Assessment
Neurobiology of Pain		
2.4.1	Define pain, acute pain, chronic pain and neuropathic pain.	IEx
2.4.2	Describe the anatomy of the sensory pathways with particular reference to pain sensation.	IEx
2.4.3	Describe the anatomy of the autonomic nervous system.	IEx
2.4.4	Describe the basic physiological mechanisms of pain including: - Peripheral nociception - Conduction - Spinal cord modulation - Central processing of pain - Mediators, pathways and reflexes - Peripheral and central sensitization - Pre-emptive and preventive analgesia	IEx
2.4.5	Describe the physiological mechanism of progression from acute to chronic pain.	IEx
2.4.6	Describe the injury response to acute pain.	IEx
2.4.7	Describe the applied physiology of classical neuropathic pain.	IEx
2.4.8	Outline the effects of pain and analgesia on injury-induced organ dysfunction.	IEx
2.4.9	Describe the alterations to physiology and perception of pain in the older patient.	IEx

2.4.10	Compare and contrast between opioid tolerance and opioid-induced hyperalgesia.	IEx
Clinical Pharmacology of Analgesic Agents		
2.4.11	Describe the pharmacology of the following agents applicable to pain management, including: - Opioids - Local anaesthetic agents (also refer to section 2.2 Regional Anaesthesia clinical fundamental) - NSAIDs/COX-2 inhibitors - Paracetamol - NMDA antagonists - Anticonvulsants - Antidepressants - Corticosteroids - Inhalational analgesics	IEx
2.4.12	Describe the effect of physiological change and pathological disturbance on the pharmacology of the agents with special reference to the elderly.	IEx
2.4.13	Describe the different modes of administration of analgesic agents and evaluate their clinical application.	IEx
2.4.14	Outline the basic concepts of multimodal analgesia.	IEx, FEx
2.4.15	Outline the pharmacokinetic principles of neonatal drug transfer via milk in breastfeeding in relevance of common analgesics in acute pain.	IEx
Pharmacology of Specific Agents: Opioid Agonists and Antagonists		
2.4.16	Describe opioid receptors.	IEx
2.4.17	Describe the mechanisms of action of opioids.	IEx
2.4.18	Describe the pharmacology of different opioids with mixed actions.	IEx
2.4.19	Describe the actions of agonists, partial agonists, mixed agonists-antagonists and antagonists.	IEx

2.4.20	Discuss the pharmacology of different routes of administration for commonly used opioids, including the oral, transdermal, subcutaneous, central neuraxial, transmucosal, intranasal, intramuscular and intravenous routes.	IEx
2.4.21	Outline the dose conversion between commonly used opioids.	IEx
2.4.22	Describe the adverse effects of opioids administered by systemic and neuraxial routes and their prevention and management.	IEx
2.4.23	Describe the potential adverse drug interactions between opioids and other agents.	IEx
2.4.24	Describe the pharmacology of opioid antagonists, including the clinical application of ultra-low dose antagonist in opioid pharmaceutics.	IEx
2.4.25	Describe the pharmacodynamics of individual opioids and evaluate their clinical applications.	IEx
Pharmacology of Specific Agents: NSAIDs		
2.4.26	Describe the prostaglandin pathways and their physiological role in the production of pain.	IEx
2.4.27	Classify non-steroidal anti-inflammatory drugs and outline their pharmacology in relation to enzyme inhibition, mode of administration and adverse effects.	IEx
2.4.28	Describe in detail pharmacology of paracetamol including mode of action, clinical utility, metabolism and toxicity (acute & chronic), drug interactions, advantages and disadvantages of different routes of administration.	IEx
Clinical Pain Management		
2.4.29	Describe the assessment of acute pain, including pain assessment scales and functional assessment.	CEX/CBD, FEx
2.4.30	Discuss the plan of management of postop pain - In the Recovery Room - After discharge from the Recovery Room	CEX/CBD, FEx

2.4.31	Describe the advantages and disadvantages of patient-controlled analgesia (PCA), continuous infusion and intermittent administration of opioids for acute pain management.	CEX/CBD, FEx
Skills		
2.4.32	Setting up of Patient Controlled Analgesia Machines, systemic analgesic infusions, and postop infusions via neuraxial or peripheral plexus catheters, demonstrating - Appropriate selection of drugs - Appropriate prescription of PCA or infusion regimes - Awareness of the safety features related to equipment set up, such as appropriate labelling of machine and lines, keypad locking, drug container locking, exclusion of air in drug compartment and lines, and use of anti-siphon valve - Awareness of the need for appropriate monitoring and follow up	DOPS

Higher Training

By the completion of Higher Training, trainees are expected to

- **Be an effective member of the Acute Pain Team**
- **Be able to implement a management strategy for patients with acute pain in the hospital environment**
- **Be able to recognize clinical situations where consultation with a pain specialist is required**

Learning outcomes		**Assessment**
Acute Pain Assessment and Care Plan		
2.4.33	Formulate a plan for acute pain management, which shows integrated knowledge of the interaction of analgesic agents, patient factors and the aetiology of pain.	CEX/CBD, FEx
2.4.34	Discuss the importance of psychological and social factors in the presentation and management of acute pain.	CEX/CBD, FEx
2.4.35	Organise appropriate review and follow up for patients, after their discharge from the acute pain service.	CEX/CBD, FEx

2.4.36	Prescribe and manage patient controlled analgesia (PCA) and/or analgesic infusions for patients with acute pain and manage potential complications.	CEX/CBD, FEx
2.4.37	Prescribe, set up and appropriately adjust neuraxial and continuous peripheral nerve infusions for patients with acute pain and manage potential complications.	CEX/CBD, FEx
2.4.38	Describe the principles of neuraxial analgesia including efficacy, drugs used, adverse effects, program parameters, equipment, patient selection and safe administration.	CEX/CBD, FEx
2.4.39	Outline clinical situations where regional infusion techniques may be of benefit for the management of acute pain (also refer to section 2.2 Regional Anaesthesia).	CEX/CBD, FEx
2.4.40	Outline the management of opioid-induced over-sedation and/or respiratory depression in acute pain settings.	CEX/CBD, FEx
2.4.41	Discuss the interaction between pain management techniques and postoperative delirium.	CEX/CBD, FEx
2.4.42	Discuss the pathophysiology, risk factors, complications and management of post-dural puncture headache.	CEX/CBD, FEx
2.4.43	List the predictive factors for persistent post-surgical pain (PPSP) and outline measures to prevent or minimize its occurrence.	CEX/CBD, FEx
Management of Pain in Specific Clinical Situations		
2.4.44	Discuss the management of acute pain in patients with preexisting chronic pain.	CEX/CBD, FEx
2.4.45	Outline a protocol for the management of pain in recovery area.	CEX/CBD, FEx
2.4.46	Discuss the management of acute pain following trauma, including chest and orthopaedic trauma.	CEX/CBD, FEx
2.4.47	Outline the issues involved in the management of acute pain during pregnancy and during lactation (also refer to section 3.5 Obstetric Anaesthesia and Analgesia).	CEX/CBD, FEx

2.4.48	Evaluate the role of acute pain management in rehabilitation and Enhanced Recovery After Surgery (ERAS) procedures.	CEX/CBD, FEx
2.4.49	Outline a pain management plan for patients having day surgery procedures.	CEX/CBD, FEx
2.4.50	Discuss issues relevant to the management of pain in the elderly in acute pain settings.	CEX/CBD, FEx
2.4.51	Discuss issues relevant to the management of pain in paediatrics in acute pain settings.	CEX/CBD, FEx
2.4.52	Outline the pathophysiology of chronic opioid use and abuse and outline management strategies for opioid tolerant patients with acute pain.	CEX/CBD, FEx

Volume of Practice and Workplace-Based Assessment Requirements for Acute Pain Management

Minimum VOLUME OF PRACTICE

	DURING BASIC TRAINING	TOTAL BY THE END OF HIGHER TRAINING
Non-Obstetrics patients (Number of patient visits)		
Postop iv PCA	10	80
Postop Central Neuraxial Analgesia	5	20
Obstetrics, post Caesarean Section patients (Number of patient visits)		
Any acute pain modality	---	20

Minimum WORKPLACE-BASED ASSESSMENTS

	FOCUS	DURING BASIC TRAINING	DURING HIGHER TRAINING
CEX/CBD	Themes focusing on learning outcomes listed above To be performed during Acute pain round	1	1
DOPS	Setting up PCA machines or postop analgesic infusions	1	---

2. 5 Perioperative Medicine

This section covers a wide range of knowledge and skills essential for the practice of perioperative medicine for the modern-day anaesthetists, including basic sciences relevant to clinical practice, preop assessment and optimization, formulaton of care plan, obtaining informed consent, and postoperative management. This applies to a wide range of patient population undergoing different types of surgery, including fit and healthy young patient undergoing simple surgery who are ready to be discharged home on the same day, to the elderly and fragile patients with significant co-morbidities who will require postoperative intensive care management.

The curriculum review workgroup supports the use of **Focused Trans-Thoracic Echocardiography (Focused TTE)** by anaesthetists as an aid for haemodynamic assessment and monitoring. The breadth and depth of knowledge required, the intended learning pathway, and the method of assessment of learning outcomes are listed in **Appendix 7**

Basic Training

By the completion of Basic Training, trainees should

- **Have acquired knowledge of physiology and pharmacology relevant to the safe practice of perioperative medicine**
- **Be able to perform structured pre-operative assessments and discuss the perioperative management with supervisors. They should be able to assess the severity of common medical conditions that have impacts on anaesthesia, and be able to recognize when further assessment, optimization and/or referral is required**
- **Be able to explain options and risks of routine anaesthesia to patients and obtain informed consent**

Learning outcomes		Assessment
Essentials of Preoperative Assessment		
2.5.1	Outline the ASA physical status classification system and the implications for anaesthesia.	CEX/CBD, FEx
2.5.2	Outline the functional assessment of patients based on exercise capacity and performance of activities of daily living.	CEX/CBD, FEx
2.5.3	Outline how functional assessment is used in perioperative risk management.	CEX/CBD, FEx
2.5.4	Discuss the use and interpretation of common investigations relevant to clinical anaesthesia/intensive care and perioperative management. These investigations will include but not limited to blood tests, ECG, radiological investigations (such as plain X-ray, CAT scan or MRI) of relevant body regions, and specific tests such	CEX/CBD, FEx

	as the lung function tests, sleep studies, basic ultrasound, and basic EEG interpretation.	
2.5.5	Describe the management of common arrhythmias.	CEX/CBD, FEx
2.5.6	Describe the features of a diagnostic test, including the concept of sensitivity, specificity, positive and negative predictive value and how these are affected by the prevalence of disease in question.	IEx
2.5.7	Describe the adverse effects of antimicrobial agents.	IEx
2.5.8	Outline the pharmacology of commonly encountered illicit drugs and their interactions with drugs used in anaesthetic care.	CEX/CBD, FEx
2.5.9	Discuss the role of antibiotic prophylaxis in preventing infection and the identification of patients requiring it.	CEX/CBD, FEx
2.5.10	Describe the potential drug interactions and adverse effects of herbal medicines with particular reference to the perioperative period.	CEX/CBD, FEx
2.5.11	Describe the perioperative risks and anaesthetic management for the surgical patient with co-existing disease, such as: - Respiratory infection - Chronic obstructive airways disease - Asthma - Restrictive lung disease - Pulmonary embolus - Obstructive sleep apnoea - Pulmonary hypertension - Congenital heart disease - Systemic hypertension - Ischaemic heart disease - Congestive cardiac failure - Arrhythmias and conduction abnormalities - Cardiac pacemakers and related devices - Transient ischaemic attack and stroke - Parkinson's disease - Myasthenia Gravis and myasthenic syndrome - Muscular dystrophies, myopathies and myotonias	CEX/CBD, FEx

	- Multiple sclerosis - Cerebral palsy - Pseudocholinesterase deficiency - Diabetes mellitis - Morbid obesity - Thyroid disease - Carcinoid disease and syndrome - Phaeochromocytoma - Rheumatoid arthritis - Scleroderma - Immunocompromised patient - Steroid dependence - Post-transplant patient - Acute and chronic renal impairment - Electrolyte abnormalities - Acid base abnormalities - Haematological malignancies - Thromboembolic disease - Coagulopathy - Thrombocytopenia - Anaemia - Anticoagulant use - Haematemesis - Porphyria - Tobacco use	
2.5.12	Outline the principles of informed consent for surgery and anaesthesia, including the issue of capacity.	CEX/CBD, FEx
2.5.13	Outline the legal perspectives of Bolam versus Montgomery case, with particular reference to explanation of "material risks", from the views of a "reasonable doctor" versus a "reasonable patient".	CEX/CBD, FEx
Respiratory Anatomy and Physiology		
2.5.14	Discuss the structure of the chest wall and diaphragm and the implications for respiratory mechanics.	IEx
2.5.15	Outline the anatomy of the upper and lower airways.	IEx
2.5.16	Outline the anatomy of the pulmonary and bronchial circulations.	IEx

2.5.17	Describe the neural and chemical control of ventilation via central and peripheral chemoreceptors and indicate how this is altered by anaesthesia and abnormal clinical states.	IEx
2.5.18	Describe the properties of surfactant and relate these to its role in influencing respiratory mechanics.	IEx
2.5.19	Define compliance (static, dynamic and specific) and relate this to the elastic properties of the lung.	IEx
2.5.20	Discuss fast and slow alveoli, including the concept of time constants.	IEx
2.5.21	Describe the elastic properties of the chest wall and plot pressure-volume relationships of the lung, chest wall and the total respiratory system.	IEx
2.5.22	Explain the vertical gradient of pleural pressure and its significance.	IEx
2.5.23	Explain the physics of gas flow and the significance of the relationship between resistance and flow in the respiratory tract.	IEx
2.5.24	Describe the factors affecting airway resistance and how airway resistance may be measured.	IEx
2.5.25	Describe closing capacity and its relationship to airway closure and explain its clinical significance and measurement.	IEx
2.5.26	Describe the work of breathing.	IEx
2.5.27	Describe altered lung mechanics in common disease states.	IEx
2.5.28	Discuss lung volumes and capacities, their measurement and normal values.	IEx
2.5.29	Discuss dead space, its measurement and apply the Bohr equation and alveolar gas equation.	IEx
2.5.30	Discuss the composition of ideal alveolar and mixed expired gases.	IEx
2.5.31	Describe the oxygen cascade.	IEx
2.5.32	Describe the alveolar exchange of oxygen and carbon dioxide.	IEx

2.5.33	Discuss diffusion capacity and its measurement.	IEx
2.5.34	Discuss normal ventilation-perfusion matching.	IEx
2.5.35	Discuss West's zones of the lung.	IEx
2.5.36	Describe the shunt equation.	IEx
2.5.37	Discuss the regional ventilation-perfusion inequalities, venous admixture and the effect on oxygenation and carbon dioxide elimination.	IEx
2.5.38	Outline methods used to measure ventilation-perfusion inequalities.	IEx
2.5.39	Discuss the carriage of oxygen in blood, the oxygen-dissociation curve, oxygen stores in the blood and their clinical significance and implications.	IEx
2.5.40	Discuss the carriage of carbon dioxide in blood, the carbon dioxide dissociation curve and their clinical significance and implications.	IEx
2.5.41	Discuss the difference between the pulmonary and systemic circulations.	IEx
2.5.42	Discuss pulmonary vascular resistance and the control of pulmonary vascular tone.	IEx
2.5.43	Discuss the physiological consequences of intermittent positive pressure ventilation and positive end-expiratory pressure.	IEx
2.5.44	Discuss the physiological effects of hypoxaemia, hyper and hypocapnia, and carbon monoxide poisoning.	IEx
2.5.45	Discuss the effect of the following on respiration: - Changes in posture - Exercise - Pregnancy - Extremes of age - Morbid obesity - Changes in altitude / Diving - Anaesthesia	IEx

	- Pathologcial states, such as spinal cord transection	
2.5.46	Define humidity and outline the importance of humidification. Outline methods of measuring humidity.	IEx
2.5.47	Outline the non-ventilatory function of the lungs.	IEx
Respiratory Pharmacology		
2.5.48	Describe the pharmacology of anti-asthma drugs, including beta 2 agonists, corticosteroids, anticholinergics, leukotriene antagonists and theophylline.	IEx
2.5.49	Outline the pharmacology of drugs used to treat pulmonary hypertension including phosphodiesterease inhibitors and nitric oxide.	IEx
2.5.50	Outline the use of oxygen therapy in the perioperative settings.	IEx
2.5.51	Describe the performance of different oxygen delivery devices.	IEx, FEx
2.5.52	Define oxygen toxicity, and outline its pathophysiology and clinical manifestations.	IEx
Cardiovascular Anatomy and Physiology		
2.5.53	Describe the anatomy of the major arteries and veins.	IEx
2.5.54	Discuss the physiological basis of electrical activity and its relationship to mechanical events including the: - Ionic basis of automaticity, and the normal and abnormal processes of cardiac excitation - Physiological basis of the ECG in normal and common pathological states - Factors that may influence cardiac electrical activity - Correlation of the mechanical events of the cardiac cycle with electrical and ionic events	IEx
2.5.55	Describe the physiology of cardiac muscle and the mechanism of excitation contraction coupling.	IEx
2.5.56	Discuss the factors that determine and control cardiac output and	IEx

	the implications for clinical practice, including: - Preload, afterload and contractility - The Frank-Starling mechanism - Cardiac output and vascular function curves - Pressure volume relationships in the heart	
2.5.57	Discuss the factors determining myocardial oxygen supply and demand and their clinical implications.	IEx
2.5.58	Discuss the control of blood pressure and the distribution of blood volume and flow throughout the cardiovascular system, including: - The factors determining systemic blood pressure and its regulation and control - Total peripheral resistance and factors affecting it - The relationship between organ blood flow and demand and the role of autoregulation - Clinically significant features of the coronary, cerebral, skin, muscle, renal, hepatic and splanchnic circulations - The essential features of the microcirculation including fluid exchange and its control	IEx
2.5.59	Discuss the cardiovascular responses to: - Changes in posture - Exercise - Valsalva maneouvre - Positive pressure ventilation and PEEP - Pneumoperitoneum - Haemorrhage and hypovolaemia - Surgery and trauma	IEx
2.5.60	Describe the cardiovascular changes that occur with ageing.	IEx
2.5.61	Describe the cardiovascular changes that occur with morbid obesity.	IEx
Cardiovascular Pharmacology		
2.5.62	Describe the autonomic nervous system and its physiological roles including: - Autonomic receptors and cellular effects of receptor activation	IEx

	- Autonomic transmitters, their synthesis, release and fate	
2.5.63	Describe the mechanism of action and effects of the sympathomimetic and anticholinergic drugs used clinically.	IEx
2.5.64	Describe the pharmacology and clinical application of adrenergic agonists.	IEx
2.5.65	Describe the pharmacology of commonly used alpha and beta receptor blocking agents, their clinical use, adverse effects and use in the perioperative period.	IEx
2.5.66	Outline clinically important drug interactions with the automatic nervous system.	IEx
2.5.67	Describe the physiological and pharmacological basis of antiarrhythmic therapy including classification based on electro-physiological activity and mechanism of action.	IEx
2.5.68	Describe the pharmacology of antiarrhythmic agents and their clinical applications.	IEx
2.5.69	Describe the pharmacology of anti-hypertensive agents and their clinical applications.	IEx
2.5.70	Describe the pharmacology of drugs used to manage myocardial ischaemia/infarction including anti-platelets, anti-coagulants and thrombolytic drugs.	IEx
2.5.71	Describe the pharmacology of drugs used to manage acute or chronic heart failure and their clinical applications.	IEx
Renal and Fluid & Electrolytes		
2.5.72	Describe the functional anatomy of the kidneys and urinary tract.	IEx
2.5.73	Explain the physiology of renal blood flow.	IEx
2.5.74	Describe glomerular filtration and tubular function.	IEx
2.5.75	Explain the counter-current mechanisms in the kidney.	IEx
2.5.76	Explain the mechanisms involved in the regulation of renal function.	IEx

2.5.77	Outline the endocrine functions of the kidney.	IEx
2.5.78	Describe the role of the kidney in the handling of glucose, nitrogenous products and drugs.	IEx
2.5.79	Describe the principles of measurement of glomerular filtration rate and renal blood flow.	IEx
2.5.80	Describe the physiological effects and clinical assessment of renal dysfunction.	IEx
2.5.81	Explain the renal responses to hyovolaemia.	IEx
2.5.82	Explain the effects of anaesthesia on renal function.	IEx
2.5.83	Describe the function, distribution and physiological importance of sodium, potassium, magnesium, calcium and phosphate ions.	IEx
2.5.84	Describe the mechanisms involved in the maintenance of fluid and electrolyte balance.	IEx
2.5.85	Outline the constituents and functions of plasma.	IEx
2.5.86	Define osmotic pressure and explain the factors that determine it.	IEx
2.5.87	Describe the regulation of osmolality.	IEx
2.5.88	Outline the significance of oncotic pressure, colloid osmotic pressure and reflection coefficients.	IEx
2.5.89	Describe the regulation of acid/base balance.	IEx
2.5.90	Describe acid-base chemistry using the Henderson-Hasselbach equation and strong ion difference.	IEx
2.5.91	Describe alterations to drug response due to renal disease.	IEx
2.5.92	Outline a physiological basis of classifying diuretics related to their site of action.	IEx
2.5.93	Describe the pharmacology of diuretics.	IEx
Metabolic and Endocrine Physiology		

2.5.94 Outline basic cellular physiology, in particular - The structure of the cell membrane and trans-membrane transport mechanisms - The composition and regulation of intracellular fluid - The generation of the trans-membrane potential - Energy production by metabolic processes in cells	IEx
2.5.95 Describe the physiological consequences of starvation.	IEx
2.5.96 Discuss the factors that influence metabolic rate.	IEx
2.5.97 Explain the control of blood glucose.	IEx
2.5.98 Describe the role of the hypothalamus in the integration of neuro-humoral responses.	IEx
2.5.99 Describe the control of secretion and the functions of: - Pituitary hormones - Thyroid hormones - Adrenocortical hormones - Adrenomedullary hormones - Renin and angiotensin - Atrial natriuretic peptide	IEx
2.5.100 Describe the regulation of plasma calcium including the actions and control of Vitamin D, parathormone and calcitonin.	IEx
2.5.101 Outline the role of prostaglandins and other autocoids.	IEx
Endocrine Pharmacology	
2.5.102 Describe the pharmacology of: - Insulin preparations - Oral hypoglycaemics - Corticosteroid drugs	IEx
2.5.103 Outline the pharmacology of: - Thyroid hormone replacement and anti-thyroid drugs - Glucagon - Vasopressin and analogues	IEx
Neurophysiology	

2.5.104 Outline the basic electrophysiology of nerve conduction.	IEx
2.5.105 Describe the physiology of sleep.	IEx
2.5.106 Outline the basis of the electroencephalogram.	IEx
2.5.107 Discuss the determinants and control of: - Intracranial and intraspinal pressure - Cerebral blood flow and autoregulation - Cerebral perfusion pressure - Spinal cord perfusion	IEx
2.5.108 Describe the structure and function of the blood brain barrier.	IEx
2.5.109 Describe the composition, dynamics and metabolism of cerebrospinal fluid.	IEx
2.5.110 Describe the cerebral and spinal cord metabolism including energy production, effects of temperature and factors leading to cell damage and cell death.	IEx
2.5.111 Describe the physiology of skeletal muscle including excitation contraction coupling and compare the physiology of skeletal muscle with that of cardiac muscle.	IEx
2.5.112 Define and explain the physiological mechanisms of a reflex.	IEx
Neurological Pharmacology	
2.5.113 Outline the pharmacology of anti-depressant, anti-psychotic, anti-convulsant, anti-parkinsonian and anti-migraine medication.	IEx
2.5.114 Outline the pharmacology of histamine antagonists.	IEx
2.5.115 Outline the pharmacology of drugs acting via effects on serotonin or serotonin receptors.	IEx
2.5.116 Discuss the clinical features and management of serotonin syndrome.	IEx
Gastrointestinal Anatomy and Physiology	
2.5.117 Describe the storage, synthetic, metabolic, immunological and	IEx

	excretory functions of the liver and identify the physiological consequences of hepatic disease.	
2.5.118	Describe the anatomical and physiological considerations in hepatic blood flow, and the changes that occur with anaesthesia.	IEx
2.5.119	Describe the portal circulation and its significance.	IEx
2.5.120	Describe the laboratory assessment of liver function and hepatic failure.	IEx
2.5.121	Explain the: - Physiology of swallowing - Factors preventing reflux of gastric contents into the oesophagus - Control of gastric motility and emptying - Composition of gastric fluid - Physiology of nausea and vomiting	IEx
Gastrointestinal Pharmacology		
2.5.122	Describe alterations to drug response due to hepatic disease.	IEx
2.5.123	Outline the pharmacological treatment of peptic ulcer disease and reflux.	IEx
Haematology, Transfusion Medicine and Oncology		
2.5.124	Describe the physiological consequences of acute and chronic anaemia.	IEx
2.5.125	Outline the major haemoglobinopathies and their clinical significance.	IEx
2.5.126	Describe the physiology of haemostasis, including: - Coagulation - The role of platelets - Fibrinolysis	IEx
2.5.127	Describe the physiological mechanisms of limiting and preventing thrombosis.	IEx
2.5.128	Outline the methods for assessing coagulation, platelet function	IEx

and fibrinolysis.	
2.5.129 Describe blood groups and outline the principles and procedures of compatibility testing.	IEx
2.5.130 Outline the composition, indications and risks of use of the following blood components and products: - Whole Blood - Packed red cells - Plasma - Platelets - Cryoprecipitates - Factor VIIa	IEx
2.5.131 Describe the changes that occur during blood storage and their clinical implications.	IEx
Pharmacology of Haematology, Transfusion Medicine and Oncology	
2.5.132 Describe the pharmacology of heparin and low molecular weight heparins including their side-effects.	IEx
2.5.133 Describe the mode of action of protamine and potential adverse reactions.	IEx
2.5.134 Describe the pharmacology of warfarin and other oral anticoagulant drugs, including the direct thrombin inhibitors.	IEx
2.5.135 Describe methods to reverse the effect of warfarin.	IEx
2.5.136 Classify and describe the pharmacology of anti-platelet drugs.	IEx
2.5.137 Outline the pharmacology of thrombolytic drugs.	IEx
2.5.138 Outline the pharmacology of anti-fibrinolytic agents, in particular tranexamic acid.	IEx
2.5.139 Outline the pharmacology of cancer chemotherapeutic agents with particular reference to problems that such agents may cause during the perioperative period.	IEx
Immunology	

2.5.140 Explain how the body defends against infection.	IEx
2.5.141 Outline the effects of anaesthesia and surgery on immune function.	IEx
2.5.142 Describe the immunological basis and pathophysiological effects of hypersensitivity.	IEx
2.5.143 Outline the principles of tissue/organ transplantation and the mechanisms of rejection of allogeneic organs.	IEx
Immunology-related Pharmacology	
2.5.144 Outline the pharmacology of antimicrobial drugs and their interactions with other drugs used during the perioperative period.	IEx
2.5.145 Explain the principles of antibiotic prophylaxis.	IEx
2.5.146 Outline the pharmacology of antiseptics and disinfectants, their clinical use and associated risks.	IEx
Skills	
2.5.147 Perform an accurate and complete preoperative assessment.	CEX/CBD
2.5.148 In patients with co-existing diseases, assess severity and perioperative risks and initiate perioperative management including consultation for further assessment and optimization when appropriate.	CEX/CBD
2.5.149 Summarize specific concerns related to anaesthesia and perioperative care.	CEX/CBD
2.5.150 Formulate an anaesthesia and perioperative management plan, and discuss with clinical supervisor.	CEX/CBD
2.5.151 Present information, including the risks and benefits of available anaesthetic techniques to patients and carers in a format they understand, and obtain proper informed consent.	CEX/CBD

Higher Training

By the completion of Higher Training, trainees should

- **Be able to provide perioperative care for patients with significant co-morbidities, including the perioperative assessment and risk stratification, preparation and optimisation prior to surgery, intraoperative care, and early and late postoperative care to ensure any harmful consequences of surgery are minimized.**
- **Be able to work effectively in partnership with colleagues from other specialties and adopt a leadership role in the multi-disciplinary perioperative care pathway.**

Learning outcomes	Assessment
Knowledge	
2.5.152 Evaluate the available classifications of physical status and their use in perioperative assessment.	CEX/CBD, FEx
2.5.153 Evaluate measures to alleviate the risk of the following complications in the perioperative period: - Aspiration - Venous thromboembolism - Surgical infection	CEX/CBD, FEx
2.5.154 Discuss the reasons for and potential implications of with-holding or continuing regular medications in the perioperative period.	CEX/CBD, FEx
2.5.155 Discuss the role of prehabilitation.	CEX/CBD, FEx
2.5.156 Discuss the role and indications for high-carbohydrate pre-operative drinks, enteral feeding, and parenteral nutrition.	CEX/CBD, FEx
2.5.157 Discuss the principles of Enhanced Recovery After Surgery (ERAS) pathways and their limitations	CEX/CBD, FEx
2.5.158 Discuss considerations for patients presenting for day surgery, including case selection, choice of anaesthesia technique, and discharge criteria.	CEX/CBD, FEx
Skills	
2.5.159 Acting as the patient's health advocate, especially for patients with medical comorbidities requiring complex, high-risk surgeries, after overlooking and balancing all risks and benefits involved in	CEX/CBD

	anaesthesia, surgery and likely postop course.	
2.5.160	Communication of the care plan to patient and/or carers in a professional way that fosters development of trust.	CEX/CBD
2.5.161	Communicating and collaborating with other healthcare teams (such as physicians, physiotherapists, dietitians) for preop optimization.	CEX/CBD
2.5.162	Communicating and collaborating with other healthcare teams (such as intensive care physicians, pain specialists, allied health workers) for continuity of care in the postop period.	CEX/CBD

Volume of Practice and Workplace-Based Assessment Requirements for Perioperative Medicine

Minimum VOLUME OF PRACTICE

There is no minimum VOP in this section of the curriculum.

Minimum WORKPLACE-BASED ASSESSMENTS

	FOCUS	DURING BASIC TRAINING	DURING HIGHER TRAINING
CEX/CBD	Themes focusing on learning outcomes listed above	1	1

2.6 Trauma, Crisis and Resuscitation

Basic Training

By the completion of Basic Training, trainees will be able to

- **Understand the pathophysiology of immediately life threatening conditions and will be able to recognize and initiate management of crises that may be encountered by anaesthetists in the course of their practice**
- **Participate as a multidisciplinary team member in the initial assessment and resuscitation of patients with life threatening medical and surgical conditions**

Learning outcomes		Assessment
Scientific Basis of Acute Medicine		
Physiology / Pathophysiology		
2.6.1	Define shock.	IEx
2.6.2	Integrate knowledge of factors determining cardiac output to classify causes of shock.	IEx
2.6.3	Describe the physiological consequences of shock.	IEx
2.6.4	Describe oxygen delivery and outline the use of indicators of tissue oxygenation (base deficit, lactate, mixed venous oxygen saturation) in resuscitation.	IEx
2.6.5	Describe the systemic inflammatory response and its physiological effects.	IEx
2.6.6	Describe the physiological basis of anaphylactic and anaphylactoid reactions.	IEx
2.6.7	Describe the physiological basis of transfusion reactions.	IEx
2.6.8	Describe the physiological consequences of massive transfusion.	IEx
2.6.9	Outline the causes of hypoxaemia.	IEx
2.6.10	Describe the physiological consequences of hypoxaemia.	IEx
2.6.11	Outline the factors determining intracranial pressure and discuss	IEx

	its regulation.	
2.6.12	Describe the cerebral circulation, the regulation of cerebral blood flow and factors leading to the loss of autoregulation.	IEx
2.6.13	Discuss cerebral perfusion pressure.	IEx
2.6.14	Describe the blood supply to the spinal cord and the regulation of spinal cord blood flow.	IEx
2.6.15	Discuss spinal cord perfusion pressure.	IEx
Pharmacology		
2.6.16	With reference to the management of shock, describe the pharmacology of vasopressors and inotropes, including: adrenaline, noradrenaline, phenylephrine, dopamine, dobutamine, phosphodiesterase inhibitors, vasopressin.	IEx
2.6.17	With reference to cardiopulmonary resuscitation, describe the pharmacology of adrenaline, vasopressin, atropine, calcium, sodium bicarbonate, amiodarone and lignocaine.	IEx
2.6.18	With reference to the treatment of malignant hyperthermia, describe the pharmacology of dantrolene.	IEx
Anatomy		
2.6.19	Outline the anatomy relevant to vascular access in resuscitation: specifically for safe cannulation of antecubital, saphenous jugular and subclavian veins and placement of intraosseous infusion devices.	FEx
2.6.20	Outline the anatomy relevant to the drainage of pericardial fluid.	FEx
2.6.21	Outline the anatomy relevant to drainage of pleural space.	FEx
2.6.22	Outline the anatomy of the cerebral and spinal cord circulation.	FEx
Management of Acute Organ Dysfunctions		
Resuscitation of the Patient with Shock		

2.6.23	Outline the clinical signs that may differentiate the causes of shock.	CEX/CBD, FEx
2.6.24	Outline the initial investigations of the shocked patient.	CEX/CBD, FEx
2.6.25	Outline the likely changes in blood gas analysis in the shocked patient.	CEX/CBD, FEx
2.6.26	Outline the use of indicators of tissue oxygenation (base deficit, lactate, mixed venous oxygen saturation) in resuscitation.	CEX/CBD, FEx
2.6.27	Evaluate the role of echocardiography in the diagnosis and management of shock.	CEX/CBD, FEx
2.6.28	Correlate clinical signs of hypovolaemia shock with estimates of volume loss.	CEX/CBD, FEx
2.6.29	Outline how the clinical signs of hypovolaemic shock may be altered by anaesthesia, sedation and current medication.	CEX/CBD, FEx
2.6.30	Outline how the clinical signs of shock may be altered by age.	CEX/CBD, FEx
2.6.31	Outline an approach to volume replacement in shock due to: haemorrhage, loss of fluid and electrolytes.	CEX/CBD, FEx
2.6.32	Outline the indications for the use of vasopressors / inotropes.	CEX/CBD, FEx
2.6.33	Outline the management of patients requiring massive blood transfusion.	CEX/CBD, FEx
2.6.34	Outline the diagnosis and management of major transfusion reactions.	CEX/CBD, FEx
2.6.35	Outline the diagnosis and management of acute anaphylaxis.	CEX/CBD, FEx
2.6.36	Outline the diagnosis and management of severe sepsis or systemic inflammatory response syndrome (SIRS).	CEX/CBD, FEx
2.6.37	Outline the approach to obtaining vascular access in the shocked patient.	CEX/CBD, FEx
2.6.38	Describe the steps to program an external pacemaker.	CEX/CBD, FEx
2.6.39	Describe the management of patients with obstructive shock, such as thromboembolism, cardiac tamponade and tension	CEX/CBD, FEx

	pneumothorax.	
Acute respiratory Failure		
2.6.40	Define respiratory failure and differentiate between type 1 and type 2 respiratory failure.	CEX/CBD, IEx
2.6.41	Interpret blood gas analysis in respiratory failure.	CEX/CBD, IEx, FEx
2.6.42	Outline methods to treat life threatening hypoxaemia.	CEX/CBD, FEx
2.6.43	Describe the management of severe asthma.	CEX/CBD, FEx
2.6.44	Describe the diagnosis and management of pneumothorax.	CEX/CBD, FEx
2.6.45	Describe the technique of emergency drainage of tension pneumothorax.	CEX/CBD, FEx
Acute Neurological Deterioration		
2.6.46	Outline the causes of coma and an approach to the initial assessment and management of the comatose patient.	CEX/CBD, FEx
2.6.47	Describe the Glasgow Coma Scale.	CEX/CBD, FEx
2.6.48	Describe the management of prolonged seizures and status epilepticus.	CEX/CBD, FEx
2.6.49	Outline strategies to treat raised intracranial pressure.	CEX/CBD, FEx
2.6.50	Outline strategies to prevent secondary brain injuries.	CEX/CBD, FEx
2.6.51	Outline the causes of acute spinal cord dysfunction and an approach to the initial assessment and management of the patient with acute spinal cord dysfunction.	CEX/CBD, FEx
Metabolic and Electrolyte Disturbances		
2.6.52	Describe clinical situations likely to result in and outline the initial management of: - Hyper/hypokalemia - Hyponatrema and hypo-osmolality - Hypernatremia	CEX/CBD, FEx

	- Hyper/hypoglycemia - Hyper/hypocalcemia - Hyper/hypomagnesemia - Metabolic acidosis	
Environmental and Equipment Crises		
2.6.53	Outline the steps to take in the event of: - An operating room fire - Electrical power failure in the operating suite	CEX/CBD, FEx
2.6.54	Describe the likely presentation of and steps to take in the event of: - Failure of pipeline gas supply - Anaesthesia machine and ventilator dysfunction - Breathing circuit malfunctions such as stuck valves and massive leaks	CEX/CBD, FEx
Trauma Care		
2.6.55	Outline appropriate preparation of equipment and personnel prior to the arrival of the trauma patient in the hospital.	CEX/CBD, FEx
2.6.56	Outline features of the patient's history that are indicator of injury severity.	CEX/CBD, FEx
2.6.57	Identify contraindications to urinary catheters and nasogastric tubes during trauma resuscitation.	CEX/CBD, FEx
2.6.58	Describe indications for a definitive airway in the trauma patient.	CEX/CBD, FEx
2.6.59	Describe strategies to prevent and manage coagulopathy, hypothermia and acidosis in trauma patient.	CEX/CBD, FEx
2.6.60	Explain the management of massive blood loss including the use of rapid infusion devices.	CEX/CBD, FEx
2.6.61	Describe strategies for minimizing secondary brain injury in patients with multiple injures.	CEX/CBD, FEx
2.6.62	Describe infection control techniques in the trauma setting.	CEX/CBD, FEx
2.6.63	Describe the primary survey of the trauma patient.	CEX/CBD, FEx

2.6.64	Describe techniques for the immobilization of patients with spinal injuries during transport and transfer.	CEX/CBD, FEx
Skills		
2.6.65	Initiate management of the following conditions when occurring in association with anaesthesia or sedation: - Dyspnoea - Hypoxia - Hypocapnoea/hypocarbia - Hypercapnoea/hypercarbia - Progressive rise in inspired CO2 - Tachycardia - Bradycardia - Hypotension - Hypertension - High airway pressures - Oliguria/anuria - Failure to wake from anaesthesia - Convulsion	CEX/CBD, FEx
2.6.66	Initiate management of patients with the following life threatening conditions: - Cardiac arrest - Respiratory arrest - Shock (hypovolemic, distributive, cardiogenic, obstructive) - Cardiac tamponade - Acute myocardial ischemia - Acute pulmonary oedema - Aortic dissection - Arrhythmias causing hemodynamic compromise - Aspiration of gastric contents - Severe bronchospasm - Severe laryngospasm - Tension pneumothorax - Massive hemoptysis - Coma - Raised intra-cranial pressure - Prolonged seizures	CEX/CBD, FEx

- Local anaesthetic toxicity - Anaphylaxis - Malignant hyperthermia - Pulmonary embolism - Gas embolism - Coagulopathy in association with surgery or trauma - Hyper/hypokalemia	
2.6.67 Demonstrate proficiency in advanced life support.	CEX/CBD, FEx

Higher Training

By the completion of Higher Training, trainees will be able to - **Lead the management of life-threatening crises that may be encountered in the course of their practice** - **Participate as a key multidisciplinary team member in the initial management and resuscitation of trauma patients and patients with life threatening medical and surgical conditions**	
Learning outcomes	**Assessment**
Acute organ Dysfunctions	
2.6.68 Where the following problems occur in association with anaesthesia and sedation, the trainee will be able to: i. Discuss potential causes and their relative frequency ii. Follow strategies to diagnose the underlying cause effectively and efficiently iii. Evaluate severity, potential consequences and the need for treatment iv. Select treatment appropriate to the severity of the condition v. Describe the clinical evaluation and both the initial and definitive management - Dyspnoea - Hypoxia - Hypocapnoea/hypocarbia - Hypercapnoea/hypercarbia - Tachycardia	CEX/CBD, FEx

	- Bradycardia - Hypotension - Hypertension - High airway pressures - Oliguria/anuria - Failure to wake from anaesthesia	
2.6.69	Describe the clinical features and resuscitative management of patients with: - Local anaesthetic toxicity - Malignant hyperthermia - Coagulopathy in association with surgery or trauma - Tension pneumothorax - Massive haemoptysis - Ischaemic and haemorrhagic stroke - Prolonged seizures - Rhabdomyolysis - Pulmonary embolism / fat embolism / gas embolism - Haematemesis and melaena - Thyroid storm - Addisonian crisis - Diabetic ketoacidosis - Hyperosmolar, hyperglycaemic state - Hypo-osmolar states - Severe electrolyte disturbances - Severe acid base disturbance - Acute drug intoxication	CEX/CBD, FEx
Trauma Care		
2.6.70	Discuss the effects of age, body mass index (BMI) and concurrent medication on the presentation and management of patients with severe multi-trauma.	CEX/CBD, FEx
2.6.71	Discuss the differential diagnosis of shock in the trauma patient.	CEX/CBD, FEx
2.6.72	Discuss pain management in multi-trauma patient.	CEX/CBD, FEx
2.6.73	Describe the role of diagnostic ultrasound in the initial management of trauma patient.	CEX/CBD, FEx

2.6.74	Discuss the diagnosis and management of life-threatening haemorrhage in the multi-trauma patient and in particular haemorrhage due to: - Chest trauma - Abdominal trauma - Pelvic trauma - Major vascular injury	CEX/CBD, FEx
2.6.75	Discuss the use of permissive hypotension (or deliberate temporary under-resuscitation) in the face of uncontrolled bleeding.	CEX/CBD, FEx
2.6.76	Outline the indications for emergency resuscitative thoracotomy.	CEX/CBD, FEx
2.6.77	Discuss the diagnosis and management of cardiac tamponade in the trauma patient.	CEX/CBD, FEx
2.6.78	Discuss the differential diagnosis of hypoxia in the trauma patient.	CEX/CBD, FEx
2.6.79	Discuss the initial diagnosis and management of: - Pneumothorax - Flail chest - Pulmonary contusion - Traumatic aortic disruption - Tracheobronchial injury	CEX/CBD, FEx
2.6.80	Discuss the initial assessment and management of: - Acute traumatic brain injury - Unstable spinal injury including clearing the cervical spine - Acute spinal cord injury and 'neurogenic' shock	CEX/CBD, FEx
2.6.81	Describe the rationale for and methods of immobilization of pelvic fractures and long bone fractures.	CEX/CBD, FEx
2.6.82	Describe problems associated with crush injury.	CEX/CBD, FEx
2.6.83	Describe the clinical features and outline the management of compartment syndrome.	CEX/CBD, FEx
2.6.84	Describe the initial assessment and management of the patient with severe burns injury including:	CEX/CBD, FEx

	- Fluid management - Pain management - Inhalational injury - Carbon monoxide poisoning	
2.6.85	Describe the initial assessment and management of the patient who has experienced: - Electrocution - Drowning and near drowning - Severe hypothermia	CEX/CBD, FEx
2.6.86	Outline the process for arranging a patient transfer.	CEX/CBD, FEx
2.6.87	Discuss requirements for the safe transfer of critically ill patients.	CEX/CBD, FEx
2.6.88	Describe the specific ethical and ethnic issues associated with managing the multiply injured patient, including issues that relate to brain stem death and organ donation.	CEX/CBD, FEx
Skills		
2.6.89	Leading the multi-disciplinary trauma team	CEX/CBD
2.6.90	Demonstrate advanced airway management skills in trauma patients (including those with suspected unstable cervical spine), including surgical airway techniques	CEX/CBD, FEx
2.6.91	Insertion of large bore rapid infusion catheter	DOPS
2.6.92	Intraosseous access for volume replacement and administration of drugs	DOPS
2.6.93	Conducting the primary and secondary survey of the trauma patient	CEX/CBD, FEx
2.6.94	Interpretation of radiological image relevant to the primary survey	CEX/CBD, FEx
2.6.95	Proficiency in advanced life support	CEX/CBD, FEx

Volume of Practice and Workplace-Based Assessment Requirements for Trauma, Crisis Management and Resuscitation

Minimum VOLUME OF PRACTICE

There is no minimum VOP in this section of the curriculum.

Minimum WORKPLACE-BASED ASSESSMENTS

	FOCUS	DURING BASIC TRAINING	DURING HIGHER TRAINING
CEX/CBD	Themes focusing on learning outcomes listed above	1	1

2.7 Safety and Quality in Anaesthesia

Basic Training

By the completion of Basic Training, trainees will be able to - **Understand the underlying physics and principles of physical measurements underpinning the design and safe use of anaesthesia equipment** - **Be familiar with local guidelines and workflow on transfusion safety, medication safety, infection control and surgical safety, and practice accordingly**	
Learning outcomes	**Assessment**
Equipment Safety	
Principles of Physical Measurements	
2.7.1 Describe the basic physical principles applicable to anaesthesia, in particular: - Use of SI units - Behaviour of fluids (gases and liquids) - Electrical concepts, current, potential difference, resistance, impedance, inductance and capacitance - Principles of humidification and use of humidifiers - Principles of ultrasound imaging and use of Doppler	IEx
2.7.2 Describe the methods of measurement applicable to anaesthesia, including their physical principles, clinical utilities, complications and sources of errors, related to: - Measurement of volume, flow, and pressure, including transducers. - Measurement of blood pressure (non-invasive and invasive means) - Measurement of cardiac output - Measurement of temperature - Pulse oximetry - ECG (12-lead, modified 3-lead and 5-lead systems) - Gas analysis, including oxygen analyzer, capnography and anaesthetic agent analyzer - Methods used to measure respiratory function,including: • Forced expiratory volume	IEx

	• Peak expiratory flow rate • Vital capacity • Flow-volume loops • Functional residual capacity and residual volume	
Equipment Design		
2.7.3	Describe different systems to deliver supplemental oxygen and the advantages and disadvantages of these systems.	CEX/CBD, FEx
2.7.4	Describe the circle system and the Mapleson's breathing systems, including the clinical use, advantages and disadvantages.	CEX/CBD, FEx
2.7.5	Describe the principles and safety features of vaporizers.	CEX/CBD, FEx
2.7.6	Describe the principles and safety use of syringe pumps, fluid infusion pumps, and fluid warmer.	CEX/CBD, FEx
2.7.7	Describe the principles and safety features of active warming devices, such as the warming blanket.	CEX/CBD, FEx
2.7.8	Describe the design and safety features of anaesthesia machines.	CEX/CBD, FEx
2.7.9	Describe the different levels of checking of anaesthesia machines.	CEX/CBD, DOPS, FEx
Infection Control		
2.7.10	Understand and practice universal precautions.	CEX/CBD, DOPS, FEx
2.7.11	Adhere to local antibiotic guidelines for prevention of surgical site infections.	CEX/CBD, FEx
Procedural Safety		
2.7.12	Describe blood transfusion safety, checking procedures and standard for blood storage.	CEX/CBD, FEx
2.7.13	Perform the standard "time-out" procedure as suggested by the WHO surgical safety checklist.	CEX/CBD, DOPS, FEx
2.7.14	Adhere to local medication safety guidelines, with particular	CEX/CBD, DOPS,

	reference to syringe labelling, prevention of contamination, handling of dangerous drugs, and prevention of inadvertent administration of drugs to patients with known drug allergy.	FEx
2.7.15	Outline the clinical signs and appropriate management of intra-arterial injection of a harmful substance.	FEx
2.7.16	Outline the anaesthetic concerns and possible complications in related to patient's positioning during surgery.	CEX/CBD, FEx
2.7.17	State the concerns of tourniquet use and related problems.	CEX/CBD, FEx
2.7.18	State the concerns related to robotic surgeries.	CEX/CBD, FEx

Higher Training

By the end of Higher Training, trainees should able to

- **Describe the safety features of environments where anaesthesia and sedation is provided**
- **Apply the standards required for the safe provision of anaesthesia and sedation according to College guidelines.**
- **Demonstrate a patient-centred approach to practice**
- **Collaborate in multidisciplinary teams to ensure patient safety**
- **Identify and analyze risks and take initiatives to improve safety and quality in anaesthesia.**

Learning outcomes		**Assessment**
Equipment Safety		
2.7.19	Discuss the principles of surgical diathermy, its safe use and the potential hazards.	CEX/CBD, FEx
2.7.20	Describe the principles of surgical lasers, their safe use and the potential hazards.	CEX/CBD, FEx
2.7.21	Outline the pharmacology of radiological contrast agents.	CEX/CBD, FEx
Environmental Safety		
2.7.22	Describe the supply of medical gases (bulk supply and cylinder) and features to ensure supply safety including pressure valves and	CEX/CBD, FEx

	regulators and connection systems.	
2.7.23	Describe how medical suction is generated and how to set up and test suction systems, both fixed and portable system.	CEX/CBD, FEx
2.7.24	Describe the hazards of anaesthetic gas pollution and the methods of scavenging anaesthetic gases.	CEX/CBD, FEx
2.7.25	Outline the causes of fires and explosions in the operating suite and discuss methods for prevention and management.	CEX/CBD, FEx
2.7.26	Describe microshock and macroshock and the mechanisms for preventing these, with particular reference to ensuring the compatibility of medical procedure, treatment area, and medical equipment used.	CEX/CBD, FEx
Infection Control		
2.7.27	Adhere to local infection control policies, with particular reference to patients requiring airborne and contact precautions.	CEX/CBD, DOPS, FEx
2.7.28	Outline the standards to which reusable anaesthetic equipment needs to be cleaned and/or treated.	CEX/CBD, FEx
2.7.29	Outline the recommended vaccinations for healthcare workers.	CEX/CBD, FEx
College Guidelines in Relation to the Safe Provision of Anaesthesia Care		
2.7.30	Describe and outline the general principles of design, operational procedures, equipment and patient safety requirements according to the College guidelines / recommendations on the followings: - Facilities for safe anaesthetic practice in operating suites - Facilities for safe anaesthetic practice in organ imaging units - Facilities for safe anaesthetic practice in the delivery suite - Facilities for safe anaesthetic practice for electro-convulsive therapy (ECT) - Assistance required for the safe conduct of anaesthesia - Monitoring in anaesthesia - Safe sedation for diagnostic and therapeutic procedures - Postanaesthetic recovery care - Conduct of epidural analgesia for parturients - Perioperative care of patients selected for day care surgery	CEX/CBD, FEx

	- Transport of the critically ill - Handover of responsibility of an anaesthesiologist - Monitored care by an anaesthesiologist	
Quality of Care in Anaesthesia		
2.7.31	Describe the characteristics of high quality anaesthesia service (safe, effective, efficient, timely, and patient-centred) and discuss the processes of quality assurance and quality improvement.	CEX/CBD, FEx
2.7.32	Outline the local quality assurance activities, such as peer review, critical incidents reporting, morbidity and mortality meetings, surveys and audits, and continuous medical education.	CEX/CBD, FEx
2.7.33	Outline the quality improvement cycle, with examples.	CEX/CBD, FEx
2.7.34	Outline the principles of risk management, including risk identification, risk rating, and strategies for managing risks (such as elimination, mitigation, acceptance, and transfer).	
2.7.35	Outline the concept of credentialing and give examples of credentialing in anaesthesia practice.	CEX/CBD, FEx
2.7.36	Outline the process for handling patient complaints in the local institution and discuss how patient complaints provide an opportunity to improve the quality of anaesthesia care.	CEX/CBD, FEx
2.7.37	Discuss the concept of open disclosure and outline how it is implemented in the local institutional settings.	CEX/CBD, FEx
2.7.38	Discuss the concept of medical negligence from the medico-legal perspective.	CEX/CBD, FEx
2.7.39	Discuss the priniciples of medical ethics, including autonomy, beneficence, non-maleficence, and justice.	CEX/CBD, FEx
Statistics and Clinical Research		
2.7.40	Describe the features of evidence-based medicine.	FEx
2.7.41	Explain the following concepts in statistics and clinical research - Distribution of data - Frequency distributions	IEx

- Measures of central tendency - Dispersion of data - Selection and application of non-parametric and parametric tests in statistical inference - Explain the principles of errors of statistical inference and describe techniques to minimise such errors through study design - Explain sources of bias and confounding factors - Describe the various statistical methods used to estimate risk	
2.7.42 Describe the stages in the design of a clinical trial including: - Research question and hypothesis - Literature review - Statistical advice - Ideal study protocol to minimise the risk of bias and to achieve optimum power of the study - Ethical issues and informed consent - Data collection and processing	FEx

Volume of Practice and Workplace-Based Assessment Requirements for Safety and Quality in Anaesthesia

Minimum VOLUME OF PRACTICE

There is no minimum VOP in this section of the curriculum.

Minimum WORKPLACE-BASED ASSESSMENTS

	FOCUS	DURING BASIC TRAINING	DURING HIGHER TRAINING
CEX/CBD	Themes focusing on learning outcomes listed above	1	1
DOPS	Checking of anaesthesia machine and breathing system	1	---
	Care of patient requiring surgery done in the prone position	1 (CAN BE DONE IN BT OR HT YEARS)	

SECTION 3 SPECIALTY MODULES

The Specialty Modules define the subsets of knowledge and skills required for the anaesthetic management of patients in specific contexts. They include

3.1 Anaesthesia for general surgery, urology, gynaecology and endoscopic procedures
3.2 Anaesthesia for head and neck surgery and Otolarygngology procedures
3.3 Anaesthesia for orthopaedic surgery
3.4 Paediatric anaesthesia
3.5 Obstetrics anaesthesia and analgesia
3.6 Neuroanaesthesia
3.7 Ophthalmic anaesthesia
3.8 Anaesthesia outside operating theatre
3.9 Anaesthesia for cardiac surgery and interventional cardiology
3.10 Anaesthesia for thoracic surgery
3.11 Anaesthesia for vascular surgery
3.12 Pain medicine
3.13 Intensive care medicine

Depending on the training materials available in different training hospitals, trainees may spend a variable duration of training in each of the above specialty, except

(1) For Intensive Care Medicine where the minimum duration of training is 6 months; and

(2) For Pain Medicine Module where 48 dedicated sessions have to be completed over a maximum period of 6 months (Please refer to section on Pain Medicine for details).

Trainees may start their Specialty Modules any time during their training, subjected to the arrangement by the Supervisor of Training.

For each of the above modules, the learning outcomes and the methods of assessment are listed in a table format for easy reference. The minimum Volume of Practice (VOP) and Workplace Based Assessments (WBAs) required are listed at the end of each section.

3.1 Anaesthesia for General Surgical, Urological, Gynaecological and Endoscopic Procedures

By completion of this specialty module trainees will be able to provide anaesthesia for patients presenting for general surgical, urological, gynaecological and endoscopic procedures. The learning outcomes cover acute and elective procedures and various surgical pathologies.

Many topics particularly relevant to this specialty module are covered in various sections under section 2 Clinical Fundamentals.

Learning outcomes		Assessment
3.1.1	For the following conditions, discuss the key clinical features which may influence anaesthetic management. (Also refer to the section 2.5 Perioperative Medicine): - Bowel disease - Disease of the oesophagus - Disease of the stomach - Gallbladder disease - Liver disease - Disease of the spleen - Renal and urinary tract disease - Pancreatic disease - Adrenal disease - Gynaecological disorders - Breast disease	CEX/CBD, FEx
3.1.2	Discuss the physiological changes associated with pneumoperitoneum and different surgical positions, and management of those changes.	CEX/CBD, FEx
3.1.3	Outline the differential diagnosis of the acute abdomen and the implications for anaesthetic management of the different causes.	CEX/CBD, FEx
3.1.4	Outline the consequences of prolonged vomiting, bowel obstruction and malabsorption syndromes.	CEX/CBD, FEx
3.1.5	Outline the anatomical modification that results from common gastrointestinal operations and the potential pathophysiological consequences.	CEX/CBD, FEx

3.1.6	Discuss the surgical requirements and implications for anaesthetic management of patients undergoing the following elective general surgery, urological, gynaecological and endoscopic procedures: - Major open abdominal surgery - Major open urological surgery - Major gynaecological operations - Minor general, urological and gynaecological surgery - Breast surgery - Laparoscopic surgery, including robot-assisted laparoscopic surgeries - Upper and Lower GI endoscopy - Endoscopic urological procedures - Treatment for infertility	CEX/CBD, FEx
3.1.7	Discuss perioperative analgesia and fluid therapy options for elective general surgery, urological, gynaecological and endoscopic procedures, including strategies for fast track recovery programs for major abdominal surgery. (Also refer to section 2.5 Perioperative Medicine)	CEX/CBD, FEx
3.1.8	Discuss selection of appropriate surgical procedures as day surgery, the choice of anaesthesia technique, perioperative analgesia and discharge criteria in this group of patients (Also refer to section 2.4 Acute Pain Management, and section 2.5 Perioperative Medicine)	CEX/CBD, FEx
3.1.9	Discuss the diagnosis and management of the possible complications of surgical procedures including (also refer to the section 2.6 Trauma, Crisis and Resuscitation): - Venous air embolism - Rapid, life-threatening bleeding, including management of severe coagulopathy - Aspiration - Cardiovascular responses to insufflation of the peritoneal cavity - Sepsis - Hypo-osmolar syndromes and fluid overload - Reperfusion of ischaemic organs - Acid base imbalance, temperature control, positioning injuries	CEX/CBD, FEx

3.1.10	Describe the provision of anaesthetic care for organ procurement in a donor declared brain dead.	CEX/CBD, FEx
3.1.11	Describe the anaesthesia considerations of patients with chronic renal failure undergoing living-related or cadaveric kidney transplant.	CEX/CBD, FEx

Volume of Practice and Workplace-Based Assessment Requirements for Anaesthesia for General Surgery, Urology, Gynaecology and Endoscopic Procedures

Minimum VOLUME OF PRACTICE

Elective general surgery / urology / gynaecology cases	100
Emergency general surgery / urology / gynaecology cases	100

Minimum WORKPLACE-BASED ASSESSMENTS

	FOCUS	
CEX/CBD	Themes focusing on learning outcomes listed above	2

3.2 Anaesthesia for Head and Neck and Otorhinolaryngology Procedures

By the completion of this specialty module, trainees will be able to provide anaesthesia for patients undergoing head and neck, ear, nose and throat surgery. They will understand and be able to manage the unique issues involved with the shared airway or limited access to the patient's airway.

Many topic areas particularly relevant to this specialty module are also covered in section 2.3 Airway management.

Learning outcomes		Assessment
3.2.1	Describe the anatomy and innervation of the face, external ear, neck, nasal passages, pharynx and larynx with reference to the performance of regional or topical anaesthesia for head, neck or ear nose and throat procedures.	CEX/CBD, FEx
3.2.2	Describe the indications for and features of special tracheal tubes used in ear nose and throat surgery, such as those used for: - Microlaryngeal surgery - Laser surgery - Laryngectomy	CEX/CBD, FEx
3.2.3	Describe the equipment used for emergency and elective jet ventilation.	CEX/CBD, FEx
3.2.4	Outline the physical principles of jet ventilation, and discuss the indications and risks of jet ventilation. Outline how the risks of jet ventilation may be minimized.	CEX/CBD, FEx
3.2.5	Evaluate the use of jet ventilation as a technique for managing the airway and ventilation in patients having ear nose and throat procedures	CEX/CBD, FEx
3.2.6	Describe the nature and biological effects of lasers commonly used in ear nose and throat.	CEX/CBD, FEx
3.2.7	Discuss the precautions, possible complications and implications for anaesthetic management associated with the use of lasers in ear nose and throat surgery.	CEX/CBD, FEx
3.2.8	Describe the common co-morbid disease and patient factors	CEX/CBD, FEx

	encountered in patients having head, neck and ear nose and throat procedures, and their implications on the anaesthetic management.	
3.2.9	Describe the effects of previous surgery or radiation on the airway (also refer to section 2.3 Airway Management)	CEX/CBD, FEx
3.2.10	Discuss the surgical requirements and the anaesthetic management of patients requiring common elective ear nose and throat procedures including: - Septo-rhinoplasty - Functional endoscopic sinus surgery (FESS) - Tonsillectomy and/or adenoidectomy - Microlaryngoscopy - Panendoscopy - Insertion of grommets - Myringoplasty or other middle ear surgery - Mastoidectomy - Laryngectomy or pharyngo-laryngectomy - Parotidectomy - Neck dissection - Tracheostomy	CEX/CBD, FEx
3.2.11	Discuss the surgical requirements and the anaesthetic management of patients requiring emergency ear nose and throat procedures including: - Reduction of fractured nose - Removal of inhaled foreign body - Removal of foreign body from the oesophagus or pharynx - Surgical management for obstructing laryngeal lesions (also refer to the section 2.3 Airway Management) - Drainage of oro-pharyngeal cysts or abscess, including quinsy	CEX/CBD, FEx
3.2.12	Describe the indications for emergency and elective tracheostomy.	CEX/CBD, FEx
3.2.13	Evaluate the anaesthetic options for emergency tracheostomy.	CEX/CBD, FEx
3.2.14	Outline the principles of anaesthetic management for awake tracheostomy.	CEX/CBD, FEx
3.2.15	Discuss the anaesthetic management of patients requiring thyroid	CEX/CBD, FEx

	or parathyroid surgery. In particular: - Use, effects and complications of thyroid hormones or anti-thyroid drugs used to stabilise patients perioperatively (also refer to the section 2.5 Perioperative Medicine) - The effects and management of hyper and hypocalcaemia - Potential airway management issues and their assessment including in the patient with a retrosternal goitre(also refer to section 2.3 Airway Management) - Surgical positioning and the implications for patient protection and access - Airway, surgical and endocrine complications in the perioperative period and their management - The use of special endotracheal tubes for monitoring recurrent laryngeal nerve function intraoperatively	
3.2.16	Discuss the implications of use of local anaesthetics and vasoconstrictive agents in head and neck surgery.	CEX/CBD, FEx
3.2.17	Evaluate the use, safety and methods of providing controlled hypotension to minimise blood loss and improve surgical operating conditions during ear nose and throat, head and neck surgery.	CEX/CBD, FEx
3.2.18	Evaluate methods for the smooth emergence and/or extubation of patients to minimise bleeding following ear nose and throat and head and neck procedures.	CEX/CBD, FEx
3.2.19	Discuss the indications, method and implications for anaesthetic management of facial nerve monitoring intraoperatively.	CEX/CBD, FEx
3.2.20	Discuss the clinical features and management of postoperative haemorrhage following head and neck and ear nose and throat surgery, particularly post tonsillectomy haemorrhage (also refer to section 2.3 Airway Management, section 2.6 Trauma, Crisis and Resuscitation and section 3.4 Paediatric Anaesthesia)	CEX/CBD, FEx
3.2.21	Describe the risks and management of airway fire, and its prevention strategies.	CEX/CBD, FEx

Volume of Practice and Workplace-Based Assessment Requirements for Anaesthesia for Head and Neck and Otorhinolaryngology Procedures

Minimum VOLUME OF PRACTICE

Airway surgery *	30
Head and Neck and ENT procedures (Not otherwise specified)	30

*Such as Tonsillectomy, adenoidectomy, laser airway surgery, microlaryngoscopy, removal of foreign bodies from upper or lower airway, tracheostomy, rigid bronchoscopy, "panendoscopy" (suspension laryngoscopy, esophagoscopy, and bronchoscopy), Functional Endoscopic Sinus surgery (FESS) and surgery for obstructive sleep apnoea

Minimum WORKPLACE-BASED ASSESSMENTS

	FOCUS	
CEX/CBD	Themes focusing on learning outcomes listed above	2

3.3 Anaesthesia for Orthopaedic Surgery

By the completion of this specialty module, trainees will be able to provide anaesthesia for patients requiring elective or emergency orthopaedic procedures.

Many topic areas relevant to this specialty module are covered in various sections of Clinical fundamentals.

Learning outcomes		Assessment
Non-traumatic Orthopaedic Procedures		
3.3.1	Discuss the implications of age and comorbidities in the perioperative plan of patients presenting for elective orthopaedic procedures (also refer to section 2.5 Perioperative Medicine and section 3.4 Paediatric Anaesthesia)	CEX/CBD, FEx
3.3.2	Outline the common comorbidities associated with scoliosis and the anaesthetic management of patients having scoliosis correction surgery.	CEX/CBD, FEx
3.3.3	Discuss the choice and timing of antibiotic prophylaxis for orthopaedic patients.	CEX/CBD, FEx
3.3.4	Discuss the use of thrombo-prophylaxis for orthopaedic patients especially joint replacement (also refer to section 2.7 Safety and Quality in Anaesthesia).	CEX/CBD, FEx
3.3.5	Discuss the perioperative management of patients on therapeutic anticoagulation requiring anaesthesia for orthopaedic procedures (also refer to section 2.5 Perioperative Medicine)	CEX/CBD, FEx
3.3.6	Discuss the implications of patients presenting with arthritis (osteoarthritis, rheumatoid arthritis or ankylosing spondylitis) (also refer to section 2.5 Perioperative Medicine).	CEX/CBD, FEx
3.3.7	Discuss the safe use of tourniquets for orthopaedic procedures (also refer to section 2.7 Safety and Quality in Anaesthetia).	CEX/CBD, FEx
3.3.8	Evaluate methods to reduce intra-operative and postoperative blood loss and minimise the need for blood transfusion during or following orthopaedic procedures.	CEX/CBD, FEx

3.3.9	Discuss the implications of the use of the beach-chair position for shoulder surgery.	CEX/CBD, FEx
3.3.10	Describe the methods of spinal cord monitoring during spinal surgery and the implications on anaesthetic management.	CEX/CBD, FEx
3.3.11	Discuss the use of NSAIDs in orthopaedics surgery (also refer to section 2.4 Acute Pain Management).	CEX/CBD, FEx
3.3.12	Discuss the options available for acute and subacute pain management following major orthopaedic surgery, with reference to: - Advantages and disadvantages of regional anaesthesia - Advantages and disadvantages of regional analgesia - Therapies to manage persistent post-surgical pain (neuropathic or nociceptive)	CEX/CBD, FEx
3.3.13	Discuss the management of patients requiring anaesthesia for: - Joint replacement - Arthroscopic procedures - Shoulder surgery - Ligament, peripheral nerve and/or artery repair - Tendon lengthening or transfer - Resection of musculoskeletal tumours - Release of compartment syndrome - Reduction / fixation of dislocated joint, including prosthesis - Drainage / clearance of joint infections - Surgical management of soft tissue infections, such as cellulitis and necrotizing fasciitis - Debridement or limb amputation for vascular insufficiency - Fixation of pathological fractures	CEX/CBD, FEx
3.3.14	Discuss the diagnosis and management of the possible complications of orthopaedic surgery including (also refer to the section 2.6 Trauma, Crisis and Resuscitation): - Cemented implant syndrome - Fat embolism syndrome - Pulmonary embolism - Compartment syndrome - Major blood loss	CEX/CBD, FEx

	- Neurological injury - Chronic and persistent pain	
Orthopaedic trauma		
3.3.15	Describe the rationale for and outline initial methods of fracture immobilisation and analgesia in patients awaiting definitive surgery for major trauma, including: - Pelvic fractures - Long bone fractures - Spinal fractures	CEX/CBD, FEx
3.3.16	Discuss the initial assessment and management of (also refer to section 2.6 Trauma, Crisis and Resuscitation): - Unstable spinal injury including clearing the cervical spine - Acute spinal cord injury and 'neurogenic' shock	CEX/CBD, FEx
3.3.17	Discuss the management of patients requiring anaesthesia for: - Pelvic fractures - Shoulder girdle fractures - Long bone fractures - Distal limb fractures - Reduction and fixation of spinal fractures	CEX/CBD, FEx
3.3.18	In the trauma patient undergoing orthopaedic surgery, discuss the aetiology, diagnosis and management of the following potential complications: - Cemented implant syndrome - Haemorrhage / Massive transfusion - Crush injury - Compartment syndrome - Re-perfusion injury - Fat embolism syndrome	CEX/CBD, FEx
3.3.19	Outline the implication of neuro-vascular compromise of a limb or compound fractures for timing of surgery.	CEX/CBD, FEx
3.3.20	Discuss the assessment and anaesthetic management of the elderly patient with a hip fracture.	CEX/CBD, FEx
3.3.21	Describe the indicators of non-accidental injury and outline an appropriate course of action when non-accidental injury is	CEX/CBD, FEx

	suspected.	
3.3.22	Evaluate the selection and use of thrombo-prophylaxis and antibiotic prophylaxis in orthopaedic trauma surgery.	CEX/CBD, FEx
3.3.23	Discuss the diagnosis and prevention of chronic pain in musculo-skeletal trauma.	CEX/CBD, FEx

Volume of Practice and Workplace-Based Assessment Requirements for Anaesthesia for Orthopaedic Surgery

Minimum VOLUME OF PRACTICE

Hip fracture surgery	30
Major joint replacement	20
Cervical spine surgery	5
Orthopaedic procedures (not otherwise specified)	100

Minimum WORKPLACE-BASED ASSESSMENTS

	FOCUS	
CEX/CBD	Themes focusing on learning outcomes listed above	2

3.4 Paediatric Anaesthesia

By the completion of this specialty module, trainees will be able to independently provide anaesthesia and sedation of children with no significant comorbidities. They should be trained to handle initial resuscitation and stabilization of critically ill children and provide acute pain management for children.

	Learning outcomes	Assessment
Paediatric Airway and Ventilation Management		
3.4.1	Describe the anatomy of neonatal airway and its change with growth and development and its implications for airway management.	IEx
3.4.2	Describe the mechanics and gasesous exchange functions of neonates and children.	IEx
3.4.3	Describe common airway equipment, including - Endotracheal tube (ETT): estimation of size and depth of insertion based on age, and rationales for use of non-cuffed versus cuffed tubes - Supraglottic airways, including different forms of laryngeal masks - Straight versus curved laryngoscopy blades - Oral airways: estimation of size based on age - Breathing circuits: Structure and function of the T-piece, and its advantages and disadvantages compared to circle system	CEX/CBD, FEx
3.4.4	Describe the clinical features associated with difficult airway in paediatric patients, e.g. Pierre Robin, mucopolysaccharidoses etc.	CEX/CBD, FEx
3.4.5	Discuss the clinical features and management of upper airway obstruction, e.g. laryngospasm, acute epiglottitis, laryngomalacia etc.	CEX/CBD, FEx
3.4.6	Describe a technique for fibreoptic intubation in children.	CEX/CBD, FEx
3.4.7	Discuss the principles of mechanical ventilation in paediatric patients, including selection of appropriate modes of ventilation, normal volumes and pressures and the role of PEEP.	CEX/CBD, FEx

3.4.8	Discuss the sources of errors and limitations of pressure, flow and capnography monitoring during mechanical ventilation in neonates.	CEX/CBD, FEx
Paediatric Pain Management		
3.4.9	Discuss the principles of assessing acute pain in children and use of paediatric pain scales.	CEX/CBD, FEx
3.4.10	Discuss the clinical pharmacology of paracetamol and non-steroidal antiinflammatroy drugs with particular reference to the paediatric population.	CEX/CBD, FEx
3.4.11	Discuss the factors which influence the choice of mode of delivery of parenteral opioids in acute pain management (patient controlled analgesia, continuous infusion and "as required" prescription) and the choices of regional techniques in children.	CEX/CBD, FEx
Perioperative Medicine		
3.4.12	Describe the circulatory and respiratory changes that occur at birth and neonatal period and its implications for anaesthetic care.	IEx
3.4.13	Describe thermoneutral zone, temperature regulation and physiological response to lowered or raised temperature in neonate and how this changes with growth and development.	IEx
3.4.14	Outline the pharmacokinetics and pharmacokinetics in neonates and children compared with adults.	IEx
3.4.15	Describe vital signs for children of different ages.	CEX/CBD, FEx
3.4.16	Discuss important medical conditions that may have implications on anaesthetic management: e.g. - Prematurity and ex-premature infants - Congenital syndromes, such as Down's syndrome - Muscular dystrophies - Congenital heart disease, including shunts, Fontan, Tetralogy of Fallot - Cerebral Palsy	CEX/CBD, FEx
General Anaesthesia and Sedation in Paediatric Patients		

3.4.17	Discuss the specific concerns during preop assessment in relation to paediatric patients presenting for anaesthesia and surgery.	CEX/CBD, FEx
3.4.18	Describe assessment and management of a child with URTI or other intercurrent medical illness in preoperative period.	CEX/CBD, FEx
3.4.19	Describe the management of a child with a murmur.	CEX/CBD, FEx
3.4.20	Outline the roles of premedications in children and neonates.	CEX/CBD, FEx
3.4.21	Describe the methods to reduce anxiety of children and the pros and cons of parental presence during induction of anaesthesia in children.	CEX/CBD, FEx
3.4.22	Discuss the pros and cons of inhalational induction versus Intravenous induction in paediatric patients.	CEX/CBD, FEx
3.4.23	Discuss the use of Total Intravenous Anaesthesia (TIVA) and Target Controlled Infusions (TCI) in children.	CEX/CBD, FEx
3.4.24	Discuss the effects of anaesthesia on the developing brain.	CEX/CBD, FEx
3.4.25	Discuss the intraoperative fluid management in children undergoing various operations.	CEX/CBD, FEx
3.4.26	Discuss the anaesthetic management of children requiring shared airway procedure, e.g. cleft lip and palate, laryngoscopy, oesophagoscopy, removal of airway foreign body.	CEX/CBD, FEx
3.4.27	Discuss anaesthetic management of children in neurosurgical procedures, e.g. burr hole, tumour excision	CEX/CBD, FEx
3.4.28	Discuss principles of anaesthetic management of children undergoing major abdominal surgery, e.g. necrotising enterocolitis operations for neonates.	CEX/CBD, FEx
3.4.29	Discuss requirements for postoperative monitoring in neonates and ex-premature infants.	CEX/CBD, FEx
Regional Anaesthesia in Paediatric Patients		
3.4.30	For commonly performed regional anaesthesia techniques for paediatric patients, such as ilioinguinal block, penile block, and	CEX/CBD, DOPS, FEx

	caudal block: - Describe the anatomy relevant to block performance and complications. - Discuss the indications and contraindications, risks and benefits. - Describe the positioning, anatomical landmarks and insertion techniques and ways to minimize complications.	
Resuscitation, Trauma and Crisis Management in Paediatric Patients		
3.4.31	Describe assessment of hydration status, blood loss and clinical features of critically ill child and principles of management.	CEX/CBD, FEx
3.4.32	Outline approach to obtaining vascular access in the shocked paediatric patients.	CEX/CBD, FEx
3.4.33	Discuss the diagnosis and resuscitative management of children with the life threatening conditions : e.g. - Cardiac arrest - Respiratory arrest - Shock - Severe bronchospasm - Coagulopathy with active bleeding	CEX/CBD, FEx
3.4.34	Describe the principles of safe intra- and inter-hospital transport of critically ill neonates and children.	CEX/CBD, FEx
3.4.35	Demonstrate advanced life support in neonates and children consistent with PALS.	CEX/CBD, DOPS, FEx
Skills		
3.4.36	Perform effective face-mask ventilation, manouvre to relieve airway obstruction and application of CPAP on paediatric patients.	DOPS
3.4.37	Insert Supraglottic airway and perform endotracheal intubation with appropriate size of device in infants and children.	DOPS
3.4.38	Provide anaesthesia for minor/moderately complex elective surgery, such as hernia repair, orchidopexy, hypospadias, insertion of grommets, myringoplasty, mastoidectomy, circumcision, hypospadias repair, and squint repair.	CEX/CBD

3.4.39	Provide anaesthesia for minor/moderately complex emergency surgery, e.g. appendectomy, scrotal exploration, closed and open fracture reductions, drainage of abscess, and suture of lacerations.	CEX/CBD

Volume of Practice and Workplace-Based Assessment Requirements for Paediatric Anaesthesia

Minimum VOLUME OF PRACTICE

Age ≤ 8 years	100

Minimum WORKPLACE-BASED ASSESSMENTS

	FOCUS	
CEX/CBD	Themes focusing on learning outcomes listed above	2
DOPS	Elective airway management in paediatric patient (BVM/LMA/ETT)	1
	Inhalational induction in paediatric patient	1
	Caudal/Penile/Ilioinguinal block In paediatric patient	1

3.5 Obstetric Anaesthesia and Analgesia

By the completion of this specialty module, trainees will be able to provide safe general and regional anaesthesia and labour analgesia for obstetric patients. Trainees will be able to work as part of a multi-disciplinary team to care for obstetric patients and participate in neonatal resuscitation.	
Learning outcomes	**Assessment**
Basic Sciences Underpinning Obstetrics Anaesthesia	
3.5.1 Describe the changes in anatomy, physiology, pharmacology and their implications for anaesthesia that occur during pregnancy, labour and delivery, in particular the airway, respiratory, cardiovascular, haematological, neurological and gastrointestinal changes.	IEx
3.5.2 Outline the reference ranges for physiological and biochemical variables in pregnancy.	IEx
3.5.3 Describe the mechanism, consequences and anaesthetic implications of aorto-caval compression in pregnancy.	IEx
3.5.4 Describe the transition from foetal to neonatal circulation and the establishment of ventilation (also refer to section 3.4 Paediatric Anaesthesia).	IEx
3.5.5 Describe the utero-placental circulation and the principles of placental physiology as related to placental gas exchange and regulation of placental blood flow.	IEx
3.5.6 Describe the anatomy and physiology of pain in labour and childbirth.	IEx
3.5.7 Describe the influence of pregnancy on the pharmacokinetics and pharmacodynamics of drugs commonly used in anaesthesia and analgesia.	IEx
3.5.8 Describe the pharmacology and anaesthetic consideration of oxytocic agents, tocolytic agents and drugs to treat pre-eclampsia.	IEx

3.5.9	Explain the factors that influence the transfer of drugs across the placenta to the foetus.	IEx
3.5.10	Outline the potential effects on the foetus and neonate of drugs administered during pregnancy.	IEx
3.5.11	Outline the potential effects on the neonate of drug administration in association with lactation.	IEx
Clinical Obstetric Anaesthesia		
3.5.12	Describe the pre-anaesthetic assessment of a pregnant woman.	CEX/CBD, FEx
3.5.13	Describe the role of acid prophylaxis in pregnant women undergoing surgery.	CEX/CBD, FEx
3.5.14	Describe the anaesthetic management of early pregnancy conditions such as molar pregnancy, termination, ectopic pregnancy, miscarriage and septic abortion.	CEX/CBD, FEx
3.5.15	Describe the mechanisms and progress of normal labour.	CEX/CBD, FEx
3.5.16	Describe the clinical methods used for foetal monitoring in labour.	CEX/CBD, FEx
3.5.17	Evaluate the analgesic options for labour and delivery.	CEX/CBD, FEx
3.5.18	Discuss the management of suboptimal epidural block during labour.	CEX/CBD, FEx
3.5.19	Describe the selection of agents and route of administration in providing neuraxial analgesia for labour and delivery.	CEX/CBD, FEx
3.5.20	Evaluate the role of epidural, spinal, and combined spinal epidural techniques for caesarean birth.	CEX/CBD, FEx
3.5.21	Discuss the role of combined spinal epidural analgesia in labour.	CEX/CBD, FEx
3.5.22	Describe the urgency of emergency delivery with regard to the threat to maternal or foetal wellbeing.	CEX/CBD, FEx
3.5.23	Evaluate methods to treat hypotension associated with neuraxial blockade for caesarean birth.	CEX/CBD, FEx

3.5.24	Discuss the management of significant complications of neuraxial analgesia and anaesthesia in childbirth, for example: - Post-dural puncture headache - Total spinal	CEX/CBD, FEx
3.5.25	Discuss the management of suboptimal block including conversion to general anaesthesia for caesarean birth.	CEX/CBD, FEx
3.5.26	Outline the difficult airway algorithm for obstetrics patients, and evaluate its application in the local institutional settings.	CEX/CBD, FEx
3.5.27	Evaluate the role of, options for and particular problems with providing general anaesthesia for elective and emergency caesarean birth.	CEX/CBD, FEx
3.5.28	Describe the prevention of venous thromboembolism in the pregnant woman.	CEX/CBD, FEx
3.5.29	Evaluate methods for providing postoperative analgesia after caesarean birth.	CEX/CBD, FEx
3.5.30	Discuss the anaesthetic management of problems that may arise with labour and delivery, including the following situations: - Vaginal birth after caesarean (VBAC) - Uterine rupture - Multiple gestation - Breech - Assisted vaginal birth - Premature labour - Cord prolapse - Abnormal placental implantation - Antepartum haemorrhage - Post partum haemorrhage - Shoulder dystocia - Foetal death in utero	CEX/CBD, FEx
3.5.31	Discuss the pathophysiology and anaesthetic management of the following medical conditions particular to pregnancy: - Hypertensive disorders of pregnancy/preeclampsia - HELLP syndrome - Eclampsia	

	- Peripartum cardiomyopathy - Gestational diabetes - Acute fatty liver of pregnancy - Cholestasis associated with pregnancy - Rhesus iso immunisation	CEX/CBD, FEx
3.5.32	Discuss the pathophysiology and anaesthetic management of co-existing maternal conditions, such as: - Morbid obesity - Cardiac disease - Intracranial pathology - Substance abuse - Psychiatric condition	CEX/CBD, FEx
3.5.33	Discuss the implications of drugs modifying haemostasis on the provision of neuraxial blockade in pregnancy.	CEX/CBD, FEx
3.5.34	Discuss the differences in basic and advanced life support in the pregnant woman.	CEX/CBD, FEx
3.5.35	Discuss the diagnosis and management of maternal collapse, including: - Thromboembolism - Amniotic fluid embolism - Air embolism - Anaphylaxis - Local anaesthetic toxicity - High spinal - Massive haemorrhage - Eclampsia	CEX/CBD, FEx
3.5.36	Discuss the diagnosis and management of neurological deficits in women after neuraxial blockade and delivery.	CEX/CBD, FEx
3.5.37	Discuss intrauterine resuscitation of the at-risk foetus.	CEX/CBD, FEx
3.5.38	Describe the unique aspects of management of resuscitation of the pregnant trauma patient including: - Optimally positioning to avoid aorto-caval compression - Altered maternal physiological responses - Maternal resuscitation as the first priority, representing best	CEX/CBD, FEx

	care of both the woman and the foetus - The need for early obstetric involvement and foetal monitoring - High possibility of placental abruption and uterine rupture - The need to give Rh immunoglobulin therapy to all Rhesus negative mothers - The place of perimortem caesarean birth - The clinical indicators and subsequent management implications of non-accidental injury in pregnancy	
3.5.39	Discuss the unique aspects of management of anaesthesia for the pregnant woman having non-obstetric surgery.	CEX/CBD, FEx
3.5.40	Discuss the anaesthesia for management of postpartum complications.	CEX/CBD, FEx
3.5.41	Describe the APGAR score.	CEX/CBD, FEx
3.5.42	Outline the basic and advanced life support of a newborn.	CEX/CBD, FEx
3.5.43	Outline the care of the newborn after delivery.	CEX/CBD, FEx
Skills		
3.5.44	Epidural insertion for labour analgesia, and care of the patient in labour with epidural analgesia	CEX/CBD, DOPS
3.5.45	Provide regional anaesthesia for Caesarean section	CEX/CBD
3.5.46	Provide general anaesthesia for Caesarean section	CEX/CBD

Volume of Practice and Workplace-Based Assessment Requirements for Obstetric Anaesthesia and Analgesia

Minimum VOLUME OF PRACTICE

Caesarean Section under GA	10
Caesarean Section under Regional Anaesthesia	50
Epidural analgesia for labour	30

Minimum WORKPLACE-BASED ASSESSMENTS

	FOCUS	
CEX/CBD	Themes focusing on learning outcomes listed above	2
DOPS	Epidural insertion	1

3.6 Neuroanaesthesia

By completion of this specialty module trainees will be able to provide anaesthesia for patients requiring neurosurgical and interventional neuroradiology procedures of moderate complexity.	
Learning outcomes	**Assessment**
Basic Sciences Underpinning Neuroanaesthesia	
Anatomy	
3.6.1 Describe the basic anatomy of the skull, brain, ventricular system, meninges, spinal cord and vertebral column of relevance to anaesthesia.	FEx
3.6.2 Describe the blood supply of the brain and spinal cord.	FEx
3.6.3 Describe the anatomy relevant to providing local anaesthesia for awake craniotomy.	FEx
Pathophysiology	
3.6.4 Outline the changes to cerebral blood flow and cerebral perfusion pressure in patients with intracranial pathology.	FEx
3.6.5 Explain the effect of fluid and electrolyte disturbances on brain function.	FEx
3.6.6 Outline the grading of subarachnoid haemorrhage severity.	FEx
3.6.7 Outline the radiological features of common acute neurosurgical conditions.	FEx
3.6.8 Discuss pharmacologic and non-pharmacologic methods to manipulate intracranial pressure.	FEx
3.6.9 Outline methods to reduce secondary injury and limit disability in traumatic brain injury and intracranial haemorrhage.	FEx
3.6.10 Describe the anaesthetic implications of spinal cord trauma.	FEx
3.6.11 Discuss the pathophysiology of pituitary tumours, including the	FEx

	implications of endocrine disorders such as acromegaly, Cushing's syndrome, pan-hypopituitarism.	
3.6.12	Describe the mechanism and management of disorders of sodium control detected after neurosurgery.	FEx
3.6.13	Outline the criteria for the diagnosis of brain stem death.	FEx
Pharmacology		
3.6.14	Evaluate the effects of anaesthetic agents on brain and spinal cord physiology including metabolism, blood flow, intracranial and intraspinal pressure.	IEx, FEx
3.6.15	Discuss the possible complications of sedative/hypnotic and analgesic agents in neurosurgical patients.	FEx
3.6.16	Describe the pharmacology of drugs used to treat intracranial hypertension.	IEx, FEx
3.6.17	Describe the pharmacology and clinical utility of antiepileptic and prophylactic therapy in neurosurgical patients.	IEx, FEx
3.6.18	Describe the pharmacology and clinical utility of corticosteroids in neurosurgical patients.	FEx
3.6.19	Discuss the pharmacology and clinical utility of pharmacological agents for prophylaxis and treatment of cerebral vasospasm associated with subarachnoid haemorrhage.	IEx, FEx
Neuro-monitoring		
3.6.20	Discuss methods to monitor cerebral blood flow including transcranial Doppler.	CEX/CBD, FEx
3.6.21	Describe methods of intracranial pressure monitoring.	CEX/CBD, FEx
3.6.22	Outline the principles of electrophysiological monitoring including Electroencephalogram (EEG) / Sensory and Motor Evoked Potentials (SSEP and MEP) and the implications on anaesthesia management.	CEX/CBD, FEx
Clinical Neuroanaesthesia		

3.6.23	Discuss the implications for anaesthesia of the positions used for neurosurgery.	CEX/CBD, FEx
3.6.24	Discuss the risks associated with patient positioning for neurosurgical procedures and the methods of risk minimization.	CEX/CBD, FEx
3.6.25	Describe the typical presentation and natural history of the different types of intracranial haemorrhage.	CEX/CBD, FEx
3.6.26	Discuss the acute resuscitation and management of patients with intracranial/subarachnoid haemorrhage (also refer to section 2.6 Trauma, Crisis and Resuscitation, and section 3.13 Intensive Care Medicine).	CEX/CBD, FEx
3.6.27	Discuss the anaesthetic management of patients requiring the following neurosurgical procedures: - Craniotomy for intracranial tumour - Craniotomy for intracranial aneurysm or haemorrhage (acute and chronic) - Interventional neuroradiology for acute intracranial bleed - Interventional neuroradiology for stable intracranial vascular pathology - Spinal surgery (cervical, thoracic, lumbar) - Spinal fluid shunt procedures - Insertion of intracranial pressure monitors	CEX/CBD, FEx
3.6.28	Discuss the anaesthetic management of patients requiring intervention for the following: - Non-neurosurgical trauma in patients with concurrent traumatic brain injury - Traumatic brain injury - Intracranial vascular malformations - Vestibular schwannoma - Trigeminal neuralgia - Pituitary tumours - Epilepsy and movement disorders (including awake craniotomy and deep brain stimulation) - Meningomyelocoele - Cranial vault pathology	CEX/CBD, FEx

3.6.29	Discuss the complications of neurosurgical procedures including: - Air embolism - Rapid, life threatening bleeding - Cerebral ischaemia - Cerebral edema	CEX/CBD, FEx
Skills		
3.6.30	Assess level of consciousness according to Glasgow Coma Score	CEX/CBD, DOPS, FEx
3.6.31	Perform a basic neurological examination for assessment of neurological deficits	CEX/CBD, DOPS, FEx
3.6.32	Manage a patient with a suspected unstable cervical spine	CEX/CBD, DOPS, FEx
3.6.33	Provide anaesthesia for patients requiring neurosurgical or neuroradiological procedures of low to moderate complexities	CEX/CBD
3.6.34	Provide anaesthesia for patients requiring complex neurosurgical or neuroradiological procedures under direct supervision, such as awake craniotomy	CEX/CBD

Volume of Practice and Workplace-Based Assessment Requirements for Neuro-anaesthesia

Minimum VOLUME OF PRACTICE

Interventional Neuro-radiological procedures	5
Neuro-surgical procedures (*)	50

(*) Neuro-surgical procedures are defined as surgical procedures performed on or within the cranium, or on the spinal cord proper

Minimum WORKPLACE-BASED ASSESSMENTS

	FOCUS	
CEX/CBD	Themes focusing on learning outcomes listed above	2

3.7 Ophthalmic Anaesthesia

By the completion of this specialty module, trainees will be able to

- **Provide sedation and general and anaesthesia for ophthalmic procedures.**
- **Understand the techniques and complications of regional anaesthesia for ophthalmic procedures**

Learning outcomes		**Assessment**
3.7.1	Describe the anatomy of the eye and the contents of the orbit with reference to the performance of regional eye blocks and their complications.	FEx
3.7.2	Describe the determinants of ocular perfusion and intra-ocular pressure.	FEx
3.7.3	Describe the eye reflexes (oculo-cardiac, oculo-respiratory, oculo-emetic) and their management during eye procedures.	FEx
3.7.4	Discuss the selection of local anaesthetic solutions for regional and topical eye blocks.	FEx
3.7.5	Discuss the use of adjuvant drugs for regional eye blocks and in particular Hyaluronidase.	FEx
3.7.6	Outline the anaesthetic implications of the perioperative use of drugs by eye surgeons; in particular topical local anaesthetic agents, vasoconstrictors, mydriatics, miotics, and intraocular pressure-reducing agents.	CEX/CBD, FEx
3.7.7	Describe the common co-morbid disease and patient factors encountered in patients having ophthalmic procedures.	CEX/CBD, FEx
3.7.8	Discuss the surgical requirements and implications for anaesthetic management of patients having surgery for: - Cataracts - Glaucoma - Retinal detachment - Penetrating eye injury - Enucleation for infection or tumour - Examination under anaesthesia	CEX/CBD, FEx

	- Strabismus - Blocked nasolacrimal duct - Extraocular procedures	
3.7.9	Discuss the specific anaesthetic requirements for emergency eye surgery and in particular the patient with a penetrating eye injury.	CEX/CBD, FEx
3.7.10	Discuss the implications for anaesthesia of the intra-ocular injection of gas.	CEX/CBD, FEx
3.7.11	Describe and compare regional blocks used for eye procedures, their possible complications and management including: - Subtenon block - Peri-bulbar block - Retrobulbar block	FEx
3.7.12	Describe the methods used to decrease or prevent a rise in intra-ocular pressure following a peri-bulbar block.	FEx
3.7.13	Discuss how patient factors and co-morbid conditions influence choice of anaesthesia for eye surgery in particular: - Anticoagulation status - Ability to lie flat - Ability to cooperate - Axial length of the globe	CEX/CBD, FEx
3.7.14	Outline the issues to be considered in providing appropriate pre-operative care for patients having eye surgery.	CEX/CBD, FEx
3.7.15	Describe sedation techniques for eye procedures.	CEX/CBD, FEx
3.7.16	Discuss strategies to convert from regional to general anaesthesia during an eye procedure.	CEX/CBD, FEx
3.7.17	Describe the patient and staff precautions required when using laser during eye surgery.	CEX/CBD, FEx

Volume of Practice and Workplace-Based Assessment Requirements for Ophthalmic Anaesthesia

Minimum VOLUME OF PRACTICE

Ophthalmic surgery	20

Minimum WORKPLACE-BASED ASSESSMENTS

	FOCUS	
CEX/CBD	Themes focusing on learning outcomes listed above	2

3.8 Anaesthesia outside Operating Theatre

By the completion of this specialty module, trainees will be able to deliver safe anaesthesia or sedation for diagnostic or therapeutic procedures, outside the operating theatre but within a hospital setting, under distant supervision.	
Learning outcomes	**Assessment**
General Principles on Remote Anaesthesia	
3.8.1 Discuss the various techniques of anaesthesia or sedation for adults and children for procedures or operations, outside operating theatre but within a hospital setting, either: - Diagnostic or therapeutic - Elective or emergency	CEX/CBD, FEx
3.8.2 Discuss the indications and contraindications of sedation for patients in the non-theatre environment.	CEX/CBD, FEx
3.8.3 Discuss the unique concerns and safety precautions required in specific peripheral environment.	CEX/CBD, FEx
3.8.4 Describe the diagnosis and management of the possible complications of remote procedures, including: - Airway emergency - Allergy and anaphylaxis - Aspiration - Cardiac arrest - Rapid, life-threatening bleeding, including management of coagulopathy - Venous air embolism	CEX/CBD, FEx
Knowledge and Skill Related to Specific Remote Procedures	
Endoscopic Procedures (OGD, ERCP)	
3.8.5 Discuss the concerns and implications for anaesthetic management of patients undergoing endoscopic procedures.	CEX/CBD, FEx
3.8.6 Describe the diagnosis and management of complications including aspiration and loss of airway.	CEX/CBD, FEx
Electroconvulsive Therapy (ECT)	

3.8.7	Discuss the considerations on legal requirements and ethical issues involved in anaesthetizing patients for ECT.	CEX/CBD, FEx
3.8.8	Describe the specific physical and physiological effects of ECT.	CEX/CBD, FEx
3.8.9	Discuss the rationale behind the choice of anaesthetic technique for ECT.	CEX/CBD, FEx
Medical Imaging Procedures (CT, MRI)		
3.8.10	Describe the specific equipment requirements and precautions for MRI.	CEX/CBD, FEx
3.8.11	Discuss the anaesthetic concerns and various techniques for child undergoing medical imaging procedures.	CEX/CBD, FEx
3.8.12	Discuss the complications related to CT including radiation hazards and contrast induced nephropathy.	CEX/CBD, FEx
Interventional Radiological Procedures		
3.8.13	Describe common interventional procedures and their pathophysiological consequences.	CEX/CBD, FEx
3.8.14	Discuss the advantages and disadvantages of interventional radiological procedures as compared with open procedures.	CEX/CBD, FEx
3.8.15	Describe the diagnosis and management of complications including contrast allergy and acute renal impairment.	CEX/CBD, FEx
Interventional Neuro-radiological Procedures		
3.8.16	Discuss the principles of anaesthetic management in patients with neurological problems undergoing interventional neuro-radiological procedures.	CEX/CBD, FEx
3.8.17	Discuss the advantages and disadvantages of interventional neuro-radiological procedures as compared with open procedures.	CEX/CBD, FEx
3.8.18	Describe the diagnosis and management of complications including air embolism, intracranial bleeding and cerebral ischaemia.	CEX/CBD, FEx

Volume of Practice and Workplace-Based Assessment Requirements for Anaesthesia Outside Operating Theatre

Minimum VOLUME OF PRACTICE

Anaesthesia outside operating theatre	20

Minimum WORKPLACE-BASED ASSESSMENTS

	FOCUS	
CEX/CBD	Themes focusing on learning outcomes listed above	2

3.9 Anaesthesia for Cardiac Surgery and Interventional Cardiology

By the completion of this specialty module, trainees will

- **Be able to provide anaesthesia for**
  - **(1) Cardiac surgery under direct supervision**
  - **(2) Interventional cardiology procedures of up to moderate complexities**
- **Have acquired the knowledge base to enable them to further subspecialize in cardiac anaesthesia after obtaining fellowship**

The basic sciences relevant to cardiac anaesthesia and perioperative cardiovascular medicine are covered in the section 2.5 Perioperative medicine. Learning outcomes related to the management of acute cardiac decompensation are covered in section 2.6 Trauma, crisis and resuscitation.

Learning outcomes		Assessment
Cardiac Surgery		
Preoperative Anaesthesia Concerns		
3.9.1	Obtain informed consent, explain procedure, risks and benefits, alternatives available and perioperative care plan from an anaesthetist's stand point.	CEX/CBD, FEx
3.9.2	Describe appropriate strategies (pharmacologic and non-pharmacologic) to relieve anxiety in patients presenting for cardiac surgery.	CEX/CBD, FEx
3.9.3	Discuss the perioperative assessment of - Myocardial ischaemia - Cardiac rhythm - Filling status - Left ventricular systolic and diastolic function - Right ventricular function and pulmonary artery pressure - Valve pathology - Shunts	CEX/CBD, FEx
3.9.4	Describe the initial medical management of acute thoracic aortic dissection.	CEX/CBD, FEx

Intraoperative Management		
3.9.5	Describe the appropriate anaesthetic technique including appropriate monitoring of various body function for the following cardiac surgical procedures: - Coronary artery bypass - Aortic and mitral valve surgery - Acute thoracic aortic dissection - 'Redo' cardiac surgery	CEX/CBD, FEx
3.9.6	Outline the basic surgical steps for: - Coronary artery bypass - Aortic and mitral valve surgery - Repair of aortic dissection - 'Redo' cardiac surgery	CEX/CBD, FEx
3.9.7	Describe issues related to the care of patients undergoing cardiopulmonary bypass: - Anticoagulation: drug, dose, monitoring (point-of-care and laboratory methods) - Maintenance of anaesthesia during cardiopulmonary bypass - Basic knowledge of the components of extracorporeal circuit - Monitoring during cardiopulmonary bypass - Techniques of intraoperative organ protection, in particular the heart, brain and spinal cord - Reperfusion injury and ischaemic preconditioning - Techniques and implication of cooling and rewarming including deep hypothermic circulatory arrest - Acid base management during bypass - Implications of aortic disease for aortic cannulation - Potential neurocognitive complication of cardiac surgery and cerebral protection - Haematological and inflammatory effects of cardiopulmonary bypass - Use of antifibrinolytics - Weaning from cardiopulmonary bypass - Reversal of anticoagulation, protamine dosage, administration and protamine reaction	CEX/CBD, FEx
3.9.8	Outline strategies for management of patients difficult to wean	CEX/CBD, FEx

	from cardiopulmonary bypass, including: - Use of pharmacologic agents: inotropes, dilators, constrictors - Intra-aortic balloon pump and its principles - Mechanical circulatory support	
Defibrillation and Cardiac Pacing		
3.9.9	State the indications for application of external defibrillation/pacing pads prior to surgery/ interventional procedure.	CEX/CBD, FEx
3.9.10	Describe the use of internal defibrillation.	CEX/CBD, FEx
3.9.11	Describe the types of cardiac pacing including transvenous, external and epicardial pacing.	CEX/CBD, FEx
3.9.12	Outline principles of perioperative programming of cardiac pacemakers.	CEX/CBD, FEx
3.9.13	Outline pacing modes, terminology and abbreviation commonly used.	CEX/CBD, FEx
Cardiac Output Monitoring		
3.9.14	Outline the measurement of cardiac output by various techniques.	CEX/CBD, FEx
3.9.15	Describe insertion of a pulmonary artery catheter, describe and interpret the waveforms (also refer to the section 3.13 Intensive Care Medcine).	CEX/CBD, FEx
3.9.16	Discuss interpretation of data obtained from PAC and other cardiac output measurement devices.	CEX/CBD, FEx
Echocardiography		
3.9.17	Discuss the role of echocardiography in assessing the haemodynamic unstable patient.	CEX/CBD, FEx
3.9.18	Outline a basic haemodynamic assessment through echocardiography.	CEX/CBD, FEx
3.9.19	Discuss the role of echocardiography in the cardiac surgical patient.	CEX/CBD, FEx

3.9.20	Describe the indications and contraindications of Trasesophageal echocardiography (TEE) in the cardiac and non-cardiac surgical settings.	CEX/CBD, FEx
3.9.21	Outline the indications for cardiopulmonary bypass and ECMO in non-cardiac surgical procedures.	CEX/CBD, FEx
Postoperative Care		
3.9.22	Describe the indications and contraindications of Trasesophageal echocardiography (TEE) in the cardiac and non-cardiac surgical settings.	CEX/CBD, FEx
3.9.23	Outline the indications for cardiopulmonary bypass and ECMO in non-cardiac surgical procedures.	CEX/CBD, FEx
3.9.24	Describe the indications and contraindications of Trasesophageal echocardiography (TEE) in the cardiac and non-cardiac surgical settings.	CEX/CBD, FEx
3.9.25	Outline the indications for cardiopulmonary bypass and ECMO in non-cardiac surgical procedures.	CEX/CBD, FEx
Interventional Cardiology		
3.9.26	Demonstrate understanding of conditions that are amendable to interventional cardiology procedures, and the related issues, e.g. remote location, radiation hazards, rapid haemodynamic fluctuation.	CEX/CBD, FEx
3.9.27	Describe the surgical/ interventional principles involved in common cardiology procedures including: - Pacemaker and AICD insertion/ removal - Electrophysiology studies: radiofrequency and cryoablation for arrhythmias - Insertion of percutaneous cardiac devices	CEX/CBD, FEx
3.9.28	Outline the major complications associated with interventional cardiology procedures, their presenting features and management.	CEX/CBD, FEx
Skills		

3.9.29	Conduct preoperative assessment of patients presenting for cardiac surgery or interventional cardiology procedures, focusing on: - Functional status - Haemodynamic status - Perioperative risk stratification - Indications for and interpretation of investigations including echocardiography, angiography and other imaging reports - Identify patients that need further optimization, including benefits of preoperative IABP	CEX/CBD
3.9.30	Provide anaesthesia for cardiac surgery with level 1 supervision	CEX/CBD
3.9.31	Provide anaesthesia for patients undergoing interventional cardiology procedures up to moderate complexities under supervision. These may include: - Pacemaker and AICD insertion/ removal - Electrophysiology studies: radiofrequency and cryoablation for arrhythmias - Insertion of percutaneous cardiac devices	CEX/CBD

Volume of Practice and Workplace-Based Assessment Requirements for Anaesthesia for Cardiac Surgery and Interventional Cardiology

Minimum VOLUME OF PRACTICE

Cardiac surgery with cardiopulmonary bypass	10
Cardiac surgery or Interventional cardiology procedures, not otherwise specified	10

Minimum WORKPLACE-BASED ASSESSMENTS

	FOCUS	
CEX/CBD	Themes focusing on learning outcomes listed above	2

3.10 Anaesthesia for Thoracic Surgery

By the completion of this specialty module, trainees will be able to provide anesthesia for patients requiring thoracic surgery of moderate complexity, including various types of open thoracic and thoracoscopic surgical procedures.

Knowledge based learning outcomes related to anesthesia for more complex thoracic surgery in this unit, will provide a foundation for those wishing to gain further experience and skills in thoracic anesthesia.

Learning outcomes related to initial resuscitation and management of patients with thoracic trauma are covered in section 2.6 Trauma, crisis management and resuscitation.

Many topic areas particularly relevant to this specialty module are also covered in section 2.4 Acute pain management and section 2.5 Perioperative medicine.

Learning outcomes	Assessment
Basic Science Underpinning Thoracic Anaesthesia	
3.10.1 Describe the anatomy of: - Tracheobronchial tree including bronchoscopic anatomy to level of lobar bronchi - Lung lobes and segments including common variations that may occur in these structures - Thorax, including the pleura and its surface anatomy - Innervation of the chest wall of relevance to the performance of regional blockade for thoracic surgery and chest trauma	FEx
3.10.2 Describe the changes in respiratory physiology and the implications for anaesthetic management which occur with: - Lateral decubitus positioning - Open thorax - One lung ventilation	FEx
3.10.3 Discuss the physiology of hypoxic pulmonary vasoconstriction, including the effects of anaesthetic agents and its anaesthetic implications.	FEx
3.10.4 Discuss the pathophysiology of chronic obstructive pulmonary disease and the strategies available to minimize gas trapping.	FEx

Pre-operative Assessment		
3.10.5	Discuss the assessment of perioperative risk prior to lobectomy and pneumonectomy including assessment of: - Respiratory mechanics - Cardiopulmonary reserve - Lung parenchymal functions - Methods for prediction of postoperative lung functions	CEX/CBD, FEx
3.10.6	Discuss the perioperative management of patients with Myasthenia Gravis presented for thymectomy.	CEX/CBD, FEx
3.10.7	Discuss the assessment of patients with mediastinal masses for surgical procedures, including the assessment of severity of vascular and respiratory obstruction and their anaesthetic implications.	CEX/CBD, FEx
Anaesthesia for Thoracic Surgery		
3.10.8	Describe the techniques used to position for thoracic surgery and to minimize risk of post-operative position-related injuries.	CEX/CBD, FEx
3.10.9	Describe the indications and contraindications for one-lung ventilation.	CEX/CBD, FEx
3.10.10	Describe the different methods available (both for adult and pediatrics) and their rationale to perform lung isolation including the use of: - Double-lumen tubes - Bronchial blockers - Univent tubes	CEX/CBD, FEx
3.10.11	Discuss the complications of double lumen tubes and the management of intra-operative problems associated with their use.	CEX/CBD, FEx
3.10.12	Outline a strategy for lung isolation in a patient with difficult airway or a tracheostomy in-situ.	CEX/CBD, FEx
3.10.13	Discuss the management of hypoxemia during one-lung ventilation.	CEX/CBD, FEx

3.10.14	Discuss the different options of ventilation (including jet ventilation) available for thoracic surgery.	CEX/CBD, FEx
3.10.15	Discuss the anaesthetic management of the following endobronchial procedures. - Diagnostic flexible and rigid bronchoscopy - Bronchoalveolar lavage - Bronchoscopic ultrasound and biopsy - Placement of tracheal and endobronchial stent - Removal of foreign body in airway - Laser excision of endobronchial tumor	CEX/CBD, FEx
3.10.16	Discuss the anaesthetic management of the following thoracic procedures. - Surgery for mediastinal mass - Thymectomy - Mediastinoscopy - Pleurodesis - Lung resection, including wedge excision, segmentectomy, lobectomy and pneumonectomy - Repair of bronchopleural fistula - Drainage of lung abscess - Drainage of empyema and decortication of lung - Bullectomy - Lung volume reduction surgery - Thoracoscopic sympathectomy	CEX/CBD, FEx
3.10.17	Discuss the specific issues for peri-operative management of patients for pneumonectomy.	CEX/CBD, FEx
3.10.18	Identify fluid management issues specific to thoracic surgery and discuss fluid management of the patient having lung resection.	CEX/CBD, FEx
3.10.19	Identify pain management issues specific to thoracic surgery and discuss analgesic options for patients having thoracic surgery.	CEX/CBD, FEx
3.10.20	Discuss the management of pleural drainage systems in the post-operative period.	CEX/CBD, FEx
3.10.21	Outline the critical times during thoracic procedures that will impact on anaesthetic management, including airway ligation and	CEX/CBD, FEx

	manipulation of pulmonary vasculature.	
3.10.22	Outline the management of the following post-operative complications associated with thoracic surgery: - Bleeding - Pneumothorax/tension pneumothorax - Arrhythmia - Bronchopleural fistulae - Nerve damage - Pulmonary torsion - Cardiac herniation	CEX/CBD, FEx
Management for Chest Trauma		
3.10.23	Briefly discuss the diagnosis and management of chest trauma, including: - Pneumothorax/tension pneumothorax - Hemothorax - Flail chest - Rib/sternal fractures - Pulmonary contusion - Major airway injury - Major vascular injury e.g. traumatic aortic disruption	CEX/CBD, FEx
3.10.24	Outline the indications for thoracotomy in the management of chest trauma.	CEX/CBD, FEx
3.10.25	Outline the methods for cardiopulmonary resuscitation during cardiac arrest in the management of chest trauma.	CEX/CBD, FEx
3.10.26	Discuss methods of analgesia for rib/sternal fractures.	CEX/CBD, FEx
3.10.27	Discuss the management of respiratory failure associated with chest trauma and the place of non-invasive ventilation.	CEX/CBD, FEx
3.10.28	Discuss the management of chest drains and pleural drainage systems for thoracic trauma.	CEX/CBD, FEx
Skills		
3.10.29	Conducting preoperative assessment for patients presenting for thoracic surgery, focusing on	CEX/CBD

	- Determination of functional status - Interpretation of blood gas analysis, lung function testing, CXR and CT thorax - Identifying patients requiring further investigation and optimization	
3.10.30	Insert an appropriate double lumen tube (size, left versus right) for lung isolation, and confirm its position both clinically and fibreoptically	DOPS, FEx
3.10.31	Demonstrate the setup for anesthesia for rigid bronchoscopy including methods of delivery of anesthetic drugs and ventilation	DOPS, FEx
3.10.32	Provide anaesthesia for patients undergoing thoracic procedures of low to moderate complexities	CEX/CBD

Volume of Practice and Workplace-Based Assessment Requirements for Thoracic Anaesthesia

Minimum VOLUME OF PRACTICE

Thoracic procedures, not otherwise specified	30

Minimum WORKPLACE-BASED ASSESSMENTS

	FOCUS	
CEX/CBD	Themes focusing on learning outcomes listed above	2
DOPS	Lung isolation and one-lung ventilation	1

3.11 Anaesthesia for Vascular Surgery

By the completion of this specialty module, trainees will be able to provide anaesthesia for patients requiring vascular surgery and interventional endovascular procedures.

Many topic areas particularly relevant to this specialty module are covered in various sections under Clinical fundamentals.

Learning outcomes	Assessment
Pre-operative Assessment	
3.11.1 Outline the pathophysiology of peripheral vascular disease including common co-morbidities.	CEX/CBD, FEx
3.11.2 Discuss the pharmacological adjuncts used in vascular surgery.	CEX/CBD, FEx
3.11.3 Discuss the perioperative management of the following comorbidities in the patient presenting for vascular surgery including perioperative risk assessment and risk reduction (also refer to section 2.5 Perioperative Medicine): - Ischaemic heart disease - Cardiac failure - Arrhythmia - Hypertension - Diabetes mellitus - Chronic obstructive airways disease - Renal failure	CEX/CBD, FEx
3.11.4 Describe the impact of vascular disease on: - Wound dehiscence and infection - Positioning injury - Perioperative myocardial ischaemia - Perioperative stroke - Perioperative renal failure	CEX/CBD, FEx
Anaesthesia for Vascular Surgery	
3.11.5 Discuss the surgical requirements and implications for anaesthetic management of patients having elective surgery for: - Peripheral arterial occlusive disease - Carotid artery stenosis	CEX/CBD, FEx

	- Aortic and aorto-iliac disease - Vascular access for haemodialysis - Thorascopic sympathectomy	
3.11.6	Discuss options for postoperative analgesia and perioperative fluid therapy for these procedures.	CEX/CBD, FEx
3.11.7	Evaluate the risks and benefits of regional anaesthesia and analgesia in vascular surgery.	CEX/CBD, FEx
3.11.8	Discuss the perioperative management, including postoperative analgesia and perioperative fluid management of patients having an emergency vascular procedure for the following: - Ruptured aortic aneurysm - Aortic dissection - Major vessel occlusion - Limb ischaemia - Limb amputation - Arterial laceration	CEX/CBD, FEx
3.11.9	Describe the pathophysiology and implications for anaesthesia management of: - Aortic cross clamping and unclamping at various levels - Prolonged limb or gut ischaemia - Carotid clamping and unclamping	CEX/CBD, FEx
3.11.10	Discuss the prevention, diagnosis and management of intraoperative complications associated with vascular surgery including: - Major haemorrhage - Bradycardia associated with carotid artery surgery - Cerebral ischaemia associated with carotid artery clamping - Reperfusion syndromes - Spinal cord ischaemia - Acute renal impairment - Myocardial ischaemia - Acute arrhythmia - Stroke - Thromboembolism	CEX/CBD, FEx
3.11.11	Discuss strategies for spinal cord protection in aortic surgery.	CEX/CBD, FEx

3.11.12 Discuss the diagnosis and management of postoperative complications associated with vascular surgery including: - Haemorrhage - Perioperative stroke - Myocardial ischaemia - Limb ischaemia - Rhabdomyolysis - Post-amputation pain	CEX/CBD, FEx
3.11.13 Discuss techniques used to monitor cerebral perfusion during carotid endarterectomy.	CEX/CBD, FEx
3.11.14 Describe techniques for performing carotid endarterectomy under regional anaesthesia and evaluate the role of regional anaesthesia for carotid endarterectomy.	CEX/CBD, FEx
3.11.15 Discuss post-operative complications specifically associated with carotid endarterectomy and discuss their management.	CEX/CBD, FEx
Anaesthesia for Interventional Vascular Procedures	
3.11.16 Outline the implications for patient safety of the location of the interventional radiology service.	CEX/CBD, FEx
3.11.17 Discuss the pathophysiology of contrast-induced nephropathy and measures of peri-operative renal protection.	CEX/CBD, FEx
3.11.18 Discuss the procedural requirements and implications for anaesthetic management of patients having interventional radiological procedures including: - Vascular embolization - Vascular stenting - Insertion of intravascular devices including aortic grafts	CEX/CBD, FEx
3.11.19 Discuss the diagnosis and management of complications associated with interventional radiological procedures including: - Reaction to intravenous contrast - Aortic occlusion - Acute renal impairment - Spinal cord ischaemia - High radiation dose	CEX/CBD, FEx

- Haemorrhage	
3.11.20 Outline the advantages and disadvantages of interventional radiological procedures as compared with open procedures for management of: - Aortic aneurysm - Aortic dissection - Emergency leaking aortic aneurysm - Carotid artery stenosis	CEX/CBD, FEx
Skills	
3.11.21 Conduct preoperative assessment of patients presenting for vascular surgery, focusing on: - Determination of functional status - Assessing perioperative risk - Risk stratification methods using scoring systems - Identifying patients requiring further investigation and optimisation	CEX/CBD
3.11.22 Provide anaesthesia for major vascular surgery or interventional radiological vascular procedures up to moderate complexities	CEX/CBD

Volume of Practice and Workplace-Based Assessment Requirements for Anaesthesia for Vascular Surgery

Minimum VOLUME OF PRACTICE

Major vascular surgery or Interventional radiological vascular procedure	20

Minimum WORKPLACE-BASED ASSESSMENTS

	FOCUS	
CEX/CBD	Themes focusing on learning outcomes listed above	2

3.12 Pain Medicine

The Specialty Module on Pain medicine specifies **a minimum of 48 designated pain-related clinical sessions to be completed over a maximum period of 6 months, preferably as a "training block" of 2-3 months**. This is to ensure **continuity of care with timely feedback** to trainees when they learn about chronic pain.

The pain-related clinical sessions

1. Should be conducted in an anaesthesia training unit, and supervised by at least one HKCA Fellow in Pain Medicine or Diploma in Pain Management holder.
2. Could include a diversity of activities, examples of which include chronic pain rounds, multidisciplinary rounds, pain intervention procedures, etc.
3. Should only have one anaesthesia trainee for each session.

By the completion of the specialty module, trainees will be able to manage patients with common chronic pain conditions, be able to participate as a multidisciplinary team member in the management to patients with chronic pain or those requiring palliative care. **They will be able to recognize when referral to a pain specialist is required.**	
Learning outcomes	**Assessment**
Knowledge	
3.12.1 Outline the principles of the assessment and management of chronic pain in a multi-disciplinary team setting.	CEX/CBD, FEx
3.12.2 Discuss the importance of psychological and social factors in the presentation and management of pain including but not limited to: - Anxiety - Depression - Placebo effect - Active and passive coping strategies - Illness behavior - Compensation and third party issues	CEX/CBD, FEx
3.12.3 Formulate a pain management plan for patients with complex pain problems demonstrating integrated knowledge of the interaction of analgesic agents, patient factors and the aetiology of pain.	CEX/CBD, FEx

3.12.4	Describe the place of common neurolytic blocks and interventions in the management of chronic pain such as - Stellate ganglion block - Coeliac plexus block - Lumbar sympathetic block - Epidural steroid injection	CEX/CBD, FEx
3.12.5	Describe the management of back pain. - Able to identify red flag and yellow flag signs - Common pharmacological and non-pharmacological methods	CEX/CBD, FEx
3.12.6	Outline pain management strategies for patients requiring palliative care.	CEX/CBD, FEx
3.12.7	Outline the pain management of common chronic pain conditions, for example, headache, neuropathic pain conditions and persistent post-surgical pain.	CEX/CBD, FEx
Skills		
3.12.8	Assessment of a patient with chronic pain condition and formulate a management plan.	CEX/CBD, FEx

Volume of Practice and Workplace-Based Assessment Requirements for Pain Medicine

Minimum VOLUME OF PRACTICE

Pain consultations (Acute pain or chronic pain consultations during pain rounds or clinics)	20
Multidisciplinary case conference	1
Pain intervention procedures, not otherwise specified (Observed or performed under supervision)	5

Minimum WORKPLACE-BASED ASSESSMENTS

	FOCUS	
CEX/CBD	Themes focusing on learning outcomes listed above	2

3.13 Intensive Care Medicine

By the completion of this specialty module, trainees, in collaboration with intensive care specialists, will be able to

- **Provide safe care for patients in a peripheral adult intensive care units presenting with medical and surgical illness**
- **Manage patients with critical illness and organ failures**
- **Manage the postop patients with surgical or anaesthetic complications**
- **Provide ongoing resuscitation and stabilisation for patients who require transfer to more specialised intensive care units.**

Knowledge-based learning outcomes related to complex intensive care medicine will provide a foundation for those wishing to gain further experience and skills intensive care.

Many topic areas particularly relevant to this specialty module are also covered in section 2.5 Perioperative medicine and section 2.6 Trauma, crisis management and resuscitation.

Learning outcomes		Assessment
General Care of the Patient in Intensive Care Medicine		
3.13.1	Discuss the importance of setting therapeutic goals for admission to intensive care.	CEX/CBD, FEx
3.13.2	Outline estimation of nutritional requirements and prescribe nutritional support.	CEX/CBD, FEx
3.13.3	Outline the complications associated with enteral and parenteral nutritional support.	CEX/CBD, FEx
3.13.4	Discuss the provision of analgesia and sedation for critically ill patients.	CEX/CBD, FEx
3.13.5	Describe the effect of critical illness on the pharmacokinetics and pharmacodynamics of sedative and analgesic agents.	CEX/CBD, FEx
3.13.6	Describe weaning protocols of sedative and analgesic agents and strategies to prevent withdrawal phenomena.	CEX/CBD, FEx
3.13.7	Evaluate the use of muscle relaxants in the critically ill patient.	CEX/CBD, FEx

3.13.8 Outline the reasons why critically ill patients are particularly at risk of acquiring nosocomial infections.	CEX/CBD, FEx
3.13.9 Describe standard precautions as applied to critically ill patients.	CEX/CBD, FEx
3.13.10 Outline a scoring system to assess severity of illness and discuss the utility of such scoring systems.	CEX/CBD, FEx
3.13.11 Outline the long-term complications of prolonged intensive care admission.	CEX/CBD, FEx
3.13.12 Describe the features of patients who may be suitable organ donors.	CEX/CBD, FEx
3.13.13 Outline the management of the brain-dead patient awaiting organ donation.	CEX/CBD, FEx
3.13.14 Describe the principles of safe intra and inter-hospital transfer of critically ill patients.	CEX/CBD, FEx
Sepsis and Multi-organ Dysfunction	
3.13.15 Define sepsis, severe sepsis and systemic inflammatory response syndrome (SIRS).	CEX/CBD, FEx
3.13.16 Outline the pathophysiology of SIRS and sepsis and severe sepsis.	CEX/CBD, FEx
3.13.17 Describe the mechanisms of organ dysfunction in severe sepsis.	CEX/CBD, FEx
3.13.18 Outline the investigation and management of the patient with severe sepsis.	CEX/CBD, FEx
3.13.19 Discuss goal directed therapy of sepsis.	CEX/CBD, FEx
3.13.20 Broadly classify antimicrobial agents according to their mode of action and spectrum of activity.	CEX/CBD, FEx
3.13.21 Describe the adverse effects of antimicrobial agents in the intensive care patient.	CEX/CBD, FEx
3.13.22 Discuss the role of prophylaxis in preventing infection in the intensive care patient.	CEX/CBD, FEx

3.13.23 Describe a rational approach to prescribing antimicrobial treatment in severe sepsis.	CEX/CBD, FEx
Acute circulatory failure and cardiovascular disorders (also refer to section 2.6 Trauma, Crisis Management and Resuscitation)	
3.13.24 Describe the clinical features of the shocked patient and the clinical features differentiating the causes of shock.	CEX/CBD, FEx
3.13.25 Describe the pathophysiological consequences of shock.	CEX/CBD, FEx
3.13.26 Outline the clinical use of indicators of tissue oxygenation.	CEX/CBD, FEx
3.13.27 Interpret blood gas analysis in the shocked patient.	CEX/CBD, FEx
3.13.28 Discuss methods of monitoring cardiac output and optimisation of fluid therapy in the intensive care patient.	CEX/CBD, FEx
3.13.29 Discuss the treatment of shock according to its cause and the role of goal directed therapy.	CEX/CBD, FEx
3.13.30 Discuss the role of fluid therapy in the shocked patient.	CEX/CBD, FEx
3.13.31 Describe the investigation and management of the patient with acute myocardial infarction and cardiogenic shock.	CEX/CBD, FEx
3.13.32 Discuss the investigation and management of myocardial contusion.	CEX/CBD, FEx
3.13.33 Outline the intensive care management of traumatic aortic injury.	CEX/CBD, FEx
3.13.34 Describe the diagnosis and medical management of acute thoracic aortic dissection (also refer to section 2.6 Trauma, Crisis Management and Resuscitation, and section 3.9 Cardiac Surgery and Interventional Cardiology).	CEX/CBD, FEx
3.13.35 Outline the management of heart failure in the intensive care setting.	CEX/CBD, FEx
3.13.36 Discuss the use of vasopressors, inotropic and lusitropic agents in the intensive care setting.	CEX/CBD, FEx
3.13.37 Outline the management of cardiac arrhythmias in the intensive	CEX/CBD, FEx

care patient.	
3.13.38 Outline the pathophysiology of and describe the investigations and management of pulmonary embolic disorders.	CEX/CBD, FEx
3.13.39 Outline the indications for and principles of use of intra aortic balloon pumps and ventricular assist devices in the intensive care setting.	CEX/CBD, FEx
3.13.40 Critically evaluate the resuscitative management of patients in cardiac arrest.	CEX/CBD, FEx
Respiratory Failure and Intensive Care of Respiratory Disorders (also refer to section 2.5 Perioperative Medicine and section 2.6 Trauma, Crisis Management and Resuscitation)	
3.13.41 Define respiratory failure and differentiate between types of respiratory failure.	CEX/CBD, FEx
3.13.42 Discuss the differences between acute and chronic respiratory failure and the implications for management.	CEX/CBD, FEx
3.13.43 Interpret blood gas analysis, CXR and pulmonary function tests in respiratory failure.	CEX/CBD, FEx
3.13.44 Describe the pathophysiology of acute lung injury (ALI) and acute respiratory distress syndrome (ARDS) and outline the intensive care management of these.	CEX/CBD, FEx
3.13.45 Describe the pathophysiology and management of pulmonary oedema.	CEX/CBD, FEx
3.13.46 Discuss the intensive care management of chest trauma including pulmonary contusions, chest wall injuries and haemorrhage.	CEX/CBD, FEx
3.13.47 Describe the pathophysiology and management of fat embolism syndrome.	CEX/CBD, FEx
3.13.48 Describe the pathophysiology and management of acute severe asthma.	CEX/CBD, FEx
3.13.49 Describe the management of acute exacerbations of COPD.	CEX/CBD, FEx
3.13.50 Outline the management of pneumonia in the intensive care	CEX/CBD, FEx

	setting.	
3.13.51	Describe the prevention and management of ventilator associated pneumonia.	CEX/CBD, FEx
3.13.52	Discuss the investigation and management of postoperative respiratory failure.	CEX/CBD, FEx
3.13.53	Describe methods of and indications for providing ventilatory assistance in respiratory failure including the place of non-invasive ventilation.	CEX/CBD, FEx
3.13.54	Evaluate ventilation strategies and non-ventilator therapies to optimise oxygenation and ventilation and minimise lung injury.	CEX/CBD, FEx
3.13.55	Discuss the complications of ventilation and the strategies to minimise ventilator-induced lung injury including the ventilation of patients with ARDS.	CEX/CBD, FEx
3.13.56	Discuss the interpretation of blood gas analysis and the use of this to guide respiratory support.	CEX/CBD, FEx
3.13.57	Discuss the assessment and management of extubation in patients who have been intubated for airway obstruction, for example, epiglottitis, angioneurotic oedema, Ludwig's angina.	CEX/CBD, FEx
3.13.58	Describe the indications for, timing and subsequent management of tracheotomies, including common complications, in the critically ill patient.	CEX/CBD, FEx
3.13.59	Describe the procedure, contraindications and possible complications of percutaneous dilatation tracheotomy.	CEX/CBD, FEx
3.13.60	Discuss the issues associated with the long-term ventilation of patients with chronic neuromuscular disorders and outline the factors important in making the decision to initiate assisted ventilation in these patients.	CEX/CBD, FEx
3.13.61	Discuss the available strategies for weaning patients from ventilatory support and discuss the timing and particular issues with different patient groups.	CEX/CBD, FEx

3.13.62	Outline the indications for the use of Extracorporeal Membrane Oxygenation (ECMO) in respiratory failure and outline the principles of delivery of ECMO.	CEX/CBD, FEx
3.13.63	Outline the indications for hyperbaric oxygen therapy in the critically ill patient and the problems associated with providing this treatment.	CEX/CBD, FEx
3.13.64	Critically evaluate the resuscitative management of patients in respiratory arrest.	CEX/CBD, FEx
3.13.65	Discuss the initiation of ventilation and management of patients on ventilators in the intensive care setting.	CEX/CBD, FEx
3.13.66	Discuss the initiation of non-invasive ventilation and management of patients receiving non-invasive ventilation in the intensive care setting.	CEX/CBD, FEx
Renal and Fluid and Electrolyte Disorders		
3.13.67	Describe the pathophysiology, investigation and management of acute renal failure.	CEX/CBD, FEx
3.13.68	Discuss strategies to prevent acute renal failure in the critically ill patient.	CEX/CBD, FEx
3.13.69	Describe the clinical situations where rhabdomyolysis is likely to occur and discuss the diagnosis and management of acute rhabdomyolysis.	CEX/CBD, FEx
3.13.70	Describe methods of providing renal replacement therapy in the patient with acute renal failure.	CEX/CBD, FEx
3.13.71	Discuss the aetiology, diagnosis and management of fluid and electrolyte disturbances in the critically ill patient.	CEX/CBD, FEx
3.13.72	Discuss the clinical management of acid-base disturbances in critically ill patients.	CEX/CBD, FEx
3.13.73	Outline the principles of postoperative care of the renal transplant recipient.	CEX/CBD, FEx

Metabolic and Endocrine Disorders	
3.13.74 Describe the metabolic response to trauma and critical illness	CEX/CBD, FEx
3.13.75 Outline the intensive care management of severe hypothermia.	CEX/CBD, FEx
3.13.76 Discuss the intensive care management of malignant hyperthermia and neuroleptic malignant syndrome	CEX/CBD, FEx
3.13.77 Discuss the management of endocrine emergencies, including thyroid storm, adrenocortical insufficiency, diabetic ketoacidosis and hyperglycaemic non-ketotic coma	CEX/CBD, FEx
Neurological and Neuromuscular Disorders	
3.13.78 Outline the diagnosis and management of persistent vegetative state.	CEX/CBD, FEx
3.13.79 Discuss the clinical diagnosis of brain death and the confirmatory investigations involved.	CEX/CBD, FEx
3.13.80 Discuss the determinants and control of: - Intracranial and intraspinal pressure - Cerebral blood flow - Spinal cord perfusion	CEX/CBD, FEx
3.13.81 Discuss the principles of intracranial pressure monitoring.	CEX/CBD, FEx
3.13.82 Outline the pathophysiology, investigation and management of delirium in the intensive care patient.	CEX/CBD, FEx
3.13.83 Discuss the management of the patient with neurological deterioration due to ischaemic and haemorrhagic stroke and subarachnoid haemorrhage.	CEX/CBD, FEx
3.13.84 Discuss the management of cerebral vasospasm.	CEX/CBD, FEx
3.13.85 Outline the investigation and management of encephalitis and meningitis.	CEX/CBD, FEx
3.13.86 Discuss the intensive care management of: - Raised intracranial pressure - Acute traumatic brain injury	CEX/CBD, FEx

- Prolonged seizures - Acute spinal cord injury	
3.13.87 Outline the principles of management of: - Hemiplegia, paraplegia, quadriplegia. - Postoperative neurosurgical patients - Diabetes insipidus - Cerebral salt wasting	CEX/CBD, FEx
3.13.88 Outline the pathophysiology and indications for intensive care management for patients with: - Tetanus - Botulism - Guillain-Barre syndrome - Myasthenia gravis - Myotonias and muscular dystrophies	CEX/CBD, FEx
3.13.89 Discuss the investigation and management of the critical care patient who wakes with neurological impairment.	CEX/CBD, FEx
Gastrointestinal Disorders	
3.13.90 Discuss the management of life-threatening gastrointestinal haemorrhage.	CEX/CBD, FEx
3.13.91 Outline the diagnosis and management of oesophageal perforation.	CEX/CBD, FEx
3.13.92 Outline the management of acute and acute on chronic liver failure including the indications for transplantation.	CEX/CBD, FEx
3.13.93 Outline the diagnosis and management of acute pancreatitis.	CEX/CBD, FEx
3.13.94 Outline the intensive care unit management of the patient with life-threatening abdominal conditions including: - Abdominal sepsis - Ischemic, perforated or obstructed gut - Major abdominal trauma	CEX/CBD, FEx
3.13.95 Discuss the intensive care management of patients who have undergone major abdominal surgery.	CEX/CBD, FEx

Haematological and Oncological Disorders	
3.13.96 Outline the management of oncology emergencies: - Due to primary disease, for example vena cava obstruction, acute cord compression, pericardial effusion - Secondary to treatment, for example, graft versus host disease, immune suppression	CEX/CBD, FEx
3.13.97 Outline an approach to the management of the intensive care patient with coagulopathy including disseminated intravascular coagulation.	CEX/CBD, FEx
3.13.98 Outline the appropriate use of anticoagulants in patients in the intensive care setting including prevention and management of venous and arterial thrombosis and thromboembolism.	CEX/CBD, FEx
3.13.99 Outline the investigation and management of anaemia and thrombocytopaenia in intensive care.	CEX/CBD, FEx
3.13.100 Discuss the rational use of blood products in the intensive care setting.	CEX/CBD, FEx
3.13.101 Discuss the investigation and management of transfusion reactions.	CEX/CBD, FEx
Environmental Injuries	
3.13.102 Outline the intensive care management of: - Electrocution - Burns - Near drowning - Envenomation - Drug overdose - Corrosive ingestion - Altitude sickness - Decompression syndromes	CEX/CBD, FEx
Intensive Care of the Obstetric Patient (also refer to section 3.5 Obstetrics Anaesthesia and Analgesia)	
3.13.103 Outline the specific requirements of managing the obstetric patient in intensive care, including maintenance of foetal viability,	CEX/CBD, FEx

for example, in the patient with cardiovascular failure, respiratory failure, or intracranial haemorrhage.	
3.13.104 Explain the differences in basic and advanced life support in the pregnant patient.	CEX/CBD, FEx
3.13.105 Discuss the intensive care management of severe pre- eclampsia and eclampsia.	CEX/CBD, FEx
3.13.106 Discuss the intensive care management of post-partum haemorrhage and amniotic fluid embolism.	CEX/CBD, FEx

Skills

During the period of Intensive care attachement, trainees are expected to

- **Gather experience and develop non-technical skills (such as communication, collaboration, teamwork and leadership skills)**
- **Participate in quality assurance activities (such as case presentation, audits) as appropriate**

Learning outcomes	**Assessment**
3.13.107 Understanding the psychological and emotional impact of the intensive care environment on patients and their families	CEX/CBD
3.13.108 Communicating effectively with the intubated patient	CEX/CBD
3.13.109 Communicating effectively with the families of patients in intensive care	CEX/CBD
3.13.110 Developing a shared plan of care with patients and families in intensive care	CEX/CBD
3.13.111 Dealing appropriately with issues related to death and dying, for example: - Treatment limitation - Brain death and organ donation	CEX/CBD
3.13.112 Demonstrating respect and understanding of the role of other team members in intensive care	CEX/CBD

3.13.113 Participating in or leading a ward round in the intensive care unit	CEX/CBD
3.13.114 Handing over to other carers within and outside intensive care	CEX/CBD
3.13.115 Describing the collaboration necessary to facilitate organ retrieval	CEX/CBD
3.13.116 Co-ordinating the transfer of a patient to or from the intensive care unit	CEX/CBD
3.13.117 Outlining the role of the intensive care unit within the wider geographical region and the mechanism for organising transfer of patients to another unit when required	CEX/CBD
3.13.118 Allocating the available bed, staffing, equipment and physical resources effectively	CEX/CBD
3.13.119 Outlining roles an intensive care unit may provide within a hospital, including postoperative care for complex/high-risk patients, patient arrest/resuscitation situations, outreach and education	CEX/CBD
3.13.120 Facilitating the learning of patients/families, students and other health professionals in intensive care and through intensive care unit outreach activities	CEX/CBD
3.13.121 Participating in quality assurance processes in intensive care, for example, monitoring hospital acquired infections	CEX/CBD
3.13.122 Describing the particular stressors that exist in intensive care and how these might be dealt with	CEX/CBD
3.13.123 Outlining the ethical and legal issues particular to end-of-life care in the intensive care environment	CEX/CBD

Volume of Practice and Workplace-Based Assessment Requirements for Intensive Care Medicine

Minimum VOLUME OF PRACTICE

There is no minimum case load requirement for the Intensive Care module.

The minimum duration of Intensive Care attachment is 6 months.

Minimum WORKPLACE-BASED ASSESSMENTS

	FOCUS	
CEX/CBD	Themes focusing on learning outcomes listed above	2

SECTION 4 THE PROVISIONAL FELLOWSHIP YEAR

4.1 Aim of the Provisional fellowship year

Trainees at this stage are at the final preparation for independent practice.

By the end of Higher Training, trainees will be competent at various aspects of anaesthesia practice to that level and will have gathered experience of most procedures and techniques. Trainees may not, however, have mastery of specialized, uncommon and difficult clinical work, and they may have relatively few chance or experience of working independently.

The aims of the Provisional Fellowship Year (PFY) are therefore:

- To further consolidate and sharpen their clinical skills, approach and judgment in uncommon and/or difficult clinical contexts, in a self-reflective manner
- To explore and develop interests in clinical subspecialties
- To extend and apply non-technical skills in clinical practice, especially on leadership and communication
- To accumulate experience in non-clinical duties that would normally be expected for a specialist working in an anaesthesia department

4.2 Learning outcomes and Method of Assessment

Learning outcomes		**Assessment**
4.2.1	Provision of safe, efficient and effective clinical care	CEX/CBD, MSF
4.2.2	Readiness to take on the leadership role	CEX/CBD, MSF
4.2.3	Demonstrating effective decision-making, communication, teamwork and organization skills, both inside and outside the operating theatre	CEX/CBD, MSF
4.2.4	Demonstrating high situation awareness at all times	CEX/CBD, MSF
4.2.5	Demonstrating compassion and understanding especially when dealing with anxious and distressed patients	CEX/CBD, MSF
4.2.6	Demonstrating safe practice in uncommon and difficult clinical situations, having personal insights and be willing to admit vulnerability and seek help	CEX/CBD, MSF

4.2.7	Be open and honest about mistakes and errors and be able to self-reflect and learn for future improvement	CEX/CBD, MSF
4.2.8	Commitment to continuous education and life-long learning	CEX/CBD, MSF
4.2.9	Understanding the nature of scientific research	CEX/CBD
4.2.10	Understanding the importance of quality assurance activities, and be able to participate or lead in a quality improvement activity	CEX/CBD, MSF
4.2.11	Understanding a typical management cycle, including planning, implementation and performance review, and where possible, participating in administrative duties	CEX/CBD, MSF

A trainee undergoing the PFY should develop a learning plan, with individualized learning outcomes. The plan should be discussed and approved by the Supervisor of Training, and be submitted within 2 months from the date of commencement of the PFY.

A minimum of 50% of the PFY should be completed undertaking clinical work.

An appropriate amount of non-clinical time should be allocated to the trainee for various non-clinical commitments, as negotiated with the Supervisor of Training and the Head of the Training Unit.

Volume of Practice and Workplace-Based Assessment Requirements In the Provisional Fellowship Year

Minimum VOLUME OF PRACTICE

There is no minimum clinical case load requirement in the PFY.

Trainees however, are required to record their learning activities during the PFY. Such learning activity reports should be vetted by an activity supervisor and submitted to the College before Exit Assessment.

The minimum number of reports to be submitted is listed in the table below:

Activity	Minimum reports
Clinical	
- Clinical case diary	Minimum 1 with case description, self-evaluation and reflection (minimum word count 500 per report)
Teaching and Education	
- Teaching a clinical skill	Minimum 1 chosen activities with documentation and self-reflection (minimum word count 500 per report)
- Giving small group tutorial to juniors or other health care workers	
- Participation as instructor or assistant instructor in a workshop or course	
Management Exposure	
- Drafting or review of clinical guidelines	Minimum 1 chosen activity with documentation and self-reflection (minimum word count 500 per report)
- Clinical Audits	
- Critical Incidents review or Morbidity and Mortality case review	
- Quality and safety improvement initiatives	
- Management-related activities, such as (but not limited to) preparation of rosters, leave plan coordination, equipment / consumable coordination, interdepartmental meetings, staff	

welfare activities	

Minimum WORKPLACE-BASED ASSESSMENTS

	FOCUS	
CEX/CBD	Themes focusing on learning outcomes listed above	1
ALMAT	Themes focusing on learning outcomes listed above	1
MSF	Overall performance maturity	1

APPENDIX 1 SUMMARY OF VOLUME OF PRACTICE (VOP) REQUIREMENTS

Clinical Fundamentals

Trainees must complete the following minimum VOP **at the end of Basic Training** and **Higher Training**:

2.1 General Anaesthesia and Sedation

	DURING BASIC TRAINING	TOTAL BY THE END OF HIGHER TRAINING
Anaesthesia using TIVA	10	50
Monitored Anaesthesia Care (MAC) or Sedation (with or without neuraxial/regional block)	10	50
Central Venous Cannulation	10	50
Arterial cannulation	10	50

2.2 Regional Anaesthesia

	DURING BASIC TRAINING	TOTAL BY THE END OF HIGHER TRAINING
Spinal blocks	50	100
Epidural or Combined Spinal Epidural Blocks (non-Obstetrics)	---	15
Major plexus blocks or peripheral nerve block	---	50

2.3 Airway Management

	DURING BASIC TRAINING	TOTAL BY THE END OF HIGHER TRAINING
Insertion of Supraglottic devices	50	---
Direct Laryngoscopy and Intubation	50	---
Video Laryngoscopy and Intubation	10	20
Fibreoptic Intubation (awake or asleep, oral or nasal)	3	10

2.4 Acute Pain Management

	DURING BASIC TRAINING	TOTAL BY THE END OF HIGHER TRAINING
Non-Obstetrics patients (Number of patient visits)		
Postop iv PCA	10	80
Postop Central Neuraxial Analgesia	5	20
Obstetrics, post Caesarean Section patients (Number of patient visits)		

Any acute pain modality	---	20

2.5 Perioperative Medicine

There is no minimum VOP in this section.

2.6 Trauma, Crisis Management and Resuscitation

There is no minimum VOP in this section.

2.7 Safety and Quality in Anaesthesia

There is no minimum VOP in this section.

Specialty Modules

Trainees must complete the following minimum VOP by the time of Exit Assessment.

3.1 Anaesthesia for General Surgery, Urology, Gynaecology and Endoscopic Procedures

Elective general surgery / urology / gynaecology cases	100
Emergency general surgery / urology / gynaecology cases	100

3.2 Anaesthesia for Head and Neck and Otorhinolaryngology Procedures

Airway surgery *	30
Head and Neck and ENT procedures (Not otherwise specified)	30

*Such as Tonsillectomy, adenoidectomy, laser airway surgery, microlaryngoscopy, removal of foreign bodies from upper or lower airway, tracheostomy, rigid bronchoscopy, “panendoscopy” (suspension laryngoscopy, esophagoscopy, and bronchoscopy), Functional Endoscopic Sinus surgery (FESS) and surgery for obstructive sleep apnoea

3.3 Anaesthesia for Orthopaedic Procedures

Hip fracture surgery	30
Major joint replacement	20
Cervical spine surgery	5
Orthopaedic procedures (not otherwise specified)	100

3.4 Paediatric Anaesthesia

Age ≤ 8 years	100

3.5 Obstetric Anaesthesia and Analgesia

Caesarean Section under GA	10
Caesarean Section under Regional Anaesthesia	50
Epidural analgesia for labour	30

3.6 Neuroanaesthesia

Interventional Neuro-radiological procedures	5
Neuro-surgical procedures (*)	50

(*) Neuro-surgical procedures are defined as surgical procedures performed on or within the cranium, or on the spinal cord proper

3.7 Ophthalmic Anaesthesia

Ophthalmic surgery	20

3.8 Anaesthesia Outside Operating Theatre

Anaesthesia outside operating theatre	20

3.9 Cardiac Anaesthesia and Interventional Cardiology

Cardiac surgery with cardiopulmonary bypass	10
Cardiac surgery or Interventional cardiology procedures, not otherwise specified	10

3.10 Thoracic Anaesthesia

Thoracic procedures, not otherwise specified	30

3.11 Vascular Anaesthesia

Major vascular surgery or Interventional radiological vascular procedure	20

3.12 Pain Medicine

Pain consultations (Acute pain or chronic pain consultations during pain rounds or clinics)	20
Multidisciplinary case conference	1
Pain intervention procedures, not otherwise specified (Observed or performed under supervision)	5

3.13 Intensive Care Medicine

There is no minimum case load requirement for this section.

The minimum duration of Intensive Care attachment is 6 months, which may include up to 2 weeks of normal leave.

APPENDIX 2 WORKPLACE BASED ASSESSMENT (WBA) GUIDE TO TRAINERS AND TRAINEES

Introduction

Workplace-based assessment is introduced as one of the assessment strategies in the new curriculum. Being a *formative* assessment (assessment *for* learning), it involves a trainer observing a trainee providing patient care in the workplace, and giving feedback to the trainee with the intention to improve his/her performance.

- In any WBA, there is no grade or mark, no pass or fail.
- **Feedback** is the most important element in WBA. Trainers must provide high quality feedback to trainees; without this the process loses its purpose.
- The features of high quality feedback include
  - Timeliness
  - Provision of specific information
  - Based on objective observation that is relevant to the trainee
  - Provided by a source perceived by the trainee to be credible
  - Occurring in the presence of psychological safety
  - Including an action plan for improvement

Goals of WBAs

- To assess competencies, as listed in the learning outcomes of each section of the curriculum
- To offer ongoing constructive feedback with the aim of improving performance
- To provide a framework to support teaching and learning in the clinical environment
- To engage the trainer and trainee in professional educational conversations.
- To enable trainees to reflect on their own practice, and use feedback from the trainers to inform and develop their own practice
- To monitor the progress of training and development
- To create a record to document holistically a trainee's clinical performance

The WBA tools

The tools adopted for WBA include Direct Observation of Procedural Skills (DOPS), Clinical Evaluation Exercise (CEX), Case Based Discussion (CBD), Anaesthesia List Management Tool (ALMAT), and Multi-Source Feedback (MSF). Each of these tools assesses a slightly different aspect

of the trainee's professional development. As the trainee makes progress through the training program, the emphasis placed on knowledge, skills, attitudes and behaviour will gradually change, moving from well-defined, predominantly skill- and knowledge-based measures during Basic Training to wider professional-based measures in Advanced Training and Professional Fellowship Year (e.g. decision making, professional roles and reflective behaviour).

1. Direct Observation of Procedural Skills (DOPS)

DOPS is used for assessing technical skills during performance of procedures, such as arterial cannulation or epidural catheter insertion. They are useful for assessing trainees who have learnt a new skill. DOPS may be completed in real patients during clinical care, or in simulated environment, if the skill to be assessed is required in crisis or emergency situations (such as the use of defibrillator).

The observation for each procedure should focus on the whole event, not just the success or failure of the intended procedure. The possible areas for feedback include

- Understanding of the clinical procedure and alternatives
- Clear explanation of the benefits and risks to the patient or carer in a way they understand
- Understanding of the theoretical background of the procedure, including anatomy, physiology, pharmacology, and imaging
- Preparation for the procedure, including equipment, staff, physical locality etc.
- Safety concerns for the procedure
- Manual dexterity
- Strategies to deal with unexpected problem(s)
- Professional interactions with patient
- Proper documentation
- Post procedural instructions
- Maintaining professional demeanour at all times

2. Clinical Evaluation Exercise (CEX)

Supervised clinical activities are the key learning events during anaesthesia training. Such activities should be fully exploited for observing trainee's performance and giving feedback. CEX looks at the trainee's performance in a case rather than focusing on a specific procedure, for example the anaesthetic management of a patient with renal failure.

In practice, the CEX should be taken during a trainee's routine work with a trainer. The trainer will act primarily as an observer, and allow the trainee to manage the major part of the clinical work.

The trainer will stimulate a dialogue, in an attempt to understand thought processes and management decisions made through the course of a procedure or operating list. Feedback is given at the end of the procedure or session. The possible areas for feedback include

- Formulation of management plans
- Techniques and procedures done
- Management of problems arising
- Rationales for decision making
- Safety concerns, e.g. medication safety and transfusion safety issues
- Quality issues, e.g. understanding the importance for critical incidents reporting
- Behavioural aspects, e.g. systematic and coordinated approach to a clinical situation
- Team working and professional behaviour

3. Case Based Discussion (CBD)

CBDs offer an opportunity to discuss a case in depth and to explore thinking, judgment and knowledge. They provide a useful forum for reflection on practice, especially for critical incidents or complications occurring in the trainee's practice. Another example is for discussion of rare events (e.g. power failure in the theatre) or clinical crisis (e.g. major obstetrics haemorrhage, air embolism in neurosurgery, anaphylaxis etc.) where it may not be appropriate for the supervisor to stay as observer to observe trainee's performance, as in CEX.

When undertaking a CBD, the trainee should bring the case notes and/or anaesthetic chart of a case that they wish to discuss in retrospect. A 'virtual' CBD can also be undertaken. The trainer will start engaging the trainee to discuss around the perioperative management of the case. The possible areas for feedback include

- Conduct and management of the case
- Appropriateness of anaesthesia plans, and awareness of alternatives
- Problems arising, differential diagnosis and thought process involved
- Therapies given if any
- Non-technical skills e.g. communication, mobilization of resources etc.
- Standards of documentation
- Safety and quality issues e.g. critical incidents reporting
- Follow up actions if necessary

4. Anaesthesia List Management Tool (ALMAT)

When undertaking an ALMAT, a trainee is given responsibility for the running of a list according to their level of competence. This tool is particularly appropriate for more senior trainees and allows assessment of both clinical and non-clinical skills. Trainees should ask for this assessment before the start of the list, and they may be assessed either by the trainer with direct responsibility for that list, or by the indirect supervisors. Possible areas for feedback include

- Case order on the list – considerations and rationales
- Communication with surgeons e.g. case complexities, equipment requirement, positioning, duration etc
- Preparation of equipment
- People management – nurses, theatre assistants, relieving anaesthetist etc.
- Measures to reduce turnover time and increase efficiency
- Teaching junior staffs in the theatre
- Management of potential overrun

5. Multi-source feedback (MSF)

The use of MSF broadens the sources of feedback on everyday clinical care, taking into consideration that the anaesthetist is actually one member of a multidisciplinary team working in the operating theatre. It provides information on how the trainee is performing across the different professional roles (not just a medical expert but also other roles such as communicator, collaborator, manager, scholar etc.). MSF works by collecting incidental observations of the trainee's performance over a period of time from peers, who have had a direct working experience with the trainee.

Trainees are expected to complete a minimum of one MSF each at the end of Basic Training, Advanced Training, Intensive care attachment and Provisional Fellowship Year. MSF gives an opportunity for members of the multidisciplinary team to provide feedback on a trainee. The trainee identifies around 15 people (who should be from a mixture of disciplines) with whom they have worked, for example, seniors, peers, nurses, and other OT staff, and sends a request to them. The trainee's supervisor of training approves the list of assessors to ensure balance, and reviews the feedback before meeting the trainee for discussion.

A minimum of eight assessors is required to support validity. If the minimum number of assessors is not achieved then the process should be repeated. Further MSFs may need to be undertaken if concerns have been raised, either in the MSF or in the workplace. The MSF is a valuable tool for assessing a trainee's professional attitudes and behaviour.

Required Number of Workplace-based Assessments

Trainees are required to complete a minimum number of workplace-based assessments as specified in the corresponding section of the curriculum (see Appendix 3 for a summary). As mentioned before the WBAs are of most value when used as 'assessment *for* learning' and therefore trainees are encouraged to do much more than the minimum to assist their training wherever possible. Assessors may recommend if the trainee needs repeat assessment for a particular case or procedure and it is expected that the trainee will do these additional assessments.

The Process of Workplace Based Assessment

- No special placement beyond conventional rostering and rotation is expected in order to facilitate conduction of WBAs.
- The WBA should not delay, hinder, complicate, or add risk to the clinical work.
- Trainees should aim to undertake WBAs relevant to their current unit of training.
- Areas for assessment should be identified prior to starting a list, and the trainee should ask the trainer in advance to perform an assessment.
- A trainer may also suggest conducting a WBA with the trainee, but the process must only start with mutual agreement.
- Requesting assessments retrospectively is considered bad practice and is not acceptable, except in Case Based Discussions.
- It is possible to use more than one tool at one WBA occasion (e.g. DOPS and CEX for a case of general anaesthesia for Caesarean section, the trainer can assess intubation skills and management of general anaesthesia in the same patient).
- The trainer should observe the performance of the trainee, and give verbal feedback as well as suggestions for future development, in an honest and objective manner.
- Both clinical (e.g. case management, procedural skills) and non-clinical (e.g. communication, team work) aspects of performance might be included in the WBA, depending on the clinical events around the case.
- The trainer should give verbal feedback to the trainee as soon as feasible and clinically appropriate and safe. The trainer should subsequently document the feedback on the trainee's e-Portfolio soon after the assessment. The trainee should review the feedback in a reflective manner and add in further comments if appropriate.

APPENDIX 3 SUMMARY OF WBA REQUIREMENTS

Clinical Evaluation Exercise (CEX), Case Based Discussion (CBD), Direct Observation of Procedural skills (DOPS), and Anaesthesia List Management Assessment Tool (ALMAT)

Clinical Fundamentals

Trainees must complete the following minimum WBAs **during Basic Training** and **Higher Training periods**: -

2.1 General Anaesthesia and Sedation

	FOCUS	DURING BASIC TRAINING	DURING HIGHER TRAINING
CEX/CBD	Themes focusing on learning outcomes listed above	1	1
DOPS	Ultrasound guided Central Venous Cannulation	1	---
	Arterial cannulation	1	---
	Transducer set up and problem solving	1	---

2.2 Regional Anaesthesia

	FOCUS	DURING BASIC TRAINING	DURING HIGHER TRAINING
CEX/CBD	Themes focusing on learning outcomes listed above	1	1
DOPS	Spinal	1	---
	Epidural or Combined Spinal Epidural Blocks (non-Obstetrics)	---	1
	Peripheral plexus / nerve block (sites and approaches not specified, with or without catheter)	1	1

2.3 Airway Management

	FOCUS	DURING BASIC TRAINING	DURING HIGHER TRAINING
CEX/CBD	Themes focusing on learning outcomes listed above	1	1
DOPS	Elective airway management in an adult (BVM/LMA/ETT)	1	---
	Rapid sequence induction in an adult	1	---
	Fibreoptic intubation in an adult (including LA of the airway)	1 (CAN BE DONE IN BT OR HT YEARS)	
	Provision of airway management for	1 (CAN BE DONE IN BT OR HT YEARS)	

	patient with potential or actual cervical spine instability	
	Provision of anaesthesia for tracheostomy in an adult	1 (CAN BE DONE IN BT OR HT YEARS)

2.4 Acute Pain Management

	FOCUS	DURING BASIC TRAINING	DURING HIGHER TRAINING
CEX/CBD	Themes focusing on learning outcomes listed above To be performed during Acute pain round	1	1
DOPS	Setting up PCA machines or postop analgesic infusions	1	---

2.5 Perioperative Medicine

	FOCUS	DURING BASIC TRAINING	DURING HIGHER TRAINING
CEX/CBD	Themes focusing on learning outcomes listed above	1	1

2.6 Trauma, Crisis management and Resuscitation

	FOCUS	DURING BASIC TRAINING	DURING HIGHER TRAINING
CEX/CBD	Themes focusing on learning outcomes listed above	1	1

2.7 Safety and Quality in Anaesthesia

	FOCUS	DURING BASIC TRAINING	DURING HIGHER TRAINING
CEX/CBD	Themes focusing on learning outcomes listed above	1	1
DOPS	Checking of anaesthesia machine and breathing system	1	---
	Care of patient requiring surgery done in the prone position	1 (CAN BE DONE IN BT OR HT YEARS)	

Specialty Modules

Trainees must complete the following minimum WBAs **before exit assessment**:

3.1 Anaesthesia for General Surgery, Urology, Gynaecology and Endoscopic Procedures

	FOCUS	
CEX/CBD	Themes focusing on learning outcomes listed above	2

3.2 Anaesthesia for Head and Neck and Otorhinolaryngology Procedures

	FOCUS	
CEX/CBD	Themes focusing on learning outcomes listed above	2

3.3 Anaesthesia for Orthopaedic Procedures

	FOCUS	
CEX/CBD	Themes focusing on learning outcomes listed above	2

3.4 Paediatric Anaesthesia

	FOCUS	
CEX/CBD	Themes focusing on learning outcomes listed above	2
DOPS	Elective airway management in paediatric patient (BVM/LMA/ETT)	1
	Inhalational induction in paediatric patient	1
	Caudal/Penile/Ilioinguinal block In paediatric patient	1

3.5 Obstetric Anaesthesia and Analgesia

	FOCUS	
CEX/CBD	Themes focusing on learning outcomes listed above	2
DOPS	Epidural insertion	1

3.6 Neuroanaesthesia

	FOCUS	
CEX/CBD	Themes focusing on learning outcomes listed above	2

3.7 Ophthalmic Anaesthesia

	FOCUS	
CEX/CBD	Themes focusing on learning outcomes listed above	2

3.8 Anaesthesia Outside Operating Theatre

	FOCUS	
CEX/CBD	Themes focusing on learning outcomes listed above	2

3.9 Cardiac Anaesthesia and Interventional Cardiology

	FOCUS	
CEX/CBD	Themes focusing on learning outcomes listed above	2

3.10 Thoracic Anaesthesia

	FOCUS	
CEX/CBD	Themes focusing on learning outcomes listed above	2
DOPS	Lung isolation and one-lung ventilation	1

3.11 Vascular Anaesthesia

	FOCUS	
CEX/CBD	Themes focusing on learning outcomes listed above	2

3.12 Pain medicine

	FOCUS	
CEX/CBD	Themes focusing on learning outcomes listed above	2

3.13 Intensive Care Medicine

	FOCUS	
CEX/CBD	Themes focusing on learning outcomes listed above	2

Provisional Fellowship Year

	FOCUS	
CEX/CBD	Themes focusing on learning outcomes listed above	1
ALMAT	Themes focusing on learning outcomes listed above	1

Multisource Feedback (MSF)

Trainees are expected to complete **one MSF**

- At the end of Basic Training
- At the end of Higher Training
- At the end of Provisional Fellowship Year

APPENDIX 4 LEARNING OUTCOMES TO BE ASSESSED IN INTERMEDIATE EXAMINATION

The following is a summary of the learning outcomes in the curriculum that will be assessed in the Intermediate examination.
Some of the learning outcomes could also be assessed during workplace based assessments and the Final examination.

Clinical Fundamentals

2.1 General Anaesthesia and Sedation

Learning outcomes		Assessment
General Knowledge		
2.1.6	Discuss proposed mechanisms of anaesthesia and the sites of action of anaesthetic agents including the physiology and pharmacology of neurotransmitters and their receptors.	IEx
2.1.7	Describe the physiological effects of anaesthesia on the cardiovascular and respiratory system and its clinical management.	IEx
2.1.8	Discuss the physiological effects of anaesthesia on liver and kidney functions.	IEx
2.1.9	Discuss the physiological effects of anaesthesia on immune, haematological and endocrine systems.	IEx
2.1.10	Outline the principles of perioperative fluid therapy.	CEX/CBD, IEx, FEx
2.1.11	Outline the physiological changes that occur with and the implications for anaesthetic management of pneumoperitoneum.	CEX/CBD, IEx, FEx
2.1.12	Outline the physiological changes that occur with and the implications for anaesthetic management of the following patient positions: - Supine - Trendelenberg and reverse trendelenberg - Sitting - Lateral - Lithotomy - Prone	CEX/CBD, IEx, FEx
Essential Pharmacodynamics		

2.1.16	Explain the concept of drug action with respect to: - Receptor theory - Enzyme interactions - Physico-chemical interactions	IEx
2.1.17	Explain receptor activity with regard to: - Ionic fluxes - Second messengers and G proteins - Nucleic acid synthesis - Evidence for the presence of receptors - Regulation of receptor number and activity	IEx
2.1.18	Define and explain dose-effect relationships of drugs with reference to: - Graded and quantal response - Therapeutic index - Potency and efficacy - Competitive and non-competitive antagonists - Partial agonists, mixed agonist-antagonists and inverse agonists - Additive and synergistic effects of drug combinations	IEx
2.1.19	Describe efficacy and potency with reference to dose response curves.	IEx
2.1.20	Explain the law of mass action and describe affinity and dissociation constants.	IEx
2.1.21	Describe the mechanisms of adverse drug effects.	IEx
Essential Pharmacokinetics		
2.1.22	Explain the concept of pharmacokinetic modelling of single and multiple compartment models and define: - Half life - Clearance - Zero and first order kinetics - Volume of distribution - Bio-availability - Area under the plasma concentration time curve - Extraction ratio	IEx
2.1.23	Describe absorption and factors that will influence it with reference to clinically utilised sites of administration.	IEx
2.1.24	Describe factors influencing the distribution of drugs (for example, protein binding, lipid solubility, pH, pKa) and their alteration in physiological and pathological disturbance.	IEx

2.1.25	Describe the mechanisms of drug clearance and how physiological and pathological disturbance may affect these.	IEx
2.1.26	Describe the mechanisms of non-hepatic and hepatic metabolism of drugs including: - Phase one and phase two reactions - Hepatic extraction ratio and its significance - First pass effect, enzyme induction and inhibition	IEx
2.1.27	Explain and describe the clinical application of concepts related to intravenous and infusion kinetics including: - Effect-site and effect-site equilibration time - Concept of context sensitive half time - Calculation of loading and maintenance dosage regimens	IEx
2.1.28	Describe the pharmacological principles of and sources of error with target controlled infusion (TCI).	IEx
2.1.29	Explain clinical drug monitoring with regard to peak and trough concentrations, minimum therapeutic concentration and toxicity.	IEx
Variability in Drug Response		
2.1.30	Develop an understanding of variations in individual drug responses together with clinical application of this knowledge.	IEx
2.1.31	Define tachyphylaxis, tolerance, addiction, dependence and idiosyncrasy and describe mechanisms of tolerance.	IEx
2.1.32	Describe alterations to drug response due to physiological change with particular reference to extremes of age.	IEx
2.1.33	Describe alterations to drug response due to pathological disturbance with particular reference to cardiac, respiratory, renal and hepatic disease.	IEx
2.1.34	Describe the mechanisms of drug interaction.	IEx
2.1.35	Describe and give examples of the clinical importance of pharmacogenetic variation, for example, atypical cholinesterase, codeine metabolism.	IEx
2.1.36	Describe and give examples of the clinical importance of isomerism.	IEx
2.1.37	Describe the mechanisms of action and potential adverse effects of buffers, anti-oxidants, anti-microbial and solubilising agents added to drugs.	IEx
Pharmacology of Specific Agents		
Inhalational Agents		

2.1.38	Describe the physical properties of inhalational agents, including the: - Principles of vaporisation of inhalational agents - Properties of an ideal inhalational anaesthetic agent - Structure-activity relationships of inhalational agents	IEx
2.1.39	Describe the uptake, distribution and elimination of inhalational anaesthetic agents and the factors which influence induction and recovery from inhalational anaesthesia, including the: - Concepts of partition coefficients, concentration effect and second gas effect - Relationships between inhaled and alveolar concentration - Significance of the distribution of cardiac output and tissue partition coefficients on uptake and distribution of volatile agents	IEx
2.1.40	Describe the concept and clinical application of Minimum Alveolar Concentration (MAC) in relation to inhaled anaesthetic agents.	IEx
2.1.41	Describe the effects of inhalational agents on the cardiovascular, respiratory and central nervous systems.	IEx
2.1.42	Describe the toxicity of inhalational agents.	IEx
2.1.43	Describe the pharmacology of nitrous oxide.	IEx
2.1.44	Describe the comparative pharmacology of nitrous oxide, halothane, enflurane, isoflurane, desflurane, sevoflurane, xenon and ether.	IEx
Sedative and Hypnotic Agents		
2.1.45	Describe the physical properties of sedative/hypnotic agents, including: - Formulation - Properties of an ideal agent - Structure-activity relationships	IEx
2.1.46	Describe the clinical situations when anxiolytic or sedative premedication may be indicated or contraindicated.	CEX/CBD, IEx, FEx
2.1.48	Describe and compare the pharmacokinetics of intravenous induction and sedative agents, the factors which affect recovery from intravenous anaesthesia and the clinical implications of these differences.	IEx
2.1.49	Describe and compare the pharmacodynamics of intravenous induction and sedative agents and in particular the effects on the cardiovascular, respiratory and central nervous systems.	IEx

2.1.50	Describe the adverse effects of individual induction, sedative and premedicant agents.	IEX
2.1.51	Describe how physiological and pathological disturbance can alter the pharmacology of intravenous anaesthetic agents.	IEx
2.1.52	Outline the pharmacology and clinical use of flumazenil.	IEx
Neuromuscular Blocking Agents and Monitoring		
2.1.53	Describe the physiology of the neuromuscular junction and the mechanism of action of neuromuscular blocking agents.	IEx
2.1.54	Describe the pharmacokinetics of neuromuscular blocking agents.	IEx
2.1.55	Discuss the indications for muscle relaxation in anaesthesia.	IEx
2.1.56	Describe the pharmacological differences between neuromuscular blocking agents and the clinical importance of these differences.	IEx
2.1.57	Describe the adverse effects of neuromuscular blocking agents and factors that may modify responses to muscle relaxants.	IEx
2.1.58	Describe the concept of depth of neuromuscular blockade and explain the use of neuromuscular monitoring using the peripheral nerve stimulator..	IEx
2.1.59	Describe the reversal of neuromuscular blockade using anticholinesterase agents, anticholinergics and sugammadex and the physiological effects of reversal.	IEx
2.1.60	Describe the adverse effects of anticholinesterase agents.	IEx
2.1.61	Describe the clinical features and management of inadequate reversal of neuromuscular blockade.	CEX/CBD, IEx, FEx
Analgesics (also refer to section 2.4 Acute Pain Management)		
2.1.62	Describe the clinical application of opioids to anaesthesia and sedation.	IEx
2.1.63	Describe the pharmacokinetics of intravenous opioids.	IEx
Postop Nausea and Vomiting and Antiemetics		
2.1.65	Outline the physiological basis of vomiting.	IEx
2.1.66	Describe the clinical pharmacology of dopamine antagonists, anti-cholinergic agents, serotonin antagonists, antihistamines pro-kinetics and steroids relevant to premedication and the management of nausea and vomiting.	IEx
2.1.67	List the risk factors, and outline a strategy for the prevention and management of postoperative nausea and vomiting.	CEX/CBD, IEx, FEx

Depth of Anaesthesia and Monitoring		
2.1.68	Describe the concept of depth of anaesthesia and how this may be monitored.	CEX/CBD, IEx, FEx
2.1.70	Explain the principles involved in the electronic monitoring of depth of sedation and anaesthesia, including the use of EEG analysis.	IEx, FEx
2.1.71	Describe techniques to balance anaesthetic depth with changing surgical stimulus.	IEx, FEx
Temperature Homeostasis and Anaesthesia		
2.1.72	Describe the mechanisms by which heat is produced by the body and transferred between the body and its environment.	IEx
2.1.73	Describe the physiological effects of hypo/hyperthermia.	IEx
2.1.74	Describe the energy requirements for maintenance of normal body temperature.	IEx
2.1.75	Describe the physiological responses to lowered and raised environmental temperature, and the effects of anaesthesia on these responses.	IEx
2.1.76	Discuss methods of maintaining body temperature during anaesthesia and sedation, including active warming of patients.	CEX/CBD, IEx, FEx
2.1.77	Describe how a patient's temperature is monitored and discuss the indications for temperature monitoring with the advantages and disadvantages of particular sites and methods.	CEX/CBD, IEx, FEx
Fluid Therapy (also refer to section 2.5 Perioperative Medicine on Cardiovascular Physiology)		
2.1.83	Define body fluid compartments and outline the physiological basis of distribution of body fluid among different body compartments.	IEx
2.1.84	Describe the composition of different body fluid compartments.	IEx
2.1.85	Outline factors determining perioperative fluid requirements and choice of fluid therapy.	IEx, FEx
2.1.86	Describe the chemical composition of crystalloids and colloids used in clinical practice and their effects / side effects when used in volume replacement.	IEx, FEx
2.1.87	Discuss the physiological principles of assessment of preload, contractility, afterload, and responsiveness to fluid challenge.	CEX/CBD, IEx

2.2 Regional Anaesthesia

Learning outcomes		Assessment
Applied Pharmacology		
2.2.7	Discuss the pharmacology of Local Anaesthetics (LA). Including: - Classification - Mechanism of actions - Pharmakokinetics including factors affecting systemic absorption - Concept of "Toxic dose" and manifestations of LA Toxicity	IEx
2.2.8	Outline the clinical features and management of LA toxicity.	CEX/CBD, IEx
2.2.9	Discuss the use of adjuvant pharmacological agents in regional anaesthesia.	CEX/CBD, IEx

2.3 Airway Management

Learning outcomes		Assessment
General Knowledge		
Basic Sciences		
2.3.2	Discuss the respiratory physiology related to airway management, including changes with pregnancy, at extremes of age, and in pathological conditions.	CEX/CBD, IEx, FEx
2.3.4	Outline the pharmacology of premedications used to decrease gastric acidity.	CEX/CBD, IEx
Airway Assessment and Plan		
2.3.9	Outline the rationale and physiology behind pre-oxygenation.	CEX/CBD, IEx, FEx

2.4 Acute Pain Management

Learning outcomes		Assessment
Neurobiology of Pain		
2.4.1	Define pain, acute pain, chronic pain and neuropathic pain.	IEx

2.4.2	Describe the anatomy of the sensory pathways with particular reference to pain sensation.	IEx
2.4.3	Describe the anatomy of the autonomic nervous system.	IEx
2.4.4	Describe the basic physiological mechanisms of pain including: - Peripheral nociception - Conduction - Spinal cord modulation - Central processing of pain - Mediators, pathways and reflexes - Peripheral and central sensitization - Pre-emptive and preventive analgesia	IEx
2.4.5	Describe the physiological mechanism of progression from acute to chronic pain.	IEx
2.4.6	Describe the injury response to acute pain.	IEx
2.4.7	Describe the applied physiology of classical neuropathic pain.	IEx
2.4.8	Outline the effects of pain and analgesia on injury-induced organ dysfunction.	IEx
2.4.9	Describe the alterations to physiology and perception of pain in the older patient.	IEx
2.4.10	Compare and contrast between opioid tolerance and opioid-induced hyperalgesia.	IEx
Clinical Pharmacology of Analgesic Agents		
2.4.11	Describe the pharmacology of the following agents applicable to pain management, including: - Opioids - Local anaesthetic agents (also refer to section 2.2 Regional Anaesthesia clinical fundamental) - NSAIDs/COX-2 inhibitors - Paracetamol - NMDA antagonists - Anticonvulsants - Antidepressants - Corticosteroids - Inhalational analgesics	IEx
2.4.12	Describe the effect of physiological change and pathological disturbance on the pharmacology of the agents with special reference to the elderly.	IEx

2.4.13	Describe the different modes of administration of analgesic agents and evaluate their clinical application.	IEx
2.4.14	Outline the basic concepts of multimodal analgesia.	IEx, FEx
2.4.15	Outline the pharmacokinetic principles of neonatal drug transfer via milk in breastfeeding in relevance of common analgesics in acute pain.	IEx
Pharmacology of Specific Agents: Opioid Agonists and Antagonists		
2.4.16	Describe opioid receptors.	IEx
2.4.17	Describe the mechanisms of action of opioids.	IEx
2.4.18	Describe the pharmacology of different opioids with mixed actions.	IEx
2.4.19	Describe the actions of agonists, partial agonists, mixed agonists-antagonists and antagonists.	IEx
2.4.20	Discuss the pharmacology of different routes of administration for commonly used opioids, including the oral, transdermal, subcutaneous, central neuraxial, transmucosal, intranasal, intramuscular and intravenous routes.	IEx
2.4.21	Outline the dose conversion between commonly used opioids.	IEx
2.4.22	Describe the adverse effects of opioids administered by systemic and neuraxial routes and their prevention and management.	IEx
2.4.23	Describe the potential adverse drug interactions between opioids and other agents.	IEx
2.4.24	Describe the pharmacology of opioid antagonists, including the clinical application of ultra-low dose antagonist in opioid pharmaceutics.	IEx
2.4.25	Describe the pharmacodynamics of individual opioids and evaluate their clinical applications.	IEx
Pharmacology of Specific Agents: NSAIDs		
2.4.26	Describe the prostaglandin pathways and their physiological role in the production of pain.	IEx
2.4.27	Classify non-steroidal anti-inflammatory drugs and outline their pharmacology in relation to enzyme inhibition, mode of administration and adverse effects.	IEx
2.4.28	Describe in detail pharmacology of paracetamol including mode of action, clinical utility, metabolism and toxicity (acute & chronic), drug interactions, advantages and disadvantages of different routes of administration.	IEx

2.5 Perioperative Medicine

Learning outcomes		Assessment
Essentials of Preoperative Assessment		
2.5.6	Describe the features of a diagnostic test, including the concept of sensitivity, specificity, positive and negative predictive value and how these are affected by the prevalence of disease in question.	IEx
2.5.7	Describe the adverse effects of antimicrobial agents.	IEx
Respiratory Anatomy and Physiology		
2.5.14	Discuss the structure of the chest wall and diaphragm and the implications for respiratory mechanics.	IEx
2.5.15	Outline the anatomy of the upper and lower airways.	IEx
2.5.16	Outline the anatomy of the pulmonary and bronchial circulations.	IEx
2.5.17	Describe the neural and chemical control of ventilation via central and peripheral chemoreceptors and indicate how this is altered by anaesthesia and abnormal clinical states.	IEx
2.5.18	Describe the properties of surfactant and relate these to its role in influencing respiratory mechanics.	IEx
2.5.19	Define compliance (static, dynamic and specific) and relate this to the elastic properties of the lung.	IEx
2.5.20	Discuss fast and slow alveoli, including the concept of time constants.	IEx
2.5.21	Describe the elastic properties of the chest wall and plot pressure-volume relationships of the lung, chest wall and the total respiratory system.	IEx
2.5.22	Explain the vertical gradient of pleural pressure and its significance.	IEx
2.5.23	Explain the physics of gas flow and the significance of the relationship between resistance and flow in the respiratory tract.	IEx
2.5.24	Describe the factors affecting airway resistance and how airway resistance may be measured.	IEx
2.5.25	Describe closing capacity and its relationship to airway closure and explain its clinical significance and measurement.	IEx
2.5.26	Describe the work of breathing.	IEx
2.5.27	Describe altered lung mechanics in common disease states.	IEx

2.5.28	Discuss lung volumes and capacities, their measurement and normal values.	IEx
2.5.29	Discuss dead space, its measurement and apply the Bohr equation and alveolar gas equation.	IEx
2.5.30	Discuss the composition of ideal alveolar and mixed expired gases.	IEx
2.5.31	Describe the oxygen cascade.	IEx
2.5.32	Describe the alveolar exchange of oxygen and carbon dioxide.	IEx
2.5.33	Discuss diffusion capacity and its measurement.	IEx
2.5.34	Discuss normal ventilation-perfusion matching.	IEx
2.5.35	Discuss West's zones of the lung.	IEx
2.5.36	Describe the shunt equation.	IEx
2.5.37	Discuss the regional ventilation-perfusion inequalities, venous admixture and the effect on oxygenation and carbon dioxide elimination.	IEx
2.5.38	Outline methods used to measure ventilation-perfusion inequalities.	IEx
2.5.39	Discuss the carriage of oxygen in blood, the oxygen-dissociation curve, oxygen stores in the blood and their clinical significance and implications.	IEx
2.5.40	Discuss the carriage of carbon dioxide in blood, the carbon dioxide dissociation curve and their clinical significance and implications.	IEx
2.5.41	Discuss the difference between the pulmonary and systemic circulations.	IEx
2.5.42	Discuss pulmonary vascular resistance and the control of pulmonary vascular tone.	IEx
2.5.43	Discuss the physiological consequences of intermittent positive pressure ventilation and positive end-expiratory pressure.	IEx
2.5.44	Discuss the physiological effects of hypoxaemia, hyper and hypocapnia, and carbon monoxide poisoning.	IEx
2.5.45	Discuss the effect of the following on respiration: - Changes in posture - Exercise - Pregnancy - Extremes of age - Morbid obesity	IEx

	- Changes in altitude / Diving - Anaesthesia - Pathologcial states, such as spinal cord transection	
2.5.46	Define humidity and outline the importance of humidification. Outline methods of measuring humidity.	IEx
2.5.47	Outline the non-ventilatory function of the lungs.	IEx
Respiratory Pharmacology		
2.5.48	Describe the pharmacology of anti-asthma drugs, including beta 2 agonists, corticosteroids, anticholinergics, leukotriene antagonists and theophylline.	IEx
2.5.49	Outline the pharmacology of drugs used to treat pulmonary hypertension including phosphodiesterease inhibitors and nitric oxide.	IEx
2.5.50	Outline the use of oxygen therapy in the perioperative settings.	IEx
2.5.51	Describe the performance of different oxygen delivery devices.	IEx, FEx
2.5.52	Define oxygen toxicity, and outline its pathophysiology and clinical manifestations.	IEx
Cardiovascular Anatomy and Physiology		
2.5.53	Describe the anatomy of the major arteries and veins.	IEx
2.5.54	Discuss the physiological basis of electrical activity and its relationship to mechanical events including the: - Ionic basis of automaticity, and the normal and abnormal processes of cardiac excitation - Physiological basis of the ECG in normal and common pathological states - Factors that may influence cardiac electrical activity - Correlation of the mechanical events of the cardiac cycle with electrical and ionic events	IEx
2.5.55	Describe the physiology of cardiac muscle and the mechanism of excitation contraction coupling.	IEx
2.5.56	Discuss the factors that determine and control cardiac output and the implications for clinical practice, including: - Preload, afterload and contractility - The Frank-Starling mechanism - Cardiac output and vascular function curves - Pressure volume relationships in the heart	IEx

2.5.57	Discuss the factors determining myocardial oxygen supply and demand and their clinical implications.	IEx
2.5.58	Discuss the control of blood pressure and the distribution of blood volume and flow throughout the cardiovascular system, including: - The factors determining systemic blood pressure and its regulation and control - Total peripheral resistance and factors affecting it - The relationship between organ blood flow and demand and the role of autoregulation - Clinically significant features of the coronary, cerebral, skin, muscle, renal, hepatic and splanchnic circulations - The essential features of the microcirculation including fluid exchange and its control	IEx
2.5.59	Discuss the cardiovascular responses to: - Changes in posture - Exercise - Valsalva maneouvre - Positive pressure ventilation and PEEP - Pneumoperitoneum - Haemorrhage and hypovolaemia - Surgery and trauma	IEx
2.5.60	Describe the cardiovascular changes that occur with ageing.	IEx
2.5.61	Describe the cardiovascular changes that occur with morbid obesity.	IEx
Cardiovascular Pharmacology		
2.5.62	Describe the autonomic nervous system and its physiological roles including: - Autonomic receptors and cellular effects of receptor activation - Autonomic transmitters, their synthesis, release and fate	IEx
2.5.63	Describe the mechanism of action and effects of the sympathomimetic and anticholinergic drugs used clinically.	IEx
2.5.64	Describe the pharmacology and clinical application of adrenergic agonists.	IEx
2.5.65	Describe the pharmacology of commonly used alpha and beta receptor blocking agents, their clinical use, adverse effects and use in the perioperative period.	IEx
2.5.66	Outline clinically important drug interactions with the automatic nervous system.	IEx

2.5.67	Describe the physiological and pharmacological basis of antiarrhythmic therapy including classification based on electro-physiological activity and mechanism of action.	IEx
2.5.68	Describe the pharmacology of antiarrhythmic agents and their clinical applications.	IEx
2.5.69	Describe the pharmacology of anti-hypertensive agents and their clinical applications.	IEx
2.5.70	Describe the pharmacology of drugs used to manage myocardial ischaemia/infarction including anti-platelets, anti-coagulants and thrombolytic drugs.	IEx
2.5.71	Describe the pharmacology of drugs used to manage acute or chronic heart failure and their clinical applications.	IEx
Renal and Fluid & Electrolytes		
2.5.72	Describe the functional anatomy of the kidneys and urinary tract.	IEx
2.5.73	Explain the physiology of renal blood flow.	IEx
2.5.74	Describe glomerular filtration and tubular function.	IEx
2.5.75	Explain the counter-current mechanisms in the kidney.	IEx
2.5.76	Explain the mechanisms involved in the regulation of renal function.	IEx
2.5.77	Outline the endocrine functions of the kidney.	IEx
2.5.78	Describe the role of the kidney in the handling of glucose, nitrogenous products and drugs.	IEx
2.5.79	Describe the principles of measurement of glomerular filtration rate and renal blood flow.	IEx
2.5.80	Describe the physiological effects and clinical assessment of renal dysfunction.	IEx
2.5.81	Explain the renal responses to hyovolaemia.	IEx
2.5.82	Explain the effects of anaesthesia on renal function.	IEx
2.5.83	Describe the function, distribution and physiological importance of sodium, potassium, magnesium, calcium and phosphate ions.	IEx
2.5.84	Describe the mechanisms involved in the maintenance of fluid and electrolyte balance.	IEx
2.5.85	Outline the constituents and functions of plasma.	IEx
2.5.86	Define osmotic pressure and explain the factors that determine it.	IEx

2.5.87	Describe the regulation of osmolality.	IEx
2.5.88	Outline the significance of oncotic pressure, colloid osmotic pressure and reflection coefficients.	IEx
2.5.89	Describe the regulation of acid/base balance.	IEx
2.5.90	Describe acid-base chemistry using the Henderson-Hasselbach equation and strong ion difference.	IEx
2.5.91	Describe alterations to drug response due to renal disease.	IEx
2.5.92	Outline a physiological basis of classifying diuretics related to their site of action.	IEx
2.5.93	Describe the pharmacology of diuretics.	IEx
Metabolic and Endocrine Physiology		
2.5.94	Outline basic cellular physiology, in particular - The structure of the cell membrane and trans-membrane transport mechanisms - The composition and regulation of intracellular fluid - The generation of the trans-membrane potential - Energy production by metabolic processes in cells	IEx
2.5.95	Describe the physiological consequences of starvation.	IEx
2.5.96	Discuss the factors that influence metabolic rate.	IEx
2.5.97	Explain the control of blood glucose.	IEx
2.5.98	Describe the role of the hypothalamus in the integration of neuro-humoral responses.	IEx
2.5.99	Describe the control of secretion and the functions of: - Pituitary hormones - Thyroid hormones - Adrenocortical hormones - Adrenomedullary hormones - Renin and angiotensin - Atrial natriuretic peptide	IEx
2.5.100	Describe the regulation of plasma calcium including the actions and control of Vitamin D, parathormone and calcitonin.	IEx
2.5.101	Outline the role of prostaglandins and other autocoids.	IEx
Endocrine Pharmacology		

2.5.102	Describe the pharmacology of: - Insulin preparations - Oral hypoglycaemics - Corticosteroid drugs	IEx
2.5.103	Outline the pharmacology of: - Thyroid hormone replacement and anti-thyroid drugs - Glucagon - Vasopressin and analogues	IEx
Neurophysiology		
2.5.104	Outline the basic electrophysiology of nerve conduction.	IEx
2.5.105	Describe the physiology of sleep.	IEx
2.5.106	Outline the basis of the electroencephalogram.	IEx
2.5.107	Discuss the determinants and control of: - Intracranial and intraspinal pressure - Cerebral blood flow and autoregulation - Cerebral perfusion pressure - Spinal cord perfusion	IEx
2.5.108	Describe the structure and function of the blood brain barrier.	IEx
2.5.109	Describe the composition, dynamics and metabolism of cerebrospinal fluid.	IEx
2.5.110	Describe the cerebral and spinal cord metabolism including energy production, effects of temperature and factors leading to cell damage and cell death.	IEx
2.5.111	Describe the physiology of skeletal muscle including excitation contraction coupling and compare the physiology of skeletal muscle with that of cardiac muscle.	IEx
2.5.112	Define and explain the physiological mechanisms of a reflex.	IEx
Neurological Pharmacology		
2.5.113	Outline the pharmacology of anti-depressant, anti-psychotic, anti-convulsant, anti-parkinsonian and anti-migraine medication.	IEx
2.5.114	Outline the pharmacology of histamine antagonists.	IEx
2.5.115	Outline the pharmacology of drugs acting via effects on serotonin or serotonin receptors.	IEx

2.5.116	Discuss the clinical features and management of serotonin syndrome.	IEx
Gastrointestinal Anatomy and Physiology		
2.5.117	Describe the storage, synthetic, metabolic, immunological and excretory functions of the liver and identify the physiological consequences of hepatic disease.	IEx
2.5.118	Describe the anatomical and physiological considerations in hepatic blood flow, and the changes that occur with anaesthesia.	IEx
2.5.119	Describe the portal circulation and its significance.	IEx
2.5.120	Describe the laboratory assessment of liver function and hepatic failure.	IEx
2.5.121	Explain the: - Physiology of swallowing - Factors preventing reflux of gastric contents into the oesophagus - Control of gastric motility and emptying - Composition of gastric fluid - Physiology of nausea and vomiting	IEx
Gastrointestinal Pharmacology		
2.5.122	Describe alterations to drug response due to hepatic disease.	IEx
2.5.123	Outline the pharmacological treatment of peptic ulcer disease and reflux.	IEx
Haematology, Transfusion Medicine and Oncology		
2.5.124	Describe the physiological consequences of acute and chronic anaemia.	IEx
2.5.125	Outline the major haemoglobinopathies and their clinical significance.	IEx
2.5.126	Describe the physiology of haemostasis, including: - Coagulation - The role of platelets - Fibrinolysis	IEx
2.5.127	Describe the physiological mechanisms of limiting and preventing thrombosis.	IEx
2.5.128	Outline the methods for assessing coagulation, platelet function and fibrinolysis.	IEx
2.5.129	Describe blood groups and outline the principles and procedures of compatibility testing.	IEx

2.5.130	Outline the composition, indications and risks of use of the following blood components and products: - Whole Blood - Packed red cells - Plasma - Platelets - Cryoprecipitates - Factor VIIa	IEx
2.5.131	Describe the changes that occur during blood storage and their clinical implications.	IEx
Pharmacology of Haematology, Transfusion Medicine and Oncology		
2.5.132	Describe the pharmacology of heparin and low molecular weight heparins including their side-effects.	IEx
2.5.133	Describe the mode of action of protamine and potential adverse reactions.	IEx
2.5.134	Describe the pharmacology of warfarin and other oral anticoagulant drugs, including the direct thrombin inhibitors.	IEx
2.5.135	Describe methods to reverse the effect of warfarin.	IEx
2.5.136	Classify and describe the pharmacology of anti-platelet drugs.	IEx
2.5.137	Outline the pharmacology of thrombolytic drugs.	IEx
2.5.138	Outline the pharmacology of anti-fibrinolytic agents, in particular tranexamic acid.	IEx
2.5.139	Outline the pharmacology of cancer chemotherapeutic agents with particular reference to problems that such agents may cause during the perioperative period.	IEx
Immunology		
2.5.140	Explain how the body defends against infection.	IEx
2.5.141	Outline the effects of anaesthesia and surgery on immune function.	IEx
2.5.142	Describe the immunological basis and pathophysiological effects of hypersensitivity.	IEx
2.5.143	Outline the principles of tissue/organ transplantation and the mechanisms of rejection of allogeneic organs.	IEx
Immunology-related Pharmacology		

2.5.144	Outline the pharmacology of antimicrobial drugs and their interactions with other drugs used during the perioperative period.	IEx
2.5.145	Explain the principles of antibiotic prophylaxis.	IEx
2.5.146	Outline the pharmacology of antiseptics and disinfectants, their clinical use and associated risks.	IEx

2.6 Trauma, Crisis Management and Resuscitation

Learning outcomes		Assessment
Scientific Basis of Acute Medicine		
Physiology / Pathophysiology		
2.6.1	Define shock.	IEx
2.6.2	Integrate knowledge of factors determining cardiac output to classify causes of shock.	IEx
2.6.3	Describe the physiological consequences of shock.	IEx
2.6.4	Describe oxygen delivery and outline the use of indicators of tissue oxygenation (base deficit, lactate, mixed venous oxygen saturation) in resuscitation.	IEx
2.6.5	Describe the systemic inflammatory response and its physiological effects.	IEx
2.6.6	Describe the physiological basis of anaphylactic and anaphylactoid reactions.	IEx
2.6.7	Describe the physiological basis of transfusion reactions.	IEx
2.6.8	Describe the physiological consequences of massive transfusion.	IEx
2.6.9	Outline the causes of hypoxaemia.	IEx
2.6.10	Describe the physiological consequences of hypoxaemia.	IEx
2.6.11	Outline the factors determining intracranial pressure and discuss its regulation.	IEx
2.6.12	Describe the cerebral circulation, the regulation of cerebral blood flow and factors leading to the loss of autoregulation.	IEx
2.6.13	Discuss cerebral perfusion pressure.	IEx
2.6.14	Describe the blood supply to the spinal cord and the regulation of spinal cord blood flow.	IEx
2.6.15	Discuss spinal cord perfusion pressure.	IEx

Pharmacology		
2.6.16	With reference to the management of shock, describe the pharmacology of vasopressors and inotropes, including: adrenaline, noradrenaline, phenylephrine, dopamine, dobutamine, phosphodiesterase inhibitors, vasopressin.	IEx
2.6.17	With reference to cardiopulmonary resuscitation, describe the pharmacology of adrenaline, vasopressin, atropine, calcium, sodium bicarbonate, amiodarone and lignocaine.	IEx
2.6.18	With reference to the treatment of malignant hyperthermia, describe the pharmacology of dantrolene.	IEx

2.7 Safety and Quality in Anaesthesia

Learning outcomes		**Assessment**
Equipment Safety		
Principles of Physical Measurements		
2.7.1	Describe the basic physical principles applicable to anaesthesia, in particular: - Use of SI units - Behaviour of fluids (gases and liquids) - Electrical concepts, current, potential difference, resistance, impedance, inductance and capacitance - Principles of humidification and use of humidifiers - Principles of ultrasound imaging and use of Doppler	IEx
2.7.2	Describe the methods of measurement applicable to anaesthesia, including their physical principles, clinical utilities, complications and sources of errors, related to: - Measurement of volume, flow, and pressure, including transducers. - Measurement of blood pressure (non-invasive and invasive means) - Measurement of cardiac output - Measurement of temperature - Pulse oximetry - ECG (12-lead, modified 3-lead and 5-lead systems) - Gas analysis, including oxygen analyzer, capnography and	IEx

	anaesthetic agent analyzer - Methods used to measure respiratory function,including: • Forced expiratory volume • -Peak expiratory flow rate • -Vital capacity • -Flow-volume loops • -Functional residual capacity and residual volume	
Statistics and Clinical Research		
2.7.41	Explain the following concepts in statistics and clinical research - Distribution of data - Frequency distributions - Measures of central tendency - Dispersion of data - Selection and application of non-parametric and parametric tests in statistical inference - Explain the principles of errors of statistical inference and describe techniques to minimise such errors through study design - Explain sources of bias and confounding factors - Describe the various statistical methods used to estimate risk	IEx, FEx

Specialty Modules

3.4 Paediatric Anaesthesia

Learning outcomes		Assessment
Paediatric Airway and Ventilation Management		
3.4.1	Describe the anatomy of neonatal airway and its change with growth and development and its implications for airway management.	IEx
3.4.2	Describe the mechanics and gasesous exchange functions of neonates and children.	IEx
Perioperative Medicine		
3.4.12	Describe the circulatory and respiratory changes that occur at birth and neonatal period and its implications for anaesthetic care.	IEx
3.4.13	Describe thermoneutral zone, temperature regulation and physiological response to lowered or raised temperature in neonate	IEx

	and how this changes with growth and development.	
3.4.14	Outline the pharmacokinetics and pharmacokinetics in neonates and children compared with adults.	IEx

3.5 Obstetric Anaesthesia and Analgesia

Learning outcomes		Assessment
Basic Sciences Underpinning Obstetrics Anaesthesia		
3.5.1	Describe the changes in anatomy, physiology, pharmacology and their implications for anaesthesia that occur during pregnancy, labour and delivery, in particular the airway, respiratory, cardiovascular, haematological, neurological and gastrointestinal changes.	IEx
3.5.2	Outline the reference ranges for physiological and biochemical variables in pregnancy.	IEx
3.5.3	Describe the mechanism, consequences and anaesthetic implications of aorto-caval compression in pregnancy.	IEx
3.5.4	Describe the transition from foetal to neonatal circulation and the establishment of ventilation (also refer to section 3.4 Paediatric Anaesthesia).	IEx
3.5.5	Describe the utero-placental circulation and the principles of placental physiology as related to placental gas exchange and regulation of placental blood flow.	IEx
3.5.6	Describe the anatomy and physiology of pain in labour and childbirth.	IEx
3.5.7	Describe the influence of pregnancy on the pharmacokinetics and pharmacodynamics of drugs commonly used in anaesthesia and analgesia.	IEx
3.5.8	Describe the pharmacology and anaesthetic consideration of oxytocic agents, tocolytic agents and drugs to treat pre-eclampsia.	IEx
3.5.9	Explain the factors that influence the transfer of drugs across the placenta to the foetus.	IEx
3.5.10	Outline the potential effects on the foetus and neonate of drugs administered during pregnancy.	IEx
3.5.11	Outline the potential effects on the neonate of drug administration in association with lactation.	IEx

3.6 Neuroanaesthesia

Learning outcomes		Assessment
Basic Sciences Underpinning Neuroanaesthesia		
Pharmacology		
3.6.14	Evaluate the effects of anaesthetic agents on brain and spinal cord physiology including metabolism, blood flow, intracranial and intraspinal pressure.	IEx, FEx
3.6.16	Describe the pharmacology of drugs used to treat intracranial hypertension.	IEx, FEx
3.6.17	Describe the pharmacology and clinical utility of antiepileptic and prophylactic therapy in neurosurgical patients.	IEx, FEx
3.6.19	Discuss the pharmacology and clinical utility of pharmacological agents for prophylaxis and treatment of cerebral vasospasm associated with subarachnoid haemorrhage.	IEx, FEx

APPENDIX 5 LEARNING OUTCOMES TO BE ASSESSED IN FINAL EXAMINATION

The following is a summary of the learning outcomes in the curriculum that will be assessed in the Final examination.
Some of the learning outcomes could also be assessed during workplace based assessments and the Intermediate examination.

Clinical Fundamentals

2.1 General Anaesthesia and Sedation

Basic Training

Learning outcomes		Assessment
General Knowledge		
2.1.2	Explain the techniques of intravenous and inhalational induction and describe clinical indications and advantages and disadvantages of both techniques.	CEX/CBD, FEx
2.1.3	Outline preoperative fasting requirements, identify patients at risk of spiration and outline common measures employed to decrease the risk of pulmonary aspiration.	CEX/CBD, FEx
2.1.4	Discuss the indications for rapid sequence induction. Outline the essential preparation and steps of rapid sequence induction.	CEX/CBD, FEx
2.1.5	Describe the synergism between anaesthetic agents, opioids and regional blockade and how this is used clinically	CEX/CBD, FEx
2.1.10	Outline the principles of perioperative fluid therapy.	CEX/CBD, IEx, FEx
2.1.11	Outline the physiological changes that occur with and the implications for anaesthetic management of pneumoperitoneum.	CEX/CBD, IEx, FEx
2.1.12	Outline the physiological changes that occur with and the implications for anaesthetic management of the following patient positions: - Supine - Trendelenberg and reverse trendelenberg - Sitting - Lateral - Lithotomy - Prone	CEX/CBD, IEx, FEx

2.1.13	Describe the clinical features that indicate a patient can be extubated safely.	CEX/CBD, FEx
2.1.14	Discuss the management of failure to wake up from anaesthesia.	CEX/CBD, FEx
2.1.15	Discuss the management of postoperative delirium.	CEX/CBD, FEx
Pharmacology of Specific Agents		
Sedative and Hypnotic Agents		
2.1.46	Describe the clinical situations when anxiolytic or sedative premedication may be indicated or contraindicated.	CEX/CBD, IEx, FEx
2.1.47	Define levels of sedation and outline the requirements for safe practice of procedural sedation.	CEX/CBD, FEx
Neuromuscular Blocking Agents and Monitoring		
2.1.61	Describe the clinical features and management of inadequate reversal of neuromuscular blockade.	CEX/CBD, IEx, FEx
Analgesics (also refer to section 2.4 Acute Pain Management)		
2.1.64	Outline a strategy for the management of post operative analgesia for patients in their care.	CEX/CBD, FEx
Postop Nausea and Vomiting and Antiemetics		
2.1.67	List the risk factors, and outline a strategy for the prevention and management of postoperative nausea and vomiting.	CEX/CBD, IEx, FEx
Depth of Anaesthesia and Monitoring		
2.1.68	Describe the concept of depth of anaesthesia and how this may be monitored.	CEX/CBD, IEx, FEx
2.1.69	Outline the aetiology of and measures to prevent intraoperative awareness under general anaesthesia.	CEX/CBD, FEx
2.1.70	Explain the principles involved in the electronic monitoring of depth of sedation and anaesthesia, including the use of EEG analysis.	IEx, FEx
2.1.71	Describe techniques to balance anaesthetic depth with changing surgical stimulus.	IEx, FEx
Temperature Homeostasis and Anaesthesia		
2.1.76	Discuss methods of maintaining body temperature during anaesthesia and sedation, including active warming of patients.	CEX/CBD, IEx, FEx
2.1.77	Describe how a patient's temperature is monitored and discuss the indications for temperature monitoring with the advantages and	CEX/CBD, IEx, FEx

	disadvantages of particular sites and methods.	
Vascular Access		
2.1.78	Outline measures to increase the rate of successful intravenous cannulation and to minimise patient discomfort during this procedure.	DOPS, FEx
2.1.79	Describe the anatomy and anatomical relations of the great veins relevant to performing central venous cannulation, including the ultrasound anatomy	FEx
2.1.80	Describe central venous cannulation by the jugular, subclavian and femoral routes, including: - Indications and contraindications - Possible complications, including measures to reduce these - Steps involved - Documentation required	DOPS, FEx
2.1.81	Describe the anatomy of the radial, brachial, femoral and dorsalis pedis arteries and their anatomical relations relevant to arterial cannulation including the ultrasound anatomy.	FEx
2.1.82	Describe arterial cannulation, including: - Indications and contraindications - Possible complications, including measures to reduce these - Steps involved - Documentation required	DOPS, FEx
Fluid Therapy (also refer to section 2.5 Perioperative Medicine on Cardiovascular Physiology)		
2.1.85	Outline factors determining perioperative fluid requirements and choice of fluid therapy.	IEx, FEx
2.1.86	Describe the chemical composition of crystalloids and colloids used in clinical practice and their effects / side effects when used in volume replacement.	IEx, FEx
2.1.88	Discuss the appropriate choice of monitoring devices to guide fluid management in the perioperative period.	FEx
2.1.89	Discuss the indications for and complications of invasive blood pressure monitoring and the interpretation of the data.	FEx

Higher Training

Learning outcomes	**Assessment**
Applied Clinical Pharmacology	

2.1.95	Evaluate the place of premedication and the utility of the available agents, particularly with reference to their safety in high risk patients.	CEX/CBD, FEx
2.1.96	Evaluate the merits of intravenous and inhalational induction.	CEX/CBD, FEx
2.1.97	Evaluate the use of Total Intravenous Anaesthesia (TIVA) and Target Controlled Infusion (TCI) in comparison with inhalational anaesthesia.	CEX/CBD, FEx
2.1.98	Describe the use of pharmacological models, such as the concept of 'Response Surface Models' to achieve optimal sedation and anaesthesia, using a combination of drugs.	CEX/CBD, FEx
2.1.99	Evaluate the methods available for monitoring depth of anaesthesia and sedation, including the role of electronic monitoring of depth of sedation and anaesthesia.	CEX/CBD, FEx
2.1.100	Discuss the aetiology of and measures to prevent intraoperative awareness under general anaesthesia.	CEX/CBD, FEx
2.1.101	Discuss the management of a patient who complains of intra-operative awareness under general anaesthesia.	CEX/CBD, FEx
2.1.102	Discuss the potential causes and management of failure to wake up from anaesthesia.	CEX/CBD, FEx
2.1.103	Discuss the potential causes and the prevention and management of postoperative delirium.	CEX/CBD, FEx
2.1.104	Discuss the potential causes and the prevention and management of postoperative cognitive dysfunction.	CEX/CBD, FEx
2.1.105	Outline the pathophysiology of drug abuse and discuss the potential interactions with perioperative anaesthetic management.	CEX/CBD, FEx
2.1.106	Describe the clinical signs and outline the factors that may predispose to residual neuromuscular blockade.	CEX/CBD, FEx
2.1.107	Discuss the risk factors for postop nausea and vomiting and evaluate the prophylaxis and treatment strategies.	CEX/CBD, FEx
Vascular Access		
2.1.108	Describe the insertion of Peripherally Inserted Central Catheters (PICCs).	FEx
2.1.109	Discuss the advantages and disadvantages of PICCs versus Central Venous Catheters.	CEX/CBD, FEx
2.1.110	Evaluate the place of ultrasound in vascular access.	CEX/CBD, FEx
2.1.111	Discuss the advantages and disadvantages of the internal/external	CEX/CBD, FEx

	jugular, subclavian and femoral routes for central venous access.	
Fluid Therapy		
2.1.112	Discuss factors determining perioperative fluid requirements and choice of fluids.	CEX/CBD, FEx
2.1.113	Discuss Goal Directed Fluid Therapy for complex surgical procedures.	CEX/CBD, FEx
2.1.114	Evaluate the place of CVP measurement in perioperative fluid management.	CEX/CBD, FEx
2.1.115	Describe the technique of insertion of a Pulmonary Artery catheter	CEX/CBD, FEx
2.1.116	Describe the principles of haemodynamic measurements using the Pulmonary artery catheter and evaluate its role in the perioperative settings.	CEX/CBD, FEx
2.1.117	Discuss the priniciples of Cardiac Output monitoring devices (such as Pulse Contour Analysis, and Transesophageal Doppler) and evaluate their roles in perioperative haemodynamic monitoring.	CEX/CBD, FEx
2.1.118	Discuss the role of Echocardiography in perioperative haemodynamic management	CEX/CBD, FEx
2.1.119	Critically evaluate the strategies to minimise blood loss and blood transfusion requirements.	CEX/CBD, FEx
Temperature Homeostasis and Monitoring		
2.1.120	Evaluate methods of manipulating body temperature during anaesthesia and sedation, including active warming and cooling of patients.	FEx

2.2 Regional Anaesthesia

Basic Training

Learning outcomes		**Assessment**
General Knowledge		
2.2.1	Describe the principles for the safe conduct of regional anaesthesia.	CEX/CBD, FEx
2.2.2	Outline the pre-operative assessment of patients specifically focusing on cencerns of regional anaesthesia.	CEX/CBD, FEx
2.2.3	Describe the absolute and relative contraindications to regional anaesthesia.	CEX/CBD, FEx

2.2.4	Articulate the indications, benefits, risks and potential complications of regional anaesthesia to obtain proper informed consent from patients.	CEX/CBD, FEx
2.2.5	Describe the necessary theatre preparation before conducting regional anaesthesia, including equipment, drugs, assistance, positioning, and proper time-out.	CEX/CBD, FEx
2.2.6	Discuss the use of sedation to alleviate pain and anxiety during performance of regional anaesthesia.	CEX/CBD, FEx
Central Neuraxial Blockade		
2.2.10	Describe the anatomy of the vertebrae, spinal cord and surrounding meninges.	FEx
2.2.11	Describe the absolute and relative contraindications of central neuraxial block.	CEX/CBD, FEx
2.2.12	Describe the physiological consequences of a central neuraxial block.	CEX/CBD, FEx
2.2.13	List and discuss on the management of minor and major complications of central neuraxial block.	CEX/CBD, FEx
Peripheral Plexus / Nerve Blocks		
2.2.14	Describe the relevant anatomy of the block.	CEX/CBD, FEx
2.2.15	Outline the potential complications of the block.	CEX/CBD, FEx
Skills		
2.2.20	Optimizing image on ultrasound machine for peripheral plexus / nerve blocks.	DOPS, FEx
2.2.21	Demonstrating proper needling technique with real-time ultrasound guidance including the in-plane and out-of plane approaches.	DOPS,FEx
2.2.22	Using the nerve stimulator to guide peripheral plexus / nerve block.	DOPS, FEx

Higher Training

Learning outcomes	**Assessment**
General Knowledge	

2.2.23	Describe the selection and performance of regional techniques, taking account of patient factors, co-morbidities and surgical procedure.	CEX/CBD, FEx
2.2.24	Describe the relevant anatomy of regional anaesthesia and the use of ultrasound and nerve stimulator to facilitate block.	CEX/CBD, DOPS, FEx
2.2.25	Discuss the choice of drugs for regional anaesthesia using continuous catheter technique for post-operative pain.	CEX/CBD, FEx
2.2.26	Discuss the indications and contraindications, risks, benefits and possible complications of various regional anaesthesia techniques.	CEX/CBD, FEx
2.2.27	Discuss the investigation and management of patients with complications after central neuraxial block and regional techniques.	CEX/CBD, FEx
2.2.28	Describe the technique of Intravenous Regional Anaesthesia (IVRA) and outline strategies to prevent complications from IVRA.	FEx
Skills		
2.2.29	Perform central neuraxial blocks, including spinal anaesthesia, lumbar and thoracic epidural block, and caudal block.	DOPS, FEx
2.2.30	Perform peripheral plexus / nerve blocks under supervision, such as: - Brachial plexus block – interscalene, supra and infraclavicular, axillary approaches - Femoral nerve / Fascia iliaca block - Obturator nerve block - Popliteal nerve block - Sciatic nerve block - Subgluteal and popliteal approaches - Ankle block - Penile block - Inguinal block - Transversus Abdominus Plane (TAP) block - Rectus sheath block - Quadratus Lumborum block - Intercostal nerve block - Pectoral nerve block - Superficial and deep cervical plexus blocks - Paravertebral block	DOPS, FEx

2.3 Airway Management

Basic Training

Learning outcomes		Assessment
General Knowledge		
Basic Sciences		
2.3.1	Describe the anatomy of the airway, including innervation and endoscopic anatomy.	FEx
2.3.2	Discuss the respiratory physiology related to airway management, including changes with pregnancy, at extremes of age, and in pathological conditions.	CEX/CBD, IEx, FEx
2.3.3	Discuss the pathophysiology of pulmonary aspiration, methods of minimizing aspiration, and the role and timing of pre-operative fasting.	CEX/CBD, FEx
Airway Assessment and Plan		
2.3.5	Describe assessment of the airway during preop visit, including assessment of risk of aspiration, predictors of difficult intubation and mask ventilation, and formulation of an airway management plan.	CEX/CBD, FEx
2.3.6	Discuss the objectives and choice of methods for airway control, including manual manoevure, supraglottic devices, intubation and surgical airways.	CEX/CBD, FEx
2.3.7	Outline the options available for relieving airway obstruction in an unconscious patient.	CEX/CBD, FEx
2.3.8	List the indications for endotracheal intubation.	CEX/CBD, FEx
2.3.9	Outline the rationale and physiology behind pre-oxygenation.	CEX/CBD, IEx, FEx
2.3.10	Assess for readiness, and outline a plan for extubation / removal of supraglottic device.	CEX/CBD, FEx
2.3.26	Discuss the complications of airway management, including oropharyngeal, laryngeal and dental injuries.	CEX/CBD, FEx

Higher Training

Learning outcome (Please refer to Section 3 Specialty modules for learning outcomes related to airway management in ENT, Paediatric and thoracic cases)	**Assessment**

General Knowledge		
Airway Equipment		
2.3.18	Describe the design features of modified laryngoscopes and blades, indications for their use, and potential limitations.	CEX/CBD, FEx
2.3.19	Describe the design features of videolaryngoscopes available in local institutional settings, and outline the pros and cons of their use.	CEX/CBD, FEx
2.3.20	Describe the design features of endotracheal tubes with modifications, such as the reinforced tube, foam-cuff tube, laryngectomy tube, laser-resistant tube, micro-laryngoscopy tube, and tubes for monitoring recurrent laryngeal nerve function.	CEX/CBD, FEx
2.3.21	Describe the design features of the Bag-Valve-Mask assembly.	CEX/CBD, FEx
2.3.22	Describe the design features of the supraglottic airway devices.	CEX/CBD, FEx
2.3.23	Describe the design features of tracheostomy tubes.	CEX/CBD, FEx
Difficult Airway Algorithms		
2.3.24	Describe the international difficult airway algorithms and evaluate its application in the local institutional settings.	CEX/CBD, FEx
2.3.25	Describe the different techniques of surgical cricothyroidotomy and evaluate the pros and cons of each technique.	CEX/CBD, FEx
Flexible Bronchoscopic Intubation		
2.3.27	Outline the techniques for providing anaesthesia of the upper airway for the performance of fibreoptic intubation.	CEX/CBD, FEx
2.3.28	Discuss the use of sedation during awake fibreoptic intubation.	CEX/CBD, FEx
2.3.29	Describe the technique of performing flexible bronchoscopic intubation through a supraglottic airway device	CEX/CBD, FEx
Tracheostomy		
2.3.30	Discuss the airway management plan for tracheostomy under general anaesthesia.	CEX/CBD, FEx
2.3.31	Discuss the immediate, short term and long term complications of tracheostomy.	CEX/CBD, FEx
Airway Challenges		

2.3.32	Describe the airway management for patients with - Acute infective conditions, such as epiglottitis - Oropharyngeal tumours - Facial scarring, fibrosis or contractures - Vocal cord palsies - Head and neck trauma including laryngeal injury, cervical spine injuries and severe facial burns - Systemic illness such as morbid obesity, ankylosing spondylitis, rheumatoid arthritis and craniofacial abnormalities	CEX/CBD, FEx
Skills		
2.3.33	Use of videolaryngoscope in patients with difficult airway	DOPS, FEx
2.3.34	Performing fibreoptic intubation, demonstrating the followings - Appropriate selection of bronchoscope and endotracheal tubes - Appropriate preparation of equipment - Adequate local anaesthesia of the airway for awake intubation - Judicious use of sedation - Advancement of bronchoscope according to endoscopic views - Smooth railroading of endotracheal tube over bronchoscope - Confirmation of position of endotracheal tube	DOPS, FEx

2.4 Acute Pain Management

Basic Training

Learning outcomes		**Assessment**
Clinical Pharmacology of Analgesic Agents		
2.4.14	Outline the basic concepts of multimodal analgesia.	IEx, FEx
Clinical Pain Management		
2.4.29	Describe the assessment of acute pain, including pain assessment scales and functional assessment.	CEX/CBD, FEx
2.4.30	Discuss the plan of management of postop pain - In the Recovery Room - After discharge from the Recovery Room	CEX/CBD, FEx
2.4.31	Describe the advantages and disadvantages of patient-controlled analgesia (PCA), continuous infusion and intermittent	CEX/CBD, FEx

administration of opioids for acute pain management.	

Higher Training

Learning outcomes		Assessment
Acute Pain Assessment and Care Plan		
2.4.33	Formulate a plan for acute pain management, which shows integrated knowledge of the interaction of analgesic agents, patient factors and the aetiology of pain.	CEX/CBD, FEx
2.4.34	Discuss the importance of psychological and social factors in the presentation and management of acute pain.	CEX/CBD, FEx
2.4.35	Organise appropriate review and follow up for patients, after their discharge from the acute pain service.	CEX/CBD, FEx
2.4.36	Prescribe and manage patient controlled analgesia (PCA) and/or analgesic infusions for patients with acute pain and manage potential complications.	CEX/CBD, FEx
2.4.37	Prescribe, set up and appropriately adjust neuraxial and continuous peripheral nerve infusions for patients with acute pain and manage potential complications.	CEX/CBD, FEx
2.4.38	Describe the principles of neuraxial analgesia including efficacy, drugs used, adverse effects, program parameters, equipment, patient selection and safe administration.	CEX/CBD, FEx
2.4.39	Outline clinical situations where regional infusion techniques may be of benefit for the management of acute pain (also refer to section 2.2 Regional Anaesthesia).	CEX/CBD, FEx
2.4.40	Outline the management of opioid-induced over-sedation and/or respiratory depression in acute pain settings.	CEX/CBD, FEx
2.4.41	Discuss the interaction between pain management techniques and postoperative delirium.	CEX/CBD, FEx
2.4.42	Discuss the pathophysiology, risk factors, complications and management of post-dural puncture headache.	CEX/CBD, FEx
2.4.43	List the predictive factors for persistent post-surgical pain (PPSP) and outline measures to prevent or minimize its occurrence.	CEX/CBD, FEx
Management of Pain in Specific Clinical Situations		
2.4.44	Discuss the management of acute pain in patients with preexisting chronic pain.	CEX/CBD, FEx

2.4.45	Outline a protocol for the management of pain in recovery area.	CEX/CBD, FEx
2.4.46	Discuss the management of acute pain following trauma, including chest and orthopaedic trauma.	CEX/CBD, FEx
2.4.47	Outline the issues involved in the management of acute pain during pregnancy and during lactation (also refer to section 3.5 Obstetric Anaesthesia and Analgesia).	CEX/CBD, FEx
2.4.48	Evaluate the role of acute pain management in rehabilitation and Enhanced Recovery After Surgery (ERAS) procedures.	CEX/CBD, FEx
2.4.49	Outline a pain management plan for patients having day surgery procedures.	CEX/CBD, FEx
2.4.50	Discuss issues relevant to the management of pain in the elderly in acute pain settings.	CEX/CBD, FEx
2.4.51	Discuss issues relevant to the management of pain in paediatrics in acute pain settings.	CEX/CBD, FEx
2.4.52	Outline the pathophysiology of chronic opioid use and abuse and outline management strategies for opioid tolerant patients with acute pain.	CEX/CBD, FEx

2. 5 Perioperative Medicine

Basic Training

Learning outcomes		**Assessment**
Essentials of Preoperative Assessment		
2.5.1	Outline the ASA physical status classification system and the implications for anaesthesia.	CEX/CBD, FEx
2.5.2	Outline the functional assessment of patients based on exercise capacity and performance of activities of daily living.	CEX/CBD, FEx
2.5.3	Outline how functional assessment is used in perioperative risk management.	CEX/CBD, FEx
2.5.4	Discuss the use and interpretation of common investigations relevant to clinical anaesthesia/intensive care and perioperative management. These investigations will include but not limited to blood tests, ECG, radiological investigations (such as plain X-ray, CAT scan or MRI) of relevant body regions, and specific tests such as the lung function tests, sleep studies, and basic ultrasound/ echocardiographic interpretation.	CEX/CBD, FEx

2.5.5	Describe the management of common arrhythmias.	CEX/CBD, FEx
2.5.8	Outline the pharmacology of commonly encountered illicit drugs and their interactions with drugs used in anaesthetic care.	CEX/CBD, FEx
2.5.9	Discuss the role of antibiotic prophylaxis in preventing infection and the identification of patients requiring it.	CEX/CBD, FEx
2.5.10	Describe the potential drug interactions and adverse effects of herbal medicines with particular reference to the perioperative period.	CEX/CBD, FEx
2.5.11	Describe the perioperative risks and anaesthetic management for the surgical patient with co-existing disease, such as: - Respiratory infection - Chronic obstructive airways disease - Asthma - Restrictive lung disease - Pulmonary embolus - Obstructive sleep apnoea - Pulmonary hypertension - Congenital heart disease - Systemic hypertension - Ischaemic heart disease - Congestive cardiac failure - Arrhythmias and conduction abnormalities - Cardiac pacemakers and related devices - Transient ischaemic attack and stroke - Parkinson's disease - Myasthenia Gravis and myasthenic syndrome - Muscular dystrophies, myopathies and myotonias - Multiple sclerosis - Cerebral palsy - Pseudocholinesterase deficiency - Diabetes mellitis - Morbid obesity - Thyroid disease - Carcinoid disease and syndrome - Phaeochromocytoma - Rheumatoid arthritis - Scleroderma	CEX/CBD, FEx

	- Immunocompromised patient - Steroid dependence - Post-transplant patient - Acute and chronic renal impairment - Electrolyte abnormalities - Acid base abnormalities - Haematological malignancies - Thromboembolic disease - Coagulopathy - Thrombocytopenia - Anaemia - Anticoagulant use - Haematemesis - Porphyria - Tobacco use	
2.5.12	Outline the principles of informed consent for surgery and anaesthesia, including the issue of capacity.	CEX/CBD, FEx
2.5.13	Outline the legal perspectives of Bolam versus Montgomery case, with particular reference to explanation of "material risks", from the views of a "reasonable doctor" versus a "reasonable patient".	CEX/CBD, FEx
Respiratory Pharmacology		
2.5.15	Describe the performance of different oxygen delivery devices.	IEx, FEx

Higher Training

Learning outcomes		**Assessment**
Knowledge		
2.5.152	Evaluate the available classifications of physical status and their use in perioperative assessment.	CEX/CBD, FEx
2.5.153	Evaluate measures to alleviate the risk of the following complications in the perioperative period: - Aspiration - Venous thromboembolism - Surgical infection	CEX/CBD, FEx
2.5.154	Discuss the reasons for and potential implications of with-holding or continuing regular medications in the perioperative period.	CEX/CBD, FEx

2.5.155	Discuss the role of prehabilitation.	CEX/CBD, FEx
2.5.156	Discuss the role and indications for high-carbohydrate pre-operative drinks, enteral feeding, and parenteral nutrition.	CEX/CBD, FEx
2.5.157	Discuss the principles of Enhanced Recovery After Surgery (ERAS) pathways and their limitations	CEX/CBD, FEx
2.5.158	Discuss considerations for patients presenting for day surgery, including case selection, choice of anaesthesia technique, and discharge criteria.	CEX/CBD, FEx

2.6 Trauma, Crisis and Resuscitation

Basic Training

Learning outcomes		Assessment
Scientific Basis of Acute Medicine		
Anatomy		
2.6.19	Outline the anatomy relevant to vascular access in resuscitation: specifically for safe cannulation of antecubital, saphenous jugular and subclavian veins and placement of intraosseous infusion devices.	FEx
2.6.20	Outline the anatomy relevant to the drainage of pericardial fluid.	FEx
2.6.21	Outline the anatomy relevant to drainage of pleural space.	FEx
2.6.22	Outline the anatomy of the cerebral and spinal cord circulation.	FEx
Management of Acute Organ Dysfunctions		
Resuscitation of the Patient with Shock		
2.6.23	Outline the clinical signs that may differentiate the causes of shock.	CEX/CBD, FEx
2.6.24	Outline the initial investigations of the shocked patient.	CEX/CBD, FEx
2.6.25	Outline the likely changes in blood gas analysis in the shocked patient.	CEX/CBD, FEx
2.6.26	Outline the use of indicators of tissue oxygenation (base deficit, lactate, mixed venous oxygen saturation) in resuscitation.	CEX/CBD, FEx
2.6.27	Evaluate the role of echocardiography in the diagnosis and	CEX/CBD, FEx

	management of shock.	
2.6.28	Correlate clinical signs of hypovolaemia shock with estimates of volume loss.	CEX/CBD, FEx
2.6.29	Outline how the clinical signs of hypovolaemic shock may be altered by anaesthesia, sedation and current medication.	CEX/CBD, FEx
2.6.30	Outline how the clinical signs of shock may be altered by age.	CEX/CBD, FEx
2.6.31	Outline an approach to volume replacement in shock due to: haemorrhage, loss of fluid and electrolytes.	CEX/CBD, FEx
2.6.32	Outline the indications for the use of vasopressors / inotropes.	CEX/CBD, FEx
2.6.33	Outline the management of patients requiring massive blood transfusion.	CEX/CBD, FEx
2.6.34	Outline the diagnosis and management of major transfusion reactions.	CEX/CBD, FEx
2.6.35	Outline the diagnosis and management of acute anaphylaxis.	CEX/CBD, FEx
2.6.36	Outline the diagnosis and management of severe sepsis or systemic inflammatory response syndrome (SIRS).	CEX/CBD, FEx
2.6.37	Outline the approach to obtaining vascular access in the shocked patient.	CEX/CBD, FEx
2.6.68	Describe the steps to program an external pacemaker.	CEX/CBD, FEx
2.6.39	Describe the management of patients with obstructive shock, such as thromboembolism, cardiac tamponade and tension pneumothorax.	CEX/CBD, FEx
Acute Respiratory Failure		
2.6.40	Define respiratory failure and differentiate between type 1 and type 2 respiratory failure.	CEX/CBD, IEx
2.6.41	Interpret blood gas analysis in respiratory failure.	CEX/CBD, IEx, FEx
2.6.42	Outline methods to treat life threatening hypoxaemia.	CEX/CBD, FEx
2.6.43	Describe the management of severe asthma.	CEX/CBD, FEx
2.6.44	Describe the diagnosis and management of pneumothorax.	CEX/CBD, FEx
2.6.45	Describe the technique of emergency drainage of tension pneumothorax.	CEX/CBD, FEx

Acute Neurological Deterioration		
2.6.46	Outline the causes of coma and an approach to the initial assessment and management of the comatose patient.	CEX/CBD, FEx
2.6.47	Describe the Glasgow Coma Scale.	CEX/CBD, FEx
2.6.48	Describe the management of prolonged seizures and status epilepticus.	CEX/CBD, FEx
2.6.49	Outline strategies to treat raised intracranial pressure.	CEX/CBD, FEx
2.6.50	Outline strategies to prevent secondary brain injuries.	CEX/CBD, FEx
2.6.51	Outline the causes of acute spinal cord dysfunction and an approach to the initial assessment and management of the patient with acute spinal cord dysfunction.	CEX/CBD, FEx
Metabolic and Electrolyte Disturbances		
2.6.52	Describe clinical situations likely to result in and outline the initial management of: - Hyper/hypokalemia - Hyponatrema and hypo-osmolality - Hypernatremia - Hyper/hypoglycemia - Hyper/hypocalcemia - Hyper/hypomagnesemia - Metabolic acidosis	CEX/CBD, FEx
Environmental and Equipment Crises		
2.6.53	Outline the steps to take in the event of: - An operating room fire - Electrical power failure in the operating suite	CEX/CBD, FEx
2.6.54	Describe the likely presentation of and steps to take in the event of: - Failure of pipeline gas supply - Anaesthesia machine and ventilator dysfunction - Breathing circuit malfunctions such as stuck valves and massive leaks	CEX/CBD, FEx
Trauma Care		
2.6.55	Outline appropriate preparation of equipment and personnel prior to the arrival of the trauma patient in the hospital.	CEX/CBD, FEx

2.6.56	Outline features of the patient's history that are indicator of injury severity.	CEX/CBD, FEx
2.6.57	Identify contraindications to urinary catheters and nasogastric tubes during trauma resuscitation.	CEX/CBD, FEx
2.6.58	Describe indications for a definitive airway in the trauma patient.	CEX/CBD, FEx
2.6.59	Describe strategies to prevent and manage coagulopathy, hypothermia and acidosis in trauma patient.	CEX/CBD, FEx
2.6.60	Explain the management of massive blood loss including the use of rapid infusion devices.	CEX/CBD, FEx
2.6.61	Describe strategies for minimizing secondary brain injury in patients with multiple injures.	CEX/CBD, FEx
2.6.62	Describe infection control techniques in the trauma setting.	CEX/CBD, FEx
2.6.63	Describe the primary survey of the trauma patient.	CEX/CBD, FEx
2.6.64	Describe techniques for the immobilization of patients with spinal injuries during transport and transfer.	CEX/CBD, FEx
Skills		
2.6.65	Initiate management of the following conditions when occurring in association with anaesthesia or sedation: - Dyspnoea - Hypoxia - Hypocapnoea/hypocarbia - Hypercapnoea/hypercarbia - Progressive rise in inspired CO2 - Tachycardia - Bradycardia - Hypotension - Hypertension - High airway pressures - Oliguria/anuria - Failure to wake from anaesthesia - Convulsion	CEX/CBD, FEx
2.6.66	Initiate management of patients with the following life threatening conditions: - Cardiac arrest - Respiratory arrest - Shock (hypovolemic, distributive, cardiogenic, obstructive)	CEX/CBD, FEx

- Cardiac tamponade - Acute myocardial ischemia - Acute pulmonary oedema - Aortic dissection - Arrhythmias causing hemodynamic compromise - Aspiration of gastric contents - Severe bronchospasm - Severe laryngospasm - Tension pneumothorax - Massive hemoptysis - Coma - Raised intra-cranial pressure - Prolonged seizures - Local anaesthetic toxicity - Anaphylaxis - Malignant hyperthermia - Pulmonary embolism - Gas embolism - Coagulopathy in association with surgery or trauma - Hyper/hypokalemia	
2.6.67 Demonstrate proficiency in advanced life support.	CEX/CBD, FEx

Higher Training

Learning outcomes	**Assessment**
Acute Organ Dysfunctions	
2.6.68 Where the following problems occur in association with anaesthesia and sedation, the trainee will be able to: i. Discuss potential causes and their relative frequency ii. Follow strategies to diagnose the underlying cause effectively and efficiently iii. Evaluate severity, potential consequences and the need for treatment iv. Select treatment appropriate to the severity of the condition v. Describe the clinical evaluation and both the initial and definitive management - Dyspnoea - Hypoxia	CEX/CBD, FEx

	- Hypocapnoea/hypocarbia - Hypercapnoea/hypercarbia - Tachycardia - Bradycardia - Hypotension - Hypertension - High airway pressures - Oliguria/anuria - Failure to wake from anaesthesia	
2.6.69	Describe the clinical features and resuscitative management of patients with: - Local anaesthetic toxicity - Malignant hyperthermia - Coagulopathy in association with surgery or trauma - Tension pneumothorax - Massive haemoptysis - Ischaemic and haemorrhagic stroke - Prolonged seizures - Rhabdomyolysis - Pulmonary embolism / fat embolism / gas embolism - Haematemesis and melaena - Thyroid storm - Addisonian crisis - Diabetic ketoacidosis - Hyperosmolar, hyperglycaemic state - Hypo-osmolar states - Severe electrolyte disturbances - Severe acid base disturbance - Acute drug intoxication	CEX/CBD, FEx
Trauma Care		
2.6.70	Discuss the effects of age, body mass index (BMI) and concurrent medication on the presentation and management of patients with severe multi-trauma.	CEX/CBD, FEx
2.6.71	Discuss the differential diagnosis of shock in the trauma patient.	CEX/CBD, FEx
2.6.72	Discuss pain management in multi-trauma patient.	CEX/CBD, FEx
2.6.73	Describe the role of diagnostic ultrasound in the initial management of trauma patient.	CEX/CBD, FEx

2.6.74	Discuss the diagnosis and management of life-threatening haemorrhage in the multi-trauma patient and in particular haemorrhage due to: - Chest trauma - Abdominal trauma - Pelvic trauma - Major vascular injury	CEX/CBD, FEx
2.6.75	Discuss the use of permissive hypotension (or deliberate temporary under-resuscitation) in the face of uncontrolled bleeding.	CEX/CBD, FEx
2.6.76	Outline the indications for emergency resuscitative thoracotomy.	CEX/CBD, FEx
2.6.77	Discuss the diagnosis and management of cardiac tamponade in the trauma patient.	CEX/CBD, FEx
2.6.78	Discuss the differential diagnosis of hypoxia in the trauma patient.	CEX/CBD, FEx
2.6.79	Discuss the initial diagnosis and management of: - Pneumothorax - Flail chest - Pulmonary contusion - Traumatic aortic disruption - Tracheobronchial injury	CEX/CBD, FEx
2.6.80	Discuss the initial assessment and management of: - Acute traumatic brain injury - Unstable spinal injury including clearing the cervical spine - Acute spinal cord injury and 'neurogenic' shock	CEX/CBD, FEx
2.6.81	Describe the rationale for and methods of immobilization of pelvic fractures and long bone fractures.	CEX/CBD, FEx
2.6.82	Describe problems associated with crush injury.	CEX/CBD, FEx
2.6.83	Describe the clinical features and outline the management of compartment syndrome.	CEX/CBD, FEx
2.6.84	Describe the initial assessment and management of the patient with severe burns injury including: - Fluid management - Pain management - Inhalational injury - Carbon monoxide poisoning	CEX/CBD, FEx
2.6.85	Describe the initial assessment and management of the patient who has experienced: - Electrocution	CEX/CBD, FEx

	- Drowning and near drowning - Severe hypothermia	
2.6.86	Outline the process for arranging a patient transfer.	CEX/CBD, FEx
2.6.87	Discuss requirements for the safe transfer of critically ill patients.	CEX/CBD, FEx
2.6.88	Describe the specific ethical and ethnic issues associated with managing the multiply injured patient, including issues that relate to brain stem death and organ donation.	CEX/CBD, FEx
Skills		
2.6.90	Demonstrate advanced airway management skills in trauma patients (including those with suspected unstable cervical spine), including surgical airway techniques	CEX/CBD, FEx
2.6.93	Conducting the primary and secondary survey of the trauma patient	CEX/CBD, FEx
2.6.94	Interpretation of radiological image relevant to the primary survey	CEX/CBD, FEx
2.6.95	Proficiency in advanced life support	CEX/CBD, FEx

2.7 Safety and Quality in Anaesthesia

Basic Training

Learning outcomes		**Assessment**
Equipment Safety		
Equipment Design		
2.7.3	Describe different systems to deliver supplemental oxygen and the advantages and disadvantages of these systems.	CEX/CBD, FEx
2.7.4	Describe the circle system and the Mapleson's breathing systems, including the clinical use, advantages and disadvantages.	CEX/CBD, FEx
2.7.5	Describe the principles and safety features of vaporizers.	CEX/CBD, FEx
2.7.6	Describe the principles and safety use of syringe pumps, fluid infusion pumps, and fluid warmer.	CEX/CBD, FEx
2.7.7	Describe the principles and safety features of active warming devices, such as the warming blanket.	CEX/CBD, FEx
2.7.8	Describe the design and safety features of anaesthesia machines.	CEX/CBD, FEx

2.7.9	Describe the different levels of checking of anaesthesia machines.	CEX/CBD, DOPS, FEx
Infection Control		
2.7.10	Understand and practice universal precautions.	CEX/CBD, DOPS, FEx
2.7.11	Adhere to local antibiotic guidelines for prevention of surgical site infections.	CEX/CBD, FEx
Procedural Safety		
2.7.12	Describe blood transfusion safety, checking procedures and standard for blood storage.	CEX/CBD, FEx
2.7.13	Perform the standard "time-out" procedure as suggested by the WHO surgical safety checklist.	CEX/CBD, DOPS, FEx
2.7.14	Adhere to local medication safety guidelines, with particular reference to syringe labelling, prevention of contamination, handling of dangerous drugs, and prevention of inadvertent administration of drugs to patients with known drug allergy.	CEX/CBD, DOPS, FEx
2.7.16	Outline the anaesthetic concerns and possible complications in related to patient's positioning during surgery.	CEX/CBD, FEx
2.7.17	State the concerns of tourniquet use and related problems.	CEX/CBD, FEx
2.7.18	State the concerns related to robotic surgeries.	CEX/CBD, FEx

Higher Training

Learning outcomes		**Assessment**
Equipment Safety		
2.7.19	Discuss the principles of surgical diathermy, its safe use and the potential hazards.	CEX/CBD, FEx
2.7.20	Describe the principles of surgical lasers, their safe use and the potential hazards.	CEX/CBD, FEx
2.7.21	Outline the pharmacology of radiological contrast agents.	CEX/CBD, FEx
Environmental Safety		
2.7.22	Describe the supply of medical gases (bulk supply and cylinder) and	CEX/CBD, FEx

	features to ensure supply safety including pressure valves and regulators and connection systems.	
2.7.23	Describe how medical suction is generated and how to set up and test suction systems, both fixed and portable system.	CEX/CBD, FEx
2.7.24	Describe the hazards of anaesthetic gas pollution and the methods of scavenging anaesthetic gases.	CEX/CBD, FEx
2.7.25	Outline the causes of fires and explosions in the operating suite and discuss methods for prevention and management.	CEX/CBD, FEx
2.7.26	Describe microshock and macroshock and the mechanisms for preventing these, with particular reference to ensuring the compatibility of medical procedure, treatment area, and medical equipment used.	CEX/CBD, FEx
Infection Control		
2.7.27	Adhere to local infection control policies, with particular reference to patients requiring airborne and contact precautions.	CEX/CBD, DOPS, FEx
2.7.28	Outline the standards to which reusable anaesthetic equipment needs to be cleaned and/or treated.	CEX/CBD, FEx
2.7.29	Outline the recommended vaccinations for healthcare workers.	CEX/CBD, FEx
College Guidelines in relation to the Safe Provision of Anaesthesia Care		
2.7.30	Describe and outline the general principles of design, operational procedures, equipment and patient safety requirements according to the College guidelines / recommendations on the followings: - Facilities for safe anaesthetic practice in operating suites - Facilities for safe anaesthetic practice in organ imaging units - Facilities for safe anaesthetic practice in the delivery suite - Facilities for safe anaesthetic practice for electro-convulsive therapy (ECT) - Assistance required for the safe conduct of anaesthesia - Monitoring in anaesthesia - Safe sedation for diagnostic and therapeutic procedures - Postanaesthetic recovery care - Conduct of epidural analgesia for parturients - Perioperative care of patients selected for day care surgery - Transport of the critically ill - Handover of responsibility of an anaesthesiologist - Monitored care by an anaesthesiologist	CEX/CBD, FEx

Quality of Care in Anaesthesia		
2.7.31	Describe the characteristics of high quality anaesthesia service (safe, effective, efficient, timely, and patient-centred) and discuss the processes of quality assurance and quality improvement.	CEX/CBD, FEx
2.7.32	Outline the local quality assurance activities, such as peer review, critical incidents reporting, morbidity and mortality meetings, surveys and audits, and continuous medical education.	CEX/CBD, FEx
2.7.33	Outline the quality improvement cycle, with examples.	CEX/CBD, FEx
2.7.34	Outline the principles of risk management, including risk identification, risk rating, and strategies for managing risks (such as elimination, mitigation, acceptance, and transfer).	
2.7.35	Outline the concept of credentialing and give examples of credentialing in anaesthesia practice.	CEX/CBD, FEx
2.7.36	Outline the process for handling patient complaints in the local institution and discuss how patient complaints provide an opportunity to improve the quality of anaesthesia care.	CEX/CBD, FEx
2.7.37	Discuss the concept of open disclosure and outline how it is implemented in the local institutional settings.	CEX/CBD, FEx
2.7.38	Discuss the concept of medical negligence from the medico-legal perspective.	CEX/CBD, FEx
2.7.39	Discuss the priniciples of medical ethics, including autonomy, beneficence, non-maleficence, and justice.	CEX/CBD, FEx
Statistics and Clinical Research		
2.7.40	Describe the features of evidence-based medicine.	FEx
2.7.42	Describe the stages in the design of a clinical trial including: - Research question and hypothesis - Literature review - Statistical advice - Ideal study protocol to minimise the risk of bias and to achieve optimum power of the study - Ethical issues and informed consent - Data collection and processing	FEx

Specialty Modules

3.1 Anaesthesia for General surgical, urological, gynaecological and endoscopic procedures

Learning outcomes		Assessment
3.1.1	For the following conditions, discuss the key clinical features which may influence anaesthetic management. (Also refer to the section 2.5 Perioperative Medicine): - Bowel disease - Disease of the oesophagus - Disease of the stomach - Gallbladder disease - Liver disease - Disease of the spleen - Renal and urinary tract disease - Pancreatic disease - Adrenal disease - Gynaecological disorders - Breast disease	CEX/CBD, FEx
3.1.2	Discuss the physiological changes associated with pneumoperitoneum and different surgical positions, and management of those changes.	CEX/CBD, FEx
3.1.3	Outline the differential diagnosis of the acute abdomen and the implications for anaesthetic management of the different causes.	CEX/CBD, FEx
3.1.4	Outline the consequences of prolonged vomiting, bowel obstruction and malabsorption syndromes.	CEX/CBD, FEx
3.1.5	Outline the anatomical modification that results from common gastrointestinal operations and the potential pathophysiological consequences.	CEX/CBD, FEx
3.1.6	Discuss the surgical requirements and implications for anaesthetic management of patients undergoing the following elective general surgery, urological, gynaecological and endoscopic procedures: - Major open abdominal surgery - Major open urological surgery - Major gynaecological operations - Minor general, urological and gynaecological surgery - Breast surgery - Laparoscopic surgery, including robot-assisted laparoscopic surgeries - Upper and Lower GI endoscopy	CEX/CBD, FEx

	- Endoscopic urological procedures - Treatment for infertility	
3.1.7	Discuss perioperative analgesia and fluid therapy options for elective general surgery, urological, gynaecological and endoscopic procedures, including strategies for fast track recovery programs for major abdominal surgery. (Also refer to section 2.5 Perioperative Medicine)	CEX/CBD, FEx
3.1.8	Discuss selection of appropriate surgical procedures as day surgery, the choice of anaesthesia technique, perioperative analgesia and discharge criteria in this group of patients (Also refer to section 2.4 Acute Pain Management, and section 2.5 Perioperative Medicine)	CEX/CBD, FEx
3.1.9	Discuss the diagnosis and management of the possible complications of surgical procedures including (also refer to the section 2.6 Trauma, crisis and resuscitation): - Venous air embolism - Rapid, life-threatening bleeding, including management of severe coagulopathy - Aspiration - Cardiovascular responses to insufflation of the peritoneal cavity - Sepsis - Hypo-osmolar syndromes and fluid overload - Reperfusion of ischaemic organs - Acid base imbalance, temperature control, positioning injuries	CEX/CBD, FEx
3.1.10	Describe the provision of anaesthetic care for organ procurement in a donor declared brain dead.	CEX/CBD, FEx

3.2 Anaesthesia for head and neck and Otorhinolaryngology procedures

Learning outcomes		**Assessment**
3.2.1	Describe the anatomy and innervation of the face, external ear, neck, nasal passages, pharynx and larynx with reference to the performance of regional or topical anaesthesia for head, neck or ear nose and throat procedures.	CEX/CBD, FEx
3.2.2	Describe the indications for and features of special tracheal tubes used in ear nose and throat surgery, such as those used for: - Microlaryngeal surgery - Laser surgery - Laryngectomy	CEX/CBD, FEx

3.2.3	Describe the equipment used for emergency and elective jet ventilation.	CEX/CBD, FEx
3.2.4	Outline the physical principles of jet ventilation, and discuss the indications and risks of jet ventilation. Outline how the risks of jet ventilation may be minimized.	CEX/CBD, FEx
3.2.5	Evaluate the use of jet ventilation as a technique for managing the airway and ventilation in patients having ear nose and throat procedures	CEX/CBD, FEx
3.2.6	Describe the nature and biological effects of lasers commonly used in ear nose and throat.	CEX/CBD, FEx
3.2.7	Discuss the precautions, possible complications and implications for anaesthetic management associated with the use of lasers in ear nose and throat surgery.	CEX/CBD, FEx
3.2.8	Describe the common co-morbid disease and patient factors encountered in patients having head, neck and ear nose and throat procedures, and their implications on the anaesthetic management.	CEX/CBD, FEx
3.2.9	Describe the effects of previous surgery or radiation on the airway (also refer to section 2.3 Airway Management)	CEX/CBD, FEx
3.2.10	Discuss the surgical requirements and the anaesthetic management of patients requiring common elective ear nose and throat procedures including: - Septo-rhinoplasty - Functional endoscopic sinus surgery (FESS) - Tonsillectomy and/or adenoidectomy - Microlaryngoscopy - Panendoscopy - Insertion of grommets - Myringoplasty or other middle ear surgery - Mastoidectomy - Laryngectomy or pharyngo-laryngectomy - Parotidectomy - Neck dissection - Tracheostomy	CEX/CBD, FEx
3.2.11	Discuss the surgical requirements and the anaesthetic management of patients requiring emergency ear nose and throat procedures including: - Reduction of fractured nose - Removal of inhaled foreign body	CEX/CBD, FEx

	- Removal of foreign body from the oesophagus or pharynx - Surgical management for obstructing laryngeal lesions (also refer to the section 2.3 Airway Management) - Drainage of oro-pharyngeal cysts or abscess, including quinsy	
3.2.12	Describe the indications for emergency and elective tracheostomy.	CEX/CBD, FEx
3.2.13	Evaluate the anaesthetic options for emergency tracheostomy.	CEX/CBD, FEx
3.2.14	Outline the principles of anaesthetic management for awake tracheostomy.	CEX/CBD, FEx
3.2.15	Discuss the anaesthetic management of patients requiring thyroid or parathyroid surgery. In particular: - Use, effects and complications of thyroid hormones or anti-thyroid drugs used to stabilise patients perioperatively (also refer to the section 2.5 Perioperative Medicine) - The effects and management of hyper and hypocalcaemia - Potential airway management issues and their assessment including in the patient with a retrosternal goitre(also refer to section 2.3 Airway Management) - Surgical positioning and the implications for patient protection and access - Airway, surgical and endocrine complications in the perioperative period and their management - The use of special endotracheal tubes for monitoring recurrent laryngeal nerve function intraoperatively	CEX/CBD, FEx
3.2.16	Discuss the implications of use of local anaesthetics and vasoconstrictive agents in head and neck surgery.	CEX/CBD, FEx
3.2.17	Evaluate the use, safety and methods of providing controlled hypotension to minimise blood loss and improve surgical operating conditions during ear nose and throat, head and neck surgery.	CEX/CBD, FEx
3.2.18	Evaluate methods for the smooth emergence and/or extubation of patients to minimise bleeding following ear nose and throat and head and neck procedures.	CEX/CBD, FEx
3.2.19	Discuss the indications, method and implications for anaesthetic management of facial nerve monitoring intraoperatively.	CEX/CBD, FEx
3.2.20	Discuss the clinical features and management of postoperative haemorrhage following head and neck and ear nose and throat surgery, particularly post tonsillectomy haemorrhage (also refer to section 2.3 Airway Management, section 2.6 Trauma, Crisis and Resuscitation and section 3.4 Paediatric Anaesthesia)	CEX/CBD, FEx

3.2.21	Describe the risks and management of airway fire, and its prevention strategies.	CEX/CBD, FEx

3.3 Anaesthesia for orthopaedic surgery

Learning outcomes		Assessment
Non-traumatic Orthopaedic Procedures		
3.3.1	Discuss the implications of age and comorbidities in the perioperative plan of patients presenting for elective orthopaedic procedures (also refer to section 2.5 Perioperative Medicine and section 3.4 Paediatric Anaesthesia)	CEX/CBD, FEx
3.3.2	Outline the common comorbidities associated with scoliosis and the anaesthetic management of patients having scoliosis correction surgery.	CEX/CBD, FEx
3.3.3	Discuss the choice and timing of antibiotic prophylaxis for orthopaedic patients.	CEX/CBD, FEx
3.3.4	Discuss the use of thrombo-prophylaxis for orthopaedic patients especially joint replacement (also refer to section 2.7 Safety and Quality in Anaesthesia).	CEX/CBD, FEx
3.3.5	Discuss the perioperative management of patients on therapeutic anticoagulation requiring anaesthesia for orthopaedic procedures (also refer to section 2.5 Perioperative Medicine)	CEX/CBD, FEx
3.3.6	Discuss the implications of patients presenting with arthritis (osteoarthritis, rheumatoid arthritis or ankylosing spondylitis) (also refer to section 2.5 Perioperative Medicine).	CEX/CBD, FEx
3.3.7	Discuss the safe use of tourniquets for orthopaedic procedures (also refer to section 2.7 Safety and Quality in Anaesthetia).	CEX/CBD, FEx
3.3.8	Evaluate methods to reduce intra-operative and postoperative blood loss and minimise the need for blood transfusion during or following orthopaedic procedures.	CEX/CBD, FEx
3.3.9	Discuss the implications of the use of the beach-chair position for shoulder surgery.	CEX/CBD, FEx
3.3.10	Describe the methods of spinal cord monitoring during spinal surgery and the implications on anaesthetic management.	CEX/CBD, FEx
3.3.11	Discuss the use of NSAIDs in orthopaedics surgery (also refer to section 2.4 Acute Pain Management).	CEX/CBD, FEx
3.3.12	Discuss the options available for acute and subacute pain	CEX/CBD, FEx

	management following major orthopaedic surgery, with reference to: - Advantages and disadvantages of regional anaesthesia - Advantages and disadvantages of regional analgesia - Therapies to manage persistent post-surgical pain (neuropathic or nociceptive)	
3.3.13	Discuss the management of patients requiring anaesthesia for: - Joint replacement - Arthroscopic procedures - Shoulder surgery - Ligament, peripheral nerve and/or artery repair - Tendon lengthening or transfer - Resection of musculoskeletal tumours - Release of compartment syndrome - Reduction / fixation of dislocated joint, including prosthesis - Drainage / clearance of joint infections - Surgical management of soft tissue infections, such as cellulitis and necrotizing fasciitis - Debridement or limb amputation for vascular insufficiency - Fixation of pathological fractures	CEX/CBD, FEx
3.3.14	Discuss the diagnosis and management of the possible complications of orthopaedic surgery including (also refer to the section 2.6 Trauma, Crisis and Resuscitation): - Cemented implant syndrome - Fat embolism syndrome - Pulmonary embolism - Compartment syndrome - Major blood loss - Neurological injury - Chronic and persistent pain	CEX/CBD, FEx
Orthopaedic Trauma		
3.3.15	Describe the rationale for and outline initial methods of fracture immobilisation and analgesia in patients awaiting definitive surgery for major trauma, including: - Pelvic fractures - Long bone fractures - Spinal fractures	CEX/CBD, FEx
3.3.16	Discuss the initial assessment and management of (also refer	CEX/CBD, FEx

	to section 2.6 Trauma, Crisis and Resuscitation): - Unstable spinal injury including clearing the cervical spine - Acute spinal cord injury and 'neurogenic' shock	
3.3.17	Discuss the management of patients requiring anaesthesia for: - Pelvic fractures - Shoulder girdle fractures - Long bone fractures - Distal limb fractures - Reduction and fixation of spinal fractures	CEX/CBD, FEx
3.3.18	In the trauma patient undergoing orthopaedic surgery, discuss the aetiology, diagnosis and management of the following potential complications: - Cemented implant syndrome - Haemorrhage / Massive transfusion - Crush injury - Compartment syndrome - Re-perfusion injury - Fat embolism syndrome	CEX/CBD, FEx
3.3.19	Outline the implication of neuro-vascular compromise of a limb or compound fractures for timing of surgery.	CEX/CBD, FEx
3.3.20	Discuss the assessment and anaesthetic management of the elderly patient with a hip fracture.	CEX/CBD, FEx
3.3.21	Describe the indicators of non-accidental injury and outline an appropriate course of action when non-accidental injury is suspected.	CEX/CBD, FEx
3.3.22	Evaluate the selection and use of thrombo-prophylaxis and antibiotic prophylaxis in orthopaedic trauma surgery.	CEX/CBD, FEx
3.2.23	Discuss the diagnosis and prevention of chronic pain in musculo-skeletal trauma.	CEX/CBD, FEx

3.4 Paediatric anaesthesia

Learning outcomes		**Assessment**
Paediatric Airway and Ventilation Management		
3.4.3	Describe common airway equipment, including - Endotracheal tube (ETT): estimation of size and depth of insertion based on age, and rationales for use of non-cuffed	CEX/CBD, FEx

	versus cuffed tubes - Supraglottic airways, including different forms of laryngeal masks - Straight versus curved laryngoscopy blades - Oral airways: estimation of size based on age - Breathing circuits: Structure and function of the T-piece, and its advantages and disadvantages compared to circle system	
3.4.4	Describe the clinical features associated with difficult airway in paediatric patients, e.g. Pierre Robin, mucopolysaccharidoses etc.	CEX/CBD, FEx
3.4.5	Discuss the clinical features and management of upper airway obstruction, e.g. laryngospasm, acute epiglottitis, laryngomalacia etc.	CEX/CBD, FEx
3.4.6	Describe a technique for fibreoptic intubation in children.	CEX/CBD, FEx
3.4.7	Discuss the principles of mechanical ventilation in paediatric patients, including selection of appropriate modes of ventilation, normal volumes and pressures and the role of PEEP.	CEX/CBD, FEx
3.4.8	Discuss the sources of errors and limitations of pressure, flow and capnography monitoring during mechanical ventilation in neonates.	CEX/CBD, FEx
Paediatric Pain Management		
3.4.9	Discuss the principles of assessing acute pain in children and use of paediatric pain scales.	CEX/CBD, FEx
3.4.10	Discuss the clinical pharmacology of paracetamol and non-steroidal antiinflammatroy drugs with particular reference to the paediatric population.	CEX/CBD, FEx
3.4.11	Discuss the factors which influence the choice of mode of delivery of parenteral opioids in acute pain management (patient controlled analgesia, continuous infusion and “as required” prescription) and the choices of regional techniques in children.	CEX/CBD, FEx
Perioperative Medicine		
3.4.15	Describe vital signs for children of different ages.	CEX/CBD, FEx
3.4.16	Discuss important medical conditions that may have implications on anaesthetic management: e.g. - Prematurity and ex-premature infants - Congenital syndromes, such as Down’s syndrome - Muscular dystrophies	CEX/CBD, FEx

	- Congenital heart disease, including shunts, Fontan, Tetralogy of Fallot - Cerebral Palsy	
General Anaesthesia and Sedation in Paediatric Patients		
3.4.17	Discuss the specific concerns during preop assessment in relation to paediatric patients presenting for anaesthesia and surgery.	CEX/CBD, FEx
3.4.18	Describe assessment and management of a child with URTI or other intercurrent medical illness in preoperative period.	CEX/CBD, FEx
3.4.19	Describe the management of a child with a murmur.	CEX/CBD, FEx
3.4.20	Outline the roles of premedications in children and neonates.	CEX/CBD, FEx
3.4.21	Describe the methods to reduce anxiety of children and the pros and cons of parental presence during induction of anaesthesia in children.	CEX/CBD, FEx
3.4.22	Discuss the pros and cons of inhalational induction versus Intravenous induction in paediatric patients.	CEX/CBD, FEx
3.4.23	Discuss the use of Total Intravenous Anaesthesia (TIVA) and Target Controlled Infusions (TCI) in children.	CEX/CBD, FEx
3.4.24	Discuss the effects of anaesthesia on the developing brain.	CEX/CBD, FEx
2.4.25	Discuss the intraoperative fluid management in children undergoing various operations.	CEX/CBD, FEx
3.4.26	Discuss the anaesthetic management of children requiring shared airway procedure, e.g. cleft lip and palate, laryngoscopy, oesophagoscopy, removal of airway foreign body.	CEX/CBD, FEx
3.4.27	Discuss anaesthetic management of children in neurosurgical procedures, e.g. burr hole, tumour excision	CEX/CBD, FEx
3.4.28	Discuss principles of anaesthetic management of children undergoing major abdominal surgery, e.g. necrotising enterocolitis operations for neonates.	CEX/CBD, FEx
3.4.29	Discuss requirements for postoperative monitoring in neonates and ex-premature infants.	CEX/CBD, FEx
Regional Anaesthesia in Paediatric Patients		
3.4.30	For commonly performed regional anaesthesia techniques for paediatric patients, such as ilioinguinal block, penile block, and caudal block: - Describe the anatomy relevant to block performance and	CEX/CBD, DOPS, FEx

	complications. - Discuss the indications and contraindications, risks and benefits. - Describe the positioning, anatomical landmarks and insertion techniques and ways to minimize complications.	
Resuscitation, Trauma and Crisis Management in Paediatric Patients		
3.4.31	Describe assessment of hydration status, blood loss and clinical features of critically ill child and principles of management.	CEX/CBD, FEx
3.4.32	Outline approach to obtaining vascular access in the shocked paediatric patients.	CEX/CBD, FEx
3.4.33	Discuss the diagnosis and resuscitative management of children with the life threatening conditions : e.g. - Cardiac arrest - Respiratory arrest - Shock - Severe bronchospasm - Coagulopathy with active bleeding	CEX/CBD, FEx
3.4.34	Describe the principles of safe intra- and inter-hospital transport of critically ill neonates and children.	CEX/CBD, FEx
3.4.35	Demonstrate advanced life support in neonates and children consistent with PALS.	CEX/CBD, DOPS, FEx

3.5 Obstetric Anaesthesia and Analgesia

Learning outcomes		**Assessment**
Basic Sciences Underpinning Obstetrics Anaesthesia		
3.5.42	Outline the basic and advanced life support of a newborn.	FEx
3.4.43	Outline the care of the newborn after delivery.	FEx
Clinical Obstetric Anaesthesia		
3.5.12	Describe the pre-anaesthetic assessment of a pregnant woman.	CEX/CBD, FEx
3.5.13	Describe the role of acid prophylaxis in pregnant women undergoing surgery.	CEX/CBD, FEx

3.5.14	Describe the anaesthetic management of early pregnancy conditions such as molar pregnancy, termination, ectopic pregnancy, miscarriage and septic abortion.	CEX/CBD, FEx
3.5.15	Describe the mechanisms and progress of normal labour.	CEX/CBD, FEx
3.5.16	Describe the clinical methods used for foetal monitoring in labour.	CEX/CBD, FEx
2.5.17	Evaluate the analgesic options for labour and delivery.	CEX/CBD, FEx
3.5.18	Discuss the management of suboptimal epidural block during labour.	CEX/CBD, FEx
3.5.19	Describe the selection of agents and route of administration in providing neuraxial analgesia for labour and delivery.	CEX/CBD, FEx
3.5.20	Evaluate the role of epidural, spinal, and combined spinal epidural techniques for caesarean birth.	CEX/CBD, FEx
3.5.21	Discuss the role of combined spinal epidural analgesia in labour.	CEX/CBD, FEx
3.5.22	Describe the urgency of emergency delivery with regard to the threat to maternal or foetal wellbeing.	CEX/CBD, FEx
3.5.23	Evaluate methods to treat hypotension associated with neuraxial blockade for caesarean birth.	CEX/CBD, FEx
3.5.24	Discuss the management of significant complications of neuraxial analgesia and anaesthesia in childbirth, for example: - Post-dural puncture headache - Total spinal	CEX/CBD, FEx
3.5.25	Discuss the management of suboptimal block including conversion to general anaesthesia for caesarean birth.	CEX/CBD, FEx
3.5.26	Outline the difficult airway algorithm for obstetrics patients, and evaluate its application in the local institutional settings.	CEX/CBD, FEx
3.5.27	Evaluate the role of, options for and particular problems with providing general anaesthesia for elective and emergency caesarean birth.	CEX/CBD, FEx
3.5.28	Describe the prevention of venous thromboembolism in the pregnant woman.	CEX/CBD, FEx
3.5.29	Evaluate methods for providing postoperative analgesia after caesarean birth.	CEX/CBD, FEx
3.5.30	Discuss the anaesthetic management of problems that may arise with labour and delivery, including the following situations: - Vaginal birth after caesarean (VBAC) - Uterine rupture	CEX/CBD, FEx

	- Multiple gestation - Breech - Assisted vaginal birth - Premature labour - Cord prolapse - Abnormal placental implantation - Antepartum haemorrhage - Post partum haemorrhage - Shoulder dystocia - Foetal death in utero	
3.5.31	Discuss the pathophysiology and anaesthetic management of the following medical conditions particular to pregnancy: - Hypertensive disorders of pregnancy/preeclampsia - HELLP syndrome - Eclampsia - Peripartum cardiomyopathy - Gestational diabetes - Acute fatty liver of pregnancy - Cholestasis associated with pregnancy - Rhesus iso immunisation	CEX/CBD, FEx
3.5.32	Discuss the pathophysiology and anaesthetic management of co-existing maternal conditions, such as: - Morbid obesity - Cardiac disease - Intracranial pathology - Substance abuse - Psychiatric condition	CEX/CBD, FEx
3.5.33	Discuss the implications of drugs modifying haemostasis on the provision of neuraxial blockade in pregnancy.	CEX/CBD, FEx
3.534	Discuss the differences in basic and advanced life support in the pregnant woman.	CEX/CBD, FEx
3.5.35	Discuss the diagnosis and management of maternal collapse, including: - Thromboembolism - Amniotic fluid embolism - Air embolism - Anaphylaxis - Local anaesthetic toxicity - High spinal	CEX/CBD, FEx

	- Massive haemorrhage - Eclampsia	
3.5.36	Discuss the diagnosis and management of neurological deficits in women after neuraxial blockade and delivery.	CEX/CBD, FEx
3.5.37	Discuss intrauterine resuscitation of the at-risk foetus.	CEX/CBD, FEx
3.5.38	Describe the unique aspects of management of resuscitation of the pregnant trauma patient including: - Optimally positioning to avoid aorto-caval compression - Altered maternal physiological responses - Maternal resuscitation as the first priority, representing best care of both the woman and the foetus - The need for early obstetric involvement and foetal monitoring - High possibility of placental abruption and uterine rupture - The need to give Rh immunoglobulin therapy to all Rhesus negative mothers - The place of perimortem caesarean birth - The clinical indicators and subsequent management implications of non-accidental injury in pregnancy	CEX/CBD, FEx
3.5.39	Discuss the unique aspects of management of anaesthesia for the pregnant woman having non-obstetric surgery.	CEX/CBD, FEx
3.5.40	Discuss the anaesthesia for management of postpartum complications.	CEX/CBD, FEx

3.6 Neuroanaesthesia

Learning outcomes		**Assessment**
Basic Sciences Underpinning Neuroanaesthesia		
Anatomy		
3.6.1	Describe the basic anatomy of the skull, brain, ventricular system, meninges, spinal cord and vertebral column of relevance to anaesthesia.	FEx
3.6.2	Describe the blood supply of the brain and spinal cord.	FEx
3.6.3	Describe the anatomy relevant to providing local anaesthesia for awake craniotomy.	FEx

Pathophysiology		
3.6.4	Outline the changes to cerebral blood flow and cerebral perfusion pressure in patients with intracranial pathology.	FEx
3.6.5	Explain the effect of fluid and electrolyte disturbances on brain function.	FEx
3.6.6	Outline the grading of subarachnoid haemorrhage severity.	FEx
3.6.7	Outline the radiological features of common acute neurosurgical conditions.	FEx
3.6.8	Discuss pharmacologic and non-pharmacologic methods to manipulate intracranial pressure.	FEx
3.6.9	Outline methods to reduce secondary injury and limit disability in traumatic brain injury and intracranial haemorrhage.	FEx
3.6.10	Describe the anaesthetic implications of spinal cord trauma.	FEx
3.6.11	Discuss the pathophysiology of pituitary tumours, including the implications of endocrine disorders such as acromegaly, Cushing's syndrome, pan-hypopituitarism.	FEx
3.6.12	Describe the mechanism and management of disorders of sodium control detected after neurosurgery.	FEx
3.6.13	Outline the criteria for the diagnosis of brain stem death.	FEx
Pharmacology		
3.6.14	Evaluate the effects of anaesthetic agents on brain and spinal cord physiology including metabolism, blood flow, intracranial and intraspinal pressure.	IEx, FEx
3.6.15	Discuss the possible complications of sedative/hypnotic and analgesic agents in neurosurgical patients.	FEx
3.6.16	Describe the pharmacology of drugs used to treat intracranial hypertension.	IEx, FEx
3.6.17	Describe the pharmacology and clinical utility of antiepileptic and prophylactic therapy in neurosurgical patients.	IEx, FEx
3.6.18	Describe the pharmacology and clinical utility of corticosteroids in neurosurgical patients.	FEx
3.6.19	Discuss the pharmacology and clinical utility of pharmacological agents for prophylaxis and treatment of cerebral vasospasm associated with subarachnoid haemorrhage.	IEx, FEx
Neuro-monitoring		

3.6.20	Discuss methods to monitor cerebral blood flow including transcranial Doppler.	CEX/CBD, FEx
3.6.21	Describe methods of intracranial pressure monitoring.	CEX/CBD, FEx
3.6.22	Outline the principles of electrophysiological monitoring including Electroencephalogram (EEG) / Sensory and Motor Evoked Potentials (SSEP and MEP) and the implications on anaesthesia management.	CEX/CBD, FEx
Clinical Neuroanaesthesia		
3.6.23	Discuss the implications for anaesthesia of the positions used for neurosurgery.	CEX/CBD, FEx
3.6.24	Discuss the risks associated with patient positioning for neurosurgical procedures and the methods of risk minimization.	CEX/CBD, FEx
3.6.25	Describe the typical presentation and natural history of the different types of intracranial haemorrhage.	CEX/CBD, FEx
3.6.26	Discuss the acute resuscitation and management of patients with intracranial/subarachnoid haemorrhage (also refer to section 2.6 Trauma, Crisis and Resuscitation, and section 3.13 Intensive Care Medicine).	CEX/CBD, FEx
3.6.27	Discuss the anaesthetic management of patients requiring the following neurosurgical procedures: - Craniotomy for intracranial tumour - Craniotomy for intracranial aneurysm or haemorrhage (acute and chronic) - Interventional neuroradiology for acute intracranial bleed - Interventional neuroradiology for stable intracranial vascular pathology - Spinal surgery (cervical, thoracic, lumbar) - Spinal fluid shunt procedures - Insertion of intracranial pressure monitors	CEX/CBD, FEx
3.6.28	Discuss the anaesthetic management of patients requiring intervention for the following: - Non-neurosurgical trauma in patients with concurrent traumatic brain injury - Traumatic brain injury - Intracranial vascular malformations - Vestibular schwannoma - Trigeminal neuralgia - Pituitary tumours - Epilepsy and movement disorders (including awake craniotomy	CEX/CBD, FEx

	and deep brain stimulation) - Meningomyelocoele - Cranial vault pathology	
3.6.29	Discuss the complications of neurosurgical procedures including: - Air embolism - Rapid, life threatening bleeding - Cerebral ischaemia - Cerebral edema	CEX/CBD, FEx
Skills		
3.6.30	Assess level of consciousness according to Glasgow Coma Score	CEX/CBD, DOPS, FEx
3.6.31	Perform a basic neurological examination for assessment of neurological deficits	CEX/CBD, DOPS, FEx
3.6.32	Manage a patient with a suspected unstable cervical spine	CEX/CBD, DOPS, FEx

3.7 Ophthalmic Anaesthesia

Learning outcomes		**Assessment**
3.7.1	Describe the anatomy of the eye and the contents of the orbit with reference to the performance of regional eye blocks and their complications.	FEx
3.7.2	Describe the determinants of ocular perfusion and intra-ocular pressure.	FEx
3.7.3	Describe the eye reflexes (oculo-cardiac, oculo-respiratory, oculo-emetic) and their management during eye procedures.	FEx
3.7.4	Discuss the selection of local anaesthetic solutions for regional and topical eye blocks.	FEx
3.7.5	Discuss the use of adjuvant drugs for regional eye blocks and in particular Hyaluronidase.	FEx
3.7.6	Outline the anaesthetic implications of the perioperative use of drugs by eye surgeons; in particular topical local anaesthetic agents, vasoconstrictors, mydriatics, miotics, and intraocular pressure-reducing agents.	CEX/CBD, FEx
3.7.7	Describe the common co-morbid disease and patient factors	CEX/CBD, FEx

	encountered in patients having ophthalmic procedures.	
3.7.8	Discuss the surgical requirements and implications for anaesthetic management of patients having surgery for: - Cataracts - Glaucoma - Retinal detachment - Penetrating eye injury - Enucleation for infection or tumour - Examination under anaesthesia - Strabismus - Blocked nasolacrimal duct - Extraocular procedures	CEX/CBD, FEx
3.7.9	Discuss the specific anaesthetic requirements for emergency eye surgery and in particular the patient with a penetrating eye injury.	CEX/CBD, FEx
3.7.10	Discuss the implications for anaesthesia of the intra-ocular injection of gas.	CEX/CBD, FEx
3.7.11	Describe and compare regional blocks used for eye procedures, their possible complications and management including: - Subtenon block - Peri-bulbar block - Retrobulbar block	FEx
3.7.12	Describe the methods used to decrease or prevent a rise in intra-ocular pressure following a peri-bulbar block.	FEx
3.7.13	Discuss how patient factors and co-morbid conditions influence choice of anaesthesia for eye surgery in particular: - Anticoagulation status - Ability to lie flat - Ability to cooperate - Axial length of the globe	CEX/CBD, FEx
3.7.14	Outline the issues to be considered in providing appropriate pre-operative care for patients having eye surgery.	CEX/CBD, FEx
3.7.15	Describe sedation techniques for eye procedures.	CEX/CBD, FEx
3.7.16	Discuss strategies to convert from regional to general anaesthesia during an eye procedure.	CEX/CBD, FEx
3.7.17	Describe the patient and staff precautions required when using laser during eye surgery.	CEX/CBD, FEx

3.8 Anaesthesia outside operating theatre

Learning outcomes		Assessment
General Principles on Remote Anaesthesia		
3.8.19	Discuss the various techniques of anaesthesia or sedation for adults and children for procedures or operations, outside operating theatre but within a hospital setting, either: - Diagnostic or therapeutic - Elective or emergency	CEX/CBD, FEx
3.8.20	Discuss the indications and contraindications of sedation for patients in the non-theatre environment.	CEX/CBD, FEx
3.8.21	Discuss the unique concerns and safety precautions required in specific peripheral environment.	CEX/CBD, FEx
3.8.22	Describe the diagnosis and management of the possible complications of remote procedures, including: - Airway emergency - Allergy and anaphylaxis - Aspiration - Cardiac arrest - Rapid, life-threatening bleeding, including management of coagulopathy - Venous air embolism	CEX/CBD, FEx
Knowledge and Skill Related to Specific Remote Procedures		
Endoscopic Procedures (OGD, ERCP)		
3.8.23	Discuss the concerns and implications for anaesthetic management of patients undergoing endoscopic procedures.	CEX/CBD, FEx
3.8.24	Describe the diagnosis and management of complications including aspiration and loss of airway.	CEX/CBD, FEx
Electroconvulsive Therapy (ECT)		
3.8.25	Discuss the considerations on legal requirements and ethical issues involved in anaesthetizing patients for ECT.	CEX/CBD, FEx
3.8.26	Describe the specific physical and physiological effects of ECT.	CEX/CBD, FEx

3.8.27 Discuss the rationale behind the choice of anaesthetic technique for ECT.	CEX/CBD, FEx
Medical Imaging Procedures (CT, MRI)	
3.8.28 Describe the specific equipment requirements and precautions for MRI.	CEX/CBD, FEx
3.8.29 Discuss the anaesthetic concerns and various techniques for child undergoing medical imaging procedures.	CEX/CBD, FEx
3.8.30 Discuss the complications related to CT including radiation hazards and contrast induced nephropathy.	CEX/CBD, FEx
Interventional Radiological Procedures	
3.8.31 Describe common interventional procedures and their pathophysiological consequences.	CEX/CBD, FEx
3.8.32 Discuss the advantages and disadvantages of interventional radiological procedures as compared with open procedures.	CEX/CBD, FEx
3.8.33 Describe the diagnosis and management of complications including contrast allergy and acute renal impairment.	CEX/CBD, FEx
Interventional Neuro-radiological Procedures	
3.8.34 Discuss the principles of anaesthetic management in patients with neurological problems undergoing interventional neuro-radiological procedures.	CEX/CBD, FEx
3.8.35 Discuss the advantages and disadvantages of interventional neuro-radiological procedures as compared with open procedures.	CEX/CBD, FEx
3.8.36 Describe the diagnosis and management of complications including air embolism, intracranial bleeding and cerebral ischaemia.	CEX/CBD, FEx

3.9 Anaesthesia for Cardiac Surgery and Interventional Cardiology

Learning outcomes	**Assessment**
Cardiac Surgery	

Preoperative Anaesthesia Concerns		
3.9.32	Obtain informed consent, explain procedure, risks and benefits, alternatives available and perioperative care plan from an anaesthetist's stand point.	CEX/CBD, FEx
3.9.33	Describe appropriate strategies (pharmacologic and non-pharmacologic) to relieve anxiety in patients presenting for cardiac surgery.	CEX/CBD, FEx
3.9.34	Discuss the perioperative assessment of - Myocardial ischaemia - Cardiac rhythm - Filling status - Left ventricular systolic and diastolic function - Right ventricular function and pulmonary artery pressure - Valve pathology - Shunts	CEX/CBD, FEx
3.9.35	Describe the initial medical management of acute thoracic aortic dissection.	CEX/CBD, FEx
Intraoperative Management		
3.9.36	Describe the appropriate anaesthetic technique including appropriate monitoring of various body function for the following cardiac surgical procedures: - Coronary artery bypass - Aortic and mitral valve surgery - Acute thoracic aortic dissection - 'Redo' cardiac surgery	CEX/CBD, FEx
3.9.37	Outline the basic surgical steps for: - Coronary artery bypass - Aortic and mitral valve surgery - Repair of aortic dissection - 'Redo' cardiac surgery	CEX/CBD, FEx
3.9.38	Describe issues related to the care of patients undergoing cardiopulmonary bypass: - Anticoagulation: drug, dose, monitoring (point-of-care and	CEX/CBD, FEx

	laboratory methods) - Maintenance of anaesthesia during cardiopulmonary bypass - Basic knowledge of the components of extracorporeal circuit - Monitoring during cardiopulmonary bypass - Techniques of intraoperative organ protection, in particular the heart, brain and spinal cord - Reperfusion injury and ischaemic preconditioning - Techniques and implication of cooling and rewarming including deep hypothermic circulatory arrest - Acid base management during bypass - Implications of aortic disease for aortic cannulation - Potential neurocognitive complication of cardiac surgery and cerebral protection - Haematological and inflammatory effects of cardiopulmonary bypass - Use of antifibrinolytics - Weaning from cardiopulmonary bypass - Reversal of anticoagulation, protamine dosage, administration and protamine reaction	
3.9.39	Outline strategies for management of patients difficult to wean from cardiopulmonary bypass, including: - Use of pharmacologic agents: inotropes, dilators, constrictors - Intra-aortic balloon pump and its principles - Mechanical circulatory support	CEX/CBD, FEx
Defibrillation and Cardiac Pacing		
3.9.40	State the indications for application of external defibrillation/pacing pads prior to surgery/ interventional procedure.	CEX/CBD, FEx
3.9.41	Describe the use of internal defibrillation.	CEX/CBD, FEx
3.9.42	Describe the types of cardiac pacing including transvenous, external and epicardial pacing.	CEX/CBD, FEx
3.9.43	Outline principles of perioperative programming of cardiac pacemakers.	CEX/CBD, FEx
3.9.44	Outline pacing modes, terminology and abbreviation commonly used.	CEX/CBD, FEx

Cardiac Output Monitoring		
3.9.45	Outline the measurement of cardiac output by various techniques.	CEX/CBD, FEx
3.9.46	Describe insertion of a pulmonary artery catheter, describe and interpret the waveforms (also refer to the section 3.13 Intensive Care Medcine).	CEX/CBD, FEx
3.9.47	Discuss interpretation of data obtained from PAC and other cardiac output measurement devices.	CEX/CBD, FEx
Echocardiography		
3.9.48	Discuss the role of echocardiography in assessing the haemodynamic unstable patient.	CEX/CBD, FEx
3.9.49	Outline a basic haemodynamic assessment through echocardiography.	CEX/CBD, FEx
3.9.50	Discuss the role of echocardiography in the cardiac surgical patient.	CEX/CBD, FEx
3.9.51	Describe the indications and contraindications of Trasesophageal echocardiography (TEE) in the cardiac and non-cardiac surgical settings.	CEX/CBD, FEx
3.9.52	Outline the indications for cardiopulmonary bypass and ECMO in non-cardiac surgical procedures.	CEX/CBD, FEx
Postoperative Care		
3.9.53	Describe the routine and emergent postoperative management of cardiac surgical patients in the intensive care unit.	CEX/CBD, FEx
3.9.54	Outline the common complications that present in the early postoperative period in cardiac surgical patients and their management, with special emphasis on the excessive bleeding patient and cardiac tamponade.	CEX/CBD, FEx
3.9.55	Discuss factors that influence duration of postoperative ventilation following cardiac surgery.	CEX/CBD, FEx
3.9.56	Discuss 'fast-track cardiac surgery', its suitability and the appropriate	CEX/CBD, FEx

	modifications to anaesthetic management that it entails.	
Interventional Cardiology		
3.9.57	Demonstrate understanding of conditions that are amendable to interventional cardiology procedures, and the related issues, e.g. remote location, radiation hazards, rapid haemodynamic fluctuation.	CEX/CBD, FEx
3.9.58	Describe the surgical/ interventional principles involved in common cardiology procedures including: - Pacemaker and AICD insertion/ removal - Electrophysiology studies: radiofrequency and cryoablation for arrhythmias - Insertion of percutaneous cardiac devices	CEX/CBD, FEx
3.9.59	Outline the major complications associated with interventional cardiology procedures, their presenting features and management.	CEX/CBD, FEx

3.10 Anaesthesia for Thoracic Surgery

Learning outcomes		**Assessment**
Basic Science Underpinning Thoracic Anaesthesia		
3.10.33	Describe the anatomy of: - Tracheobronchial tree including bronchoscopic anatomy to level of lobar bronchi - Lung lobes and segments including common variations that may occur in these structures - Thorax, including the pleura and its surface anatomy - Innervation of the chest wall of relevance to the performance of regional blockade for thoracic surgery and chest trauma	FEx
3.10.34	Describe the changes in respiratory physiology and the implications for anaesthetic management which occur with: - Lateral decubitus positioning - Open thorax - One lung ventilation	FEx
3.10.35	Discuss the physiology of hypoxic pulmonary vasoconstriction, including the effects of anaesthetic agents and its anaesthetic	FEx

	implications.	
3.10.36	Discuss the pathophysiology of chronic obstructive pulmonary disease and the strategies available to minimize gas trapping.	FEx
Pre-operative Assessment		
3.10.37	Discuss the assessment of perioperative risk prior to lobectomy and pneumonectomy including assessment of: - Respiratory mechanics - Cardiopulmonary reserve - Lung parenchymal functions - Methods for prediction of postoperative lung functions	CEX/CBD, FEx
3.10.38	Discuss the perioperative management of patients with Myasthenia Gravis presented for thymectomy.	CEX/CBD, FEx
3.10.39	Discuss the assessment of patients with mediastinal masses for surgical procedures, including the assessment of severity of vascular and respiratory obstruction and their anaesthetic implications.	CEX/CBD, FEx
Anaesthesia for Thoracic Surgery		
3.10.40	Describe the techniques used to position for thoracic surgery and to minimize risk of post-operative position-related injuries.	CEX/CBD, FEx
3.10.41	Describe the indications and contraindications for one-lung ventilation.	CEX/CBD, FEx
3.10.42	Describe the different methods available (both for adult and pediatrics) and their rationale to perform lung isolation including the use of: - Double-lumen tubes - Bronchial blockers - Univent tubes	CEX/CBD, FEx
3.10.43	Discuss the complications of double lumen tubes and the management of intra-operative problems associated with their use.	CEX/CBD, FEx
3.10.44	Outline a strategy for lung isolation in a patient with difficult airway or a tracheostomy in-situ.	CEX/CBD, FEx

3.10.45	Discuss the management of hypoxemia during one-lung ventilation.	CEX/CBD, FEx
3.10.46	Discuss the different options of ventilation (including jet ventilation) available for thoracic surgery.	CEX/CBD, FEx
3.10.47	Discuss the anaesthetic management of the following endobronchial procedures. - Diagnostic flexible and rigid bronchoscopy - Bronchoalveolar lavage - Bronchoscopic ultrasound and biopsy - Placement of tracheal and endobronchial stent - Removal of foreign body in airway - Laser excision of endobronchial tumor	CEX/CBD, FEx
3.10.48	Discuss the anaesthetic management of the following thoracic procedures. - Surgery for mediastinal mass - Thymectomy - Mediastinoscopy - Pleurodesis - Lung resection, including wedge excision, segmentectomy, lobectomy and pneumonectomy - Repair of bronchopleural fistula - Drainage of lung abscess - Drainage of empyema and decortication of lung - Bullectomy - Lung volume reduction surgery - Thoracoscopic sympathectomy	CEX/CBD, FEx
3.10.49	Discuss the specific issues for peri-operative management of patients for pneumonectomy.	CEX/CBD, FEx
3.10.50	Identify fluid management issues specific to thoracic surgery and discuss fluid management of the patient having lung resection.	CEX/CBD, FEx
3.10.51	Identify pain management issues specific to thoracic surgery and discuss analgesic options for patients having thoracic surgery.	CEX/CBD, FEx
3.10.52	Discuss the management of pleural drainage systems in the post-operative period.	CEX/CBD, FEx

3.10.53	Outline the critical times during thoracic procedures that will impact on anaesthetic management, including airway ligation and manipulation of pulmonary vasculature.	CEX/CBD, FEx
3.10.54	Outline the management of the following post-operative complications associated with thoracic surgery: - Bleeding - Pneumothorax/tension pneumothorax - Arrhythmia - Bronchopleural fistulae - Nerve damage - Pulmonary torsion - Cardiac herniation	CEX/CBD, FEx
Management for Chest Trauma		
3.10.55	Briefly discuss the diagnosis and management of chest trauma, including: - Pneumothorax/tension pneumothorax - Hemothorax - Flail chest - Rib/sternal fractures - Pulmonary contusion - Major airway injury - Major vascular injury e.g. traumatic aortic disruption	CEX/CBD, FEx
3.10.56	Outline the indications for thoracotomy in the management of chest trauma.	CEX/CBD, FEx
3.10.57	Outline the methods for cardiopulmonary resuscitation during cardiac arrest in the management of chest trauma.	CEX/CBD, FEx
3.10.58	Discuss methods of analgesia for rib/sternal fractures.	CEX/CBD, FEx
3.10.59	Discuss the management of respiratory failure associated with chest trauma and the place of non-invasive ventilation.	CEX/CBD, FEx
3.10.60	Discuss the management of chest drains and pleural drainage systems for thoracic trauma.	CEX/CBD, FEx
Skills		

3.10.30	Insert an appropriate double lumen tube (size, left versus right) for lung isolation, and confirm its position both clinically and fibreoptically	DOPS, FEx
3.10.31	Demonstrate the setup for anesthesia for rigid bronchoscopy including methods of delivery of anesthetic drugs and ventilation	DOPS, FEx

3.11 Anaesthesia for Vascular Surgery

Learning outcomes		Assessment
Pre-operative Assessment		
3.11.23	Outline the pathophysiology of peripheral vascular disease including common co-morbidities.	CEX/CBD, FEx
3.11.24	Discuss the pharmacological adjuncts used in vascular surgery.	CEX/CBD, FEx
3.11.25	Discuss the perioperative management of the following comorbidities in the patient presenting for vascular surgery including perioperative risk assessment and risk reduction (also refer to section 2.5 Perioperative Medicine): - Ischaemic heart disease - Cardiac failure - Arrhythmia - Hypertension - Diabetes mellitus - Chronic obstructive airways disease - Renal failure	CEX/CBD, FEx
3.11.26	Describe the impact of vascular disease on: - Wound dehiscence and infection - Positioning injury - Perioperative myocardial ischaemia - Perioperative stroke - Perioperative renal failure	CEX/CBD, FEx
Anaesthesia for Vascular Surgery		
3.11.27	Discuss the surgical requirements and implications for anaesthetic	CEX/CBD, FEx

	management of patients having elective surgery for: - Peripheral arterial occlusive disease - Carotid artery stenosis - Aortic and aorto-iliac disease - Vascular access for haemodialysis - Thorascopic sympathectomy	
3.11.28	Discuss options for postoperative analgesia and perioperative fluid therapy for these procedures.	CEX/CBD, FEx
3.11.29	Evaluate the risks and benefits of regional anaesthesia and analgesia in vascular surgery.	CEX/CBD, FEx
3.11.30	Discuss the perioperative management, including postoperative analgesia and perioperative fluid management of patients having an emergency vascular procedure for the following: - Ruptured aortic aneurysm - Aortic dissection - Major vessel occlusion - Limb ischaemia - Limb amputation - Arterial laceration	CEX/CBD, FEx
3.11.31	Describe the pathophysiology and implications for anaesthesia management of: - Aortic cross clamping and unclamping at various levels - Prolonged limb or gut ischaemia - Carotid clamping and unclamping	CEX/CBD, FEx
3.11.32	Discuss the prevention, diagnosis and management of intraoperative complications associated with vascular surgery including: - Major haemorrhage - Bradycardia associated with carotid artery surgery - Cerebral ischaemia associated with carotid artery clamping - Reperfusion syndromes - Spinal cord ischaemia - Acute renal impairment - Myocardial ischaemia - Acute arrhythmia - Stroke	CEX/CBD, FEx

- Thromboembolism	
3.11.33 Discuss strategies for spinal cord protection in aortic surgery.	CEX/CBD, FEx
3.11.34 Discuss the diagnosis and management of postoperative complications associated with vascular surgery including: - Haemorrhage - Perioperative stroke - Myocardial ischaemia - Limb ischaemia - Rhabdomyolysis - Post-amputation pain	CEX/CBD, FEx
3.11.35 Discuss techniques used to monitor cerebral perfusion during carotid endarterectomy.	CEX/CBD, FEx
3.11.36 Describe techniques for performing carotid endarterectomy under regional anaesthesia and evaluate the role of regional anaesthesia for carotid endarterectomy.	CEX/CBD, FEx
3.11.37 Discuss post-operative complications specifically associated with carotid endarterectomy and discuss their management.	CEX/CBD, FEx
Anaesthesia for Interventional Vascular Procedures	
3.11.38 Outline the implications for patient safety of the location of the interventional radiology service.	CEX/CBD, FEx
3.11.39 Discuss the pathophysiology of contrast-induced nephropathy and measures of peri-operative renal protection.	CEX/CBD, FEx
3.11.40 Discuss the procedural requirements and implications for anaesthetic management of patients having interventional radiological procedures including: - Vascular embolization - Vascular stenting - Insertion of intravascular devices including aortic grafts	CEX/CBD, FEx
3.11.41 Discuss the diagnosis and management of complications associated with interventional radiological procedures including: - Reaction to intravenous contrast - Aortic occlusion	CEX/CBD, FEx

	- Acute renal impairment - Spinal cord ischaemia - High radiation dose - Haemorrhage	
3.11.42	Outline the advantages and disadvantages of interventional radiological procedures as compared with open procedures for management of: - Aortic aneurysm - Aortic dissection - Emergency leaking aortic aneurysm - Carotid artery stenosis	CEX/CBD, FEx

3.12 Pain Medicine

Learning outcomes		Assessment
Knowledge		
3.12.9	Outline the principles of the assessment and management of chronic pain in a multi-disciplinary team setting.	CEX/CBD, FEx
3.12.10	Discuss the importance of psychological and social factors in the presentation and management of pain including but not limited to: - Anxiety - Depression - Placebo effect - Active and passive coping strategies - Illness behavior - Compensation and third party issues	CEX/CBD, FEx
3.12.11	Formulate a pain management plan for patients with complex pain problems demonstrating integrated knowledge of the interaction of analgesic agents, patient factors and the aetiology of pain.	CEX/CBD, FEx
3.12.12	Describe the place of common neurolytic blocks and interventions in the management of chronic pain such as - Stellate ganglion block - Coeliac plexus block - Lumbar sympathetic block	CEX/CBD, FEx

- Epidural steroid injection	
3.12.13 Describe the management of back pain. - Able to identify red flag and yellow flag signs - Common pharmacological and non-pharmacological methods	CEX/CBD, FEx
3.12.14 Outline pain management strategies for patients requiring palliative care.	CEX/CBD, FEx
3.12.15 Outline the pain management of common chronic pain conditions, for example, headache, neuropathic pain conditions and persistent post-surgical pain.	CEX/CBD, FEx
Skills	
3.12.16 Assessment of a patient with chronic pain condition and formulate a management plan.	CEX/CBD, FEx

3.13 Intensive Care Medicine

Learning outcomes	**Assessment**
General Care of the Patient in Intensive Care Medicine	
3.13.124 Discuss the importance of setting therapeutic goals for admission to intensive care.	CEX/CBD, FEx
3.13.125 Outline estimation of nutritional requirements and prescribe nutritional support.	CEX/CBD, FEx
3.13.126 Outline the complications associated with enteral and parenteral nutritional support.	CEX/CBD, FEx
3.13.127 Discuss the provision of analgesia and sedation for critically ill patients.	CEX/CBD, FEx
3.13.128 Describe the effect of critical illness on the pharmacokinetics and pharmacodynamics of sedative and analgesic agents.	CEX/CBD, FEx
3.13.129 Describe weaning protocols of sedative and analgesic agents and strategies to prevent withdrawal phenomena.	CEX/CBD, FEx

3.13.130 Evaluate the use of muscle relaxants in the critically ill patient.	CEX/CBD, FEx
3.13.131 Outline the reasons why critically ill patients are particularly at risk of acquiring nosocomial infections.	CEX/CBD, FEx
3.13.132 Describe standard precautions as applied to critically ill patients.	CEX/CBD, FEx
3.13.133 Outline a scoring system to assess severity of illness and discuss the utility of such scoring systems.	CEX/CBD, FEx
3.13.134 Outline the long-term complications of prolonged intensive care admission.	CEX/CBD, FEx
3.13.135 Describe the features of patients who may be suitable organ donors.	CEX/CBD, FEx
3.13.136 Outline the management of the brain-dead patient awaiting organ donation.	CEX/CBD, FEx
3.13.137 Describe the principles of safe intra and inter-hospital transfer of critically ill patients.	CEX/CBD, FEx
Sepsis and Multi-organ Dysfunction	
3.13.138 Define sepsis, severe sepsis and systemic inflammatory response syndrome (SIRS).	CEX/CBD, FEx
3.13.139 Outline the pathophysiology of SIRS and sepsis and severe sepsis.	CEX/CBD, FEx
3.13.140 Describe the mechanisms of organ dysfunction in severe sepsis.	CEX/CBD, FEx
3.13.141 Outline the investigation and management of the patient with severe sepsis.	CEX/CBD, FEx
3.13.142 Discuss goal directed therapy of sepsis.	CEX/CBD, FEx
3.13.143 Broadly classify antimicrobial agents according to their mode of action and spectrum of activity.	CEX/CBD, FEx
3.13.144 Describe the adverse effects of antimicrobial agents in the intensive care patient.	CEX/CBD, FEx
3.13.145 Discuss the role of prophylaxis in preventing infection in the	CEX/CBD, FEx

intensive care patient.	
3.13.146 Describe a rational approach to prescribing antimicrobial treatment in severe sepsis.	CEX/CBD, FEx
Acute circulatory failure and cardiovascular disorders (also refer to section 2.6 Trauma, Crisis Management and Resuscitation)	
3.13.147 Describe the clinical features of the shocked patient and the clinical features differentiating the causes of shock.	CEX/CBD, FEx
3.13.148 Describe the pathophysiological consequences of shock.	CEX/CBD, FEx
3.13.149 Outline the clinical use of indicators of tissue oxygenation.	CEX/CBD, FEx
3.13.150 Interpret blood gas analysis in the shocked patient.	CEX/CBD, FEx
3.13.151 Discuss methods of monitoring cardiac output and optimisation of fluid therapy in the intensive care patient.	CEX/CBD, FEx
3.13.152 Discuss the treatment of shock according to its cause and the role of goal directed therapy.	CEX/CBD, FEx
3.13.153 Discuss the role of fluid therapy in the shocked patient.	CEX/CBD, FEx
3.13.154 Describe the investigation and management of the patient with acute myocardial infarction and cardiogenic shock.	CEX/CBD, FEx
3.13.155 Discuss the investigation and management of myocardial contusion.	CEX/CBD, FEx
3.13.156 Outline the intensive care management of traumatic aortic injury.	CEX/CBD, FEx
3.13.157 Describe the diagnosis and medical management of acute thoracic aortic dissection (also refer to section 2.6 Trauma, Crisis Management and Resuscitation, and section 3.9 Cardiac Surgery and Interventional Cardiology).	CEX/CBD, FEx
3.13.158 Outline the management of heart failure in the intensive care setting.	CEX/CBD, FEx
3.13.159 Discuss the use of vasopressors, inotropic and lusitropic agents in the intensive care setting.	CEX/CBD, FEx

3.13.160 Outline the management of cardiac arrhythmias in the intensive care patient.	CEX/CBD, FEx
3.13.161 Outline the pathophysiology of and describe the investigations and management of pulmonary embolic disorders.	CEX/CBD, FEx
3.13.162 Outline the indications for and principles of use of intra aortic balloon pumps and ventricular assist devices in the intensive care setting.	CEX/CBD, FEx
3.13.163 Critically evaluate the resuscitative management of patients in cardiac arrest.	CEX/CBD, FEx
Respiratory Failure and Intensive Care of Respiratory Disorders (also refer to section 2.5 Perioperative Medicine and section 2.6 Trauma, Crisis Management and Resuscitation)	
3.13.164 Define respiratory failure and differentiate between types of respiratory failure.	CEX/CBD, FEx
3.13.165 Discuss the differences between acute and chronic respiratory failure and the implications for management.	CEX/CBD, FEx
3.13.166 Interpret blood gas analysis, CXR and pulmonary function tests in respiratory failure.	CEX/CBD, FEx
3.13.167 Describe the pathophysiology of acute lung injury (ALI) and acute respiratory distress syndrome (ARDS) and outline the intensive care management of these.	CEX/CBD, FEx
3.13.168 Describe the pathophysiology and management of pulmonary oedema.	CEX/CBD, FEx
3.13.169 Discuss the intensive care management of chest trauma including pulmonary contusions, chest wall injuries and haemorrhage.	CEX/CBD, FEx
3.13.170 Describe the pathophysiology and management of fat embolism syndrome.	CEX/CBD, FEx
3.13.171 Describe the pathophysiology and management of acute severe asthma.	CEX/CBD, FEx
3.13.172 Describe the management of acute exacerbations of COPD.	CEX/CBD, FEx

3.13.173 Outline the management of pneumonia in the intensive care setting.	CEX/CBD, FEx
3.13.174 Describe the prevention and management of ventilator associated pneumonia.	CEX/CBD, FEx
3.13.175 Discuss the investigation and management of postoperative respiratory failure.	CEX/CBD, FEx
3.13.176 Describe methods of and indications for providing ventilatory assistance in respiratory failure including the place of non- invasive ventilation.	CEX/CBD, FEx
3.13.177 Evaluate ventilation strategies and non-ventilator therapies to optimise oxygenation and ventilation and minimise lung injury.	CEX/CBD, FEx
3.13.178 Discuss the complications of ventilation and the strategies to minimise ventilator-induced lung injury including the ventilation of patients with ARDS.	CEX/CBD, FEx
3.13.179 Discuss the interpretation of blood gas analysis and the use of this to guide respiratory support.	CEX/CBD, FEx
3.13.180 Discuss the assessment and management of extubation in patients who have been intubated for airway obstruction, for example, epiglottitis, angioneurotic oedema, Ludwig's angina.	CEX/CBD, FEx
3.13.181 Describe the indications for, timing and subsequent management of tracheotomies, including common complications, in the critically ill patient.	CEX/CBD, FEx
3.13.182 Describe the procedure, contraindications and possible complications of percutaneous dilatation tracheotomy.	CEX/CBD, FEx
3.13.183 Discuss the issues associated with the long-term ventilation of patients with chronic neuromuscular disorders and outline the factors important in making the decision to initiate assisted ventilation in these patients.	CEX/CBD, FEx
3.13.184 Discuss the available strategies for weaning patients from ventilatory support and discuss the timing and particular issues with different patient groups.	CEX/CBD, FEx

3.13.185 Outline the indications for the use of Extracorporeal Membrane Oxygenation (ECMO) in respiratory failure and outline the principles of delivery of ECMO.	CEX/CBD, FEx
3.13.186 Outline the indications for hyperbaric oxygen therapy in the critically ill patient and the problems associated with providing this treatment.	CEX/CBD, FEx
3.13.187 Critically evaluate the resuscitative management of patients in respiratory arrest.	CEX/CBD, FEx
3.13.188 Discuss the initiation of ventilation and management of patients on ventilators in the intensive care setting.	CEX/CBD, FEx
3.13.189 Discuss the initiation of non-invasive ventilation and management of patients receiving non-invasive ventilation in the intensive care setting.	CEX/CBD, FEx
Renal and Fluid and Electrolyte Disorders	
3.13.190 Describe the pathophysiology, investigation and management of acute renal failure.	CEX/CBD, FEx
3.13.191 Discuss strategies to prevent acute renal failure in the critically ill patient.	CEX/CBD, FEx
3.13.192 Describe the clinical situations where rhabdomyolysis is likely to occur and discuss the diagnosis and management of acute rhabdomyolysis.	CEX/CBD, FEx
3.13.193 Describe methods of providing renal replacement therapy in the patient with acute renal failure.	CEX/CBD, FEx
3.13.194 Discuss the aetiology, diagnosis and management of fluid and electrolyte disturbances in the critically ill patient.	CEX/CBD, FEx
3.13.195 Discuss the clinical management of acid-base disturbances in critically ill patients.	CEX/CBD, FEx
3.13.196 Outline the principles of postoperative care of the renal transplant recipient.	CEX/CBD, FEx

Metabolic and Endocrine Disorders	
3.13.197 Describe the metabolic response to trauma and critical illness	CEX/CBD, FEx
3.13.198 Outline the intensive care management of severe hypothermia.	CEX/CBD, FEx
3.13.199 Discuss the intensive care management of malignant hyperthermia and neuroleptic malignant syndrome	CEX/CBD, FEx
3.13.200 Discuss the management of endocrine emergencies, including thyroid storm, adrenocortical insufficiency, diabetic ketoacidosis and hyperglycaemic non-ketotic coma	CEX/CBD, FEx
Neurological and Neuromuscular Disorders	
3.13.201 Outline the diagnosis and management of persistent vegetative state.	CEX/CBD, FEx
3.13.202 Discuss the clinical diagnosis of brain death and the confirmatory investigations involved.	CEX/CBD, FEx
3.13.203 Discuss the determinants and control of: - Intracranial and intraspinal pressure - Cerebral blood flow - Spinal cord perfusion	CEX/CBD, FEx
3.13.204 Discuss the principles of intracranial pressure monitoring.	CEX/CBD, FEx
3.13.205 Outline the pathophysiology, investigation and management of delirium in the intensive care patient.	CEX/CBD, FEx
3.13.206 Discuss the management of the patient with neurological deterioration due to ischaemic and haemorrhagic stroke and subarachnoid haemorrhage.	CEX/CBD, FEx
3.13.207 Discuss the management of cerebral vasospasm.	CEX/CBD, FEx
3.13.208 Outline the investigation and management of encephalitis and meningitis.	CEX/CBD, FEx
3.13.209 Discuss the intensive care management of: - Raised intracranial pressure - Acute traumatic brain injury	CEX/CBD, FEx

- Prolonged seizures - Acute spinal cord injury	
3.13.210 Outline the principles of management of: - Hemiplegia, paraplegia, quadriplegia. - Postoperative neurosurgical patients - Diabetes insipidus - Cerebral salt wasting	CEX/CBD, FEx
3.13.211 Outline the pathophysiology and indications for intensive care management for patients with: - Tetanus - Botulism - Guillain-Barre syndrome - Myasthenia gravis - Myotonias and muscular dystrophies	CEX/CBD, FEx
3.13.212 Discuss the investigation and management of the critical care patient who wakes with neurological impairment.	CEX/CBD, FEx
Gastrointestinal Disorders	
3.13.213 Discuss the management of life-threatening gastrointestinal haemorrhage.	CEX/CBD, FEx
3.13.214 Outline the diagnosis and management of oesophageal perforation.	CEX/CBD, FEx
3.13.215 Outline the management of acute and acute on chronic liver failure including the indications for transplantation.	CEX/CBD, FEx
3.13.216 Outline the diagnosis and management of acute pancreatitis.	CEX/CBD, FEx
3.13.217 Outline the intensive care unit management of the patient with life-threatening abdominal conditions including: - Abdominal sepsis - Ischemic, perforated or obstructed gut - Major abdominal trauma	CEX/CBD, FEx
3.13.218 Discuss the intensive care management of patients who have undergone major abdominal surgery.	CEX/CBD, FEx
Haematological and Oncological Disorders	

3.13.219 Outline the management of oncology emergencies: - Due to primary disease, for example vena cava obstruction, acute cord compression, pericardial effusion - Secondary to treatment, for example, graft versus host disease, immune suppression	CEX/CBD, FEx
3.13.220 Outline an approach to the management of the intensive care patient with coagulopathy including disseminated intravascular coagulation.	CEX/CBD, FEx
3.13.221 Outline the appropriate use of anticoagulants in patients in the intensive care setting including prevention and management of venous and arterial thrombosis and thromboembolism.	CEX/CBD, FEx
3.13.222 Outline the investigation and management of anaemia and thrombocytopaenia in intensive care.	CEX/CBD, FEx
3.13.223 Discuss the rational use of blood products in the intensive care setting.	CEX/CBD, FEx
3.13.224 Discuss the investigation and management of transfusion reactions.	CEX/CBD, FEx
Environmental Injuries	
3.13.225 Outline the intensive care management of: - Electrocution - Burns - Near drowning - Envenomation - Drug overdose - Corrosive ingestion - Altitude sickness - Decompression syndromes	CEX/CBD, FEx
Intensive Care of the Obstetric Patient (also refer to section 3.5 Obstetrics Anaesthesia and Analgesia)	
3.13.226 Outline the specific requirements of managing the obstetric patient in intensive care, including maintenance of foetal viability, for example, in the patient with cardiovascular failure, respiratory failure, or intracranial haemorrhage.	CEX/CBD, FEx

3.13.227 Explain the differences in basic and advanced life support in the pregnant patient.	CEX/CBD, FEx
3.13.228 Discuss the intensive care management of severe pre- eclampsia and eclampsia.	CEX/CBD, FEx
3.13.229 Discuss the intensive care management of post-partum haemorrhage and amniotic fluid embolism.	CEX/CBD, FEx

APPENDIX 6 IN-TRAINING ASSESSMENT (ITA) GUIDE TO TRAINEES AND TRAINERS

The In-training assessment (ITA) is an essential part of an overall assessment strategy. It is a form of summative assessment conducted at the end of a training period between the trainee and the Supervisor of training, and will complement other methods of evaluation, such as examination. ITA will focus on trainees' professional competence on three domains: clinical skills, attitudes and behavior.

Objectives

- To assess and assist the trainees' progress towards appropriate professional competence
- To provide regular feedback to trainees
- To develop remedial activities for the trainee with difficulty, if required

Process and Methods of Assessment

The ITA should be

- Undertaken by the College designated specialist trainers and the College Supervisor of Training
- Conducted at least every 6 month during the period of vocational training (or at the end of a hospital rotation, if the rotation is less than 6 months)
- Conducted for attachments to Anaesthesia, Intensive Care, or Pain medicine. There are no mandatory ITA requirements for training periods attached to other clinical specialty departments.

Separate ITA forms are designed for use by specialist trainers and SOTs.

ITA Form for Trainers

- This form is meant to be used for collection of comments regarding trainee's performance from all trainers within the training unit.
- It could be individually filled in by different trainers, or alternatively, be filled in at a trainers' meeting discussing trainees' performance.
- The form(s) should be collected and kept by the College SOT.

ITA Form for SOTs

- This form is meant to be used by College SOT, for summarizing and documenting the comments from other trainers in the training unit.

Documentation of ITA on Electronic Training Portfolio of the trainee

- The results of the ITA and the comments from trainers should be documented on the trainee's Electronic Training Portfolio. Any comments or feedback from the trainee should also be

recorded.

Unsatisfactory ITA

- The College SOT should give a summative assessment of the trainee's performance during the period of attachment, taking into consideration all trainers' comments regarding the knowledge, clinical skills, non-technical skills, and general behavior and attitudes of the trainee, at his/her level of training. Additional areas to examine would be the volume of practice and the documentation of various workplace based assessments.
- The overall grading of an ITA could be "Good", "Satisfactory", or "Fail".
- Trainees with unsatisfactory ITA(s) may not be allowed to attempt fellowship examinations or progressing from one stage of training to the next. Hence, trainees who experience difficulty are encouraged to discuss with the College SOT so that remedial strategies can be established. Examples of remedial strategies include:
  - Feedback, advice and counseling of the trainee for any problem identified
  - Attendance of additional courses
  - Mentor appointment and close follow up for the progress of the trainee
  - Additional period of training
  - Psychological support
- Trainees with an unsatisfactory ITA must be monitored and reassessed at a later stage. Formal documentation of the ITA and remedial strategies are required.
- The Board of Education should be notified for any trainee with unsatisfactory ITA. The Board shall decide on appropriate action(s) on an individual basis, such as
  - Excluding from sitting the fellowship examination(s) and/or Exit Assessment
  - Recommending for further period of training
  - Interruption of training with temporary leave
  - Termination of training / Advice for career change

Appeal

- Trainee with unsatisfactory ITA who has any dispute of the ITA can appeal to the College.

APPENDIX 7 FOCUSED TRANSTHORACIC ECHOCARDIOGRAPHY (FTTE) TRAINING

Echo Committee, HKCA

Introduction

1. FTTEs are usually performed at the point of patient care to provide information to guide haemodynamic management. Generally speaking, FTTEs are qualitative assessments with limited views obtained and limited time for assessment when compared to comprehensive transthoracic echo studies.
2. FTTE is the only bedside non-invasive device which allows direct visual assessment of hemodynamic conditions (including ventricular function, volume status, pericardial status and valvular function).
3. FTTE has been shown in studies to improve diagnosis, change management decisions and possibly improve patient outcomes and mortality in the perioperative setting.
4. FTTE is an invaluable aid to an anaesthetist as a perioperative physician when managing rapidly changing hemodynamic conditions.

Learning Outcomes

Anaesthetists trained in FTTE should:

1. Possess the following basic **knowledge** about FTTE
   - An understanding of physics of ultrasound and its application in echocardiography
   - An understanding of relevant cardiac sonographic anatomy
   - Basic hemodynamic assessment (fluid status, ventricular filling and functional assessment)
   - Limited valvular assessment for clinically relevant disease
   - Significant cardiac pathologies requiring urgent interventions
   - Limitations of FTTE and indications for cardiologist consultation
2. Possess the following **skills**
   - Be able to acquire the standard views in FTTE and optimize the images obtained
   - Be able to perform 2D assessments of haemodynamic conditions
   - Be able to perform colour flow Doppler (CFD) assessment of aortic, mitral and tricuspid valves

- Be able to interpret the images obtained (left and right ventricular function, volume status, pericardial status and valvular function) and make use of the information to assist haemodynamic management
- Be able to diagnose common cardiac emergencies, such as acute heart failure, massive myocardial infarction, hypovolemia, pulmonary embolism, cardiac tamponade, and Type A aortic dissection)

Training requirements

The minimum requirements for FTTE training under the HKCA curriculum are

1. 20 supervised FTTE hands-on image acquisition in human subjects, patients or simulator.
2. 20 image interpretation encompassing common pathologies using standardized educational materials on an electronic platform.

Learning pathway

HKCA Echo Committee will provide the following learning platforms to enable HKCA trainees to achieve the minimum learning requirements:

1. The HKCA focused Echocardiography Course
   - HKCA Echo Committee will hold regular HKCA focused Echocardiography courses which are mandatory for HKCA trainees.
   - The course is divided into 3 parts: pre-workshop electronic tutorials; hands-on practical training workshop (Echo A workshop); post-workshop case studies via electronic platform and supervised FTTE practice
   - Trainees can take the course any time after the first year of Basic Training.
   - Trainees must access and learn the relevant materials (with tutorials and assessments) on an electronic platform before attending the practical workshop.
   - The practical workshop will provide 10 supervised hands-on image acquisition opportunities for course attendants.
   - A standardized assessment is included at the end of the workshop.

2. After the Practical Training Workshop

   a. Image Acquisition

      ◆ A minimum of 10 supervised FTTE image acquisitions are expected at the workplace.

- Supervision from HKCA Echo Committee accredited Echo trainers is necessary. The Echo Committee shall regularly maintain an updated list of accredited echo trainers and the list will be accessible to all trainees.
- The supervised hands-on practice can occur in any appropriate clinical environment, including (but not limited to) the perioperative and intensive care settings.
- Trainees are required to keep a log book of the cases they have done. Trainees document their cases by an electronic-log book portal, which is provided to trainees when they register for HKCA focused Echocardiography Course.
- Trainees who have difficulties acquiring supervised hands-on image acquisition experience at their workplace may re-attend Echo-A workshops (free of charge) to complete the minimum learning requirements.

b. Image Interpretation

- An electronic platform will be accessible to all HKCA trainees for reviewing and interpreting echo images.
- Twenty standardized images covering the essential pathologies will be available on the electronic platform.
- Trainees must access the tutorials and complete the assessment at their own pace.

Upon completion of all training requirements, the trainee will be issued a Certificate of Completion of training of FTTE.

Assessments

1. **Formative assessments** take place
   - During the Echo-A workshop
   - During the self-learning activities on the electronic platforms during pre-workshop learning, and post-workshop image interpretation tutorials and assessments
   - During supervised image acquisition in the workplace, where at least one DOPS (Direct Observation of Procedural Skills) with the trainer is required
2. **Summative assessments** take place at the Final Fellowship Examination.