Appendix Two

Learning outcomes mapped to the primary examination

ANZCA Roles in Practice			
Medical Expert			
AR_ME 1.3	Apply knowledge of the clinical and biomedical sciences relevant to anaesthesia	ME	PEx
AR_ME 3.2	Demonstrate knowledge and understanding of the procedure including indications, contraindications, anatomy, technique side-effects and complications	ME	PEx
Airway management			
Introductory training			
Code	**Learning outcome**	**Role**	**Assessment**
IT_AM 1.1	Describe the basic structural anatomy of the upper airway including the larynx	ME	IAACQ, PEx
IT_AM 1.6	Outline the equipment required to be immediately available for basic airway management and the 'can't intubate, can't oxygenate' situation (refer to College professional document: *PS56 Guidelines on Equipment to Manage a Difficult Airway During Anaesthesia)*	ME	IAACQ, PEx
IT_AM 1.9	Describe preoxygenation, including its physiological basis	ME	IAACQ, PEx
Basic training			
BT_AM 1.1	Describe the anatomy of the upper airway, larynx and trachea, including its innervation and endoscopic appearance	ME	PEx
BT_AM 1.2	Describe the physiology of the airway including airway reflexes	ME	PEx
BT_AM 1.3	Describe the effect of anaesthetic agents and other drugs on airway reflexes	ME	PEx
BT_AM 1.4	Describe the physiological consequences of anaesthesia and patient positioning on the respiratory system and their management (also refer to the *General anaesthesia and sedation* clinical fundamental)	ME	PEx
BT_AM 1.19	Describe different modes of ventilation available on modern ventilators and their physiological consequences	ME	PEx

General anaesthesia and sedation			
Introductory training			
Code	**Learning outcome**	**Role**	**Assessment**
IT_GS 1.1	Outline the basic pharmacology of sedative/hypnotic agents (propofol, thiopentone, midazolam, ketamine), inhalational agents, opioids, muscle relaxants, reversal drugs and anti-emetic agents relevant to their clinical practice.	ME	IAACQ, PEx
IT_GS 1.5	Describe the chemical composition of crystalloids and colloids used in clinical practice and their effects when used in volume replacement	ME	IAACQ, PEx
IT_GS 1.8	Outline the physiological changes that occur with and the implications for anaesthetic management of pneumoperitoneum	ME	IAACQ, PEx
IT_GS 1.9	Outline the physiological changes that occur with and the implications for anaesthetic management of the following patient positions: • Supine • Trendelenberg and reverse trendelenberg • Lateral • Lithotomy • Prone (Also refer to the *Safety and quality in anaesthetic practice* clinical fundamental)	ME	IAACQ, PEx
Basic training			
Pharmacodynamics			
BT_GS 1.1	Explain the concept of drug action with respect to: • Receptor theory • Enzyme interactions • Physico-chemical interactions	ME	PEx
BT_GS 1.2	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	ME	PEx
BT_GS 1.3	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	ME	PEx

Code	Learning outcome	Role	Assessment
BT_GS 1.4	Describe efficacy and potency with reference to dose-response curves	ME	PEx
BT_GS 1.5	Explain the law of mass action and describe affinity and dissociation constants	ME	PEx
BT_GS 1.6	Describe the mechanisms of adverse drug effects	ME	PEx
Pharmacokinetics			
BT_GS 1.7	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	ME	PEx
BT_GS 1.8	Describe absorption and factors that will influence it with reference to clinically utilised sites of administration	ME	PEx
BT_GS 1.9	Describe factors influencing the distribution of drugs (for example, protein binding, lipid solubility, pH, pKa) and their alteration in physiological and pathological disturbance	ME	PEx
BT_GS 1.10	Describe the mechanisms of drug clearance and how physiological and pathological disturbance may affect these	ME	PEx
BT_GS 1.11	Describe the mechanisms of non-hepatic and hepatic metabolism of drugs including: • Phase 1 and phase 2 reactions • Hepatic extraction ratio and its significance • First pass effect, enzyme induction and inhibition	ME	PEx
BT_GS 1.12	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	ME	PEx
BT_GS 1.13	Explain clinical drug monitoring with regard to peak and trough concentrations, minimum therapeutic concentration and toxicity	ME	PEx

Code	Learning outcome	Role	Assessment
Variability in drug response			
BT_GS 1.14	Develop an understanding of variations in individual drug responses together with clinical application of this knowledge	ME	PEx
BT_GS 1.15	Define tachyphylaxis, tolerance, addiction, dependence and idiosyncrasy and describe mechanisms of tolerance	ME	PEx
BT_GS 1.16	Describe alterations to drug response due to physiological change with particular reference to the elderly	ME	PEx
BT_GS 1.17	Describe alterations to drug response due to pathological disturbance with particular reference to cardiac, respiratory, renal and hepatic disease	ME	PEx
BT_GS 1.19	Describe the mechanisms of drug interaction	ME	PEx
BT_GS 1.20	Describe and give examples of the clinical importance of pharmacogenetic variation, for example, atypical cholinesterase, codeine metabolism	ME	PEx
BT_GS 1.21	Describe and give examples of the clinical importance of isomerism	ME	PEx
BT_GS 1.22	Describe the mechanisms of action and potential adverse effects of buffers, anti-oxidants, anti-microbial and solubilising agents added to drugs	ME	PEx
Pharmacology of specific agents			
BT_GS 1.23	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	ME	PEx
BT_GS 1.24	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	ME	PEx
BT_GS 1.25	Describe the effects of inhalational agents on the cardiovascular, respiratory and central nervous systems	ME	PEx
BT_GS 1.26	Describe the toxicity of inhalational agents	ME	PEx

Code	Learning outcome	Role	Assessment
BT_GS 1.27	Describe the pharmacology of nitrous oxide	ME	PEx
BT_GS 1.28	Describe the comparative pharmacology of nitrous oxide, halothane, enflurane, isoflurane, desflurane, sevoflurane, xenon and ether	ME	PEx
BT_GS 1.29	Describe the physical properties of sedative/hypnotic agents, including: • Formulation • Properties of an ideal agent • Structure-activity relationships	ME	PEx
BT_GS 1.30	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	ME	PEx
BT_GS 1.31	Describe and compare the pharmacodynamics of intravenous induction and sedative agents and in particular the effects on the cardiovascular, respiratory and central nervous systems	ME	PEx
BT_GS 1.32	Describe the adverse effects of individual induction, sedative and premedicant agents	ME	PEx
BT_GS 1.33	Describe how physiological and pathological disturbance can alter the pharmacology of intravenous anaesthetic agents	ME	PEx
BT_GS 1.34	Outline the pharmacology and clinical use of flumazenil	ME	PEx
BT_GS 1.35	Describe the physiology of the neuromuscular junction and the mechanism of action of neuromuscular blocking agents	ME	PEx
BT_GS 1.36	Describe the pharmacokinetics of neuromuscular blocking agents	ME	PEx
BT_GS 1.37	Describe the pharmacological differences between neuromuscular blocking agents and the clinical importance of these differences.	ME	PEx
BT_GS 1.38	Describe the adverse effects of neuromuscular blocking agents and factors that may modify responses to muscle relaxants	ME	PEx
BT_GS 1.39	Describe the reversal of neuromuscular blockade using anti-cholinesterase agents, anticholinergics and sugammadex and the physiological effects of reversal	ME	PEx
BT_GS 1.40	Describe the adverse effects of anticholinesterase agents	ME	PEx

Code	Learning outcome	Role	Assessment
BT_GS 1.41	Describe the clinical application of opioids to anaesthesia and sedation (also refer to the *Pain medicine* clinical fundamental)	ME	PEx
BT_GS 1.42	Describe the pharmacokinetics of intravenous opioids (also refer to the *Pain medicine* clinical fundamental)	ME	PEx
BT_GS 1.43	Outline the physiological basis of vomiting	ME	PEx
BT_GS 1.44	Describe the clinical pharmacology of dopamine antagonists, anti-cholinergic agents, serotonin antagonists, anti-histamines pro-kinetics and steroids relevant to premedication and the management of nausea and vomiting	ME	PEx
Integrated pharmacology for anaesthesia and sedation			
BT_GS 1.46	Discuss factors influencing choice of agents for: • Sedation • Induction and maintenance of anaesthesia • Muscle relaxation	ME	PEx
BT_GS 1.47	Discuss the indications for muscle relaxation in anaesthesia	ME	PEx
BT_GS 1.48	Describe the effects of anaesthetic agents on regional circulation	ME	PEx
BT_GS 1.49	Discuss proposed mechanisms of anaesthesia and the sites of action of anaesthetic agents including the physiology and pharmacology of neurotransmitters and their receptors (that is GABA, excitatory amino acids, acetylcholine, noradrenaline, dopamine and serotonin)	ME	PEx
BT_GS 1.50	Describe the concept and clinical application of MAC in relation to inhaled anaesthetic agents	ME	PEx
BT_GS 1.51	Describe the concept of depth of anaesthesia and how this may be monitored	ME	PEx
BT_GS 1.51a	Outline the aetiology of and measures to prevent intra-operative awareness under general anaesthesia	ME	PEx
BT_GS 1.52	Explain the principles involved in the electronic monitoring of depth of sedation and anaesthesia, including the use of EEG analysis	ME	PEx
BT_GS 1.53	Describe the synergism between anaesthetic agents, opioids and regional blockade and how this is used clinically	ME	PEx
BT_GS 1.54	Describe techniques to balance anaesthetic depth with changing surgical stimulus	ME	PEx

Code	Learning outcome	Role	Assessment
BT_GS 1.55	Describe the concept of depth of neuromuscular blockade and explain the use of neuromuscular monitoring	ME	PEx
BT_GS 1.56	Describe the clinical features and management of inadequate reversal of neuromuscular blockade	ME	PEx
BT_GS 1.57	Explain the techniques of intravenous and inhalational induction and describe clinical indications and advantages and disadvantages of both techniques	ME	PEx
BT_GS 1.59	Describe the pharmacological principles of and sources of error with target controlled infusion	ME	PEx
BT_GS 1.60	Describe the physiological effects of anaesthesia on the respiratory system and its clinical management (also refer to the *Airway management* clinical fundamental)	ME	PEx
BT_GS 1.61	Discuss the effects of anaesthesia on the immune, haematological and endocrine systems	ME	PEx
BT_GS 1.62	Discuss the prevention and management of postoperative nausea and vomiting	ME	PEx
Temperature homeostasis and anaesthesia			
BT_GS 1.65	Describe the mechanisms by which heat is produced by the body and transferred between the body and its environment	ME	PEx
BT_GS 1.66	Describe the physiological effects of hypo/hyperthermia	ME	PEx
BT_GS 1.67	Describe the energy requirements for maintenance of normal body temperature	ME	PEx
BT_GS 1.68	Describe the physiological responses to lowered and raised environmental temperature, and the effects of anaesthesia on these responses	ME	PEx
BT_GS 1.69	Discuss methods of maintaining body temperature during anaesthesia and sedation, including active warming of patients (also refer to the *Safety and quality in anaesthetic practice* clinical fundamental)	ME	PEx
BT_GS 1.69a	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 (also refer to monitors and monitoring standards, which is covered in the *Safety and quality in anaesthetic practice* clinical fundamental)	ME	PEx

Code	Learning outcome	Role	Assessment
Vascular access			
BT_GS 1.70	Describe the anatomy including ultrasonic anatomy of the peripheral venous system relevant to performing intravenous cannulation	ME	PEx
BT_GS 1.72	Describe the anatomy and anatomical relations of the great veins relevant to performing central venous cannulation, including the ultrasound anatomy	ME	PEx
BT_GS 1.74	Describe the anatomy of the radial, brachial, femoral and dorsalis pedis arteries and their anatomical relations relevant to arterial cannulation including the ultrasound anatomy	ME	PEx

Pain medicine			
Introductory training			
Code	**Learning outcome**	**Role**	**Assessment**
IT_PM 1.3	Outline the basic concepts of multimodal analgesia and pre-emptive analgesia	ME	IAACQ, PEx
IT_PM 1.4	Outline the basic pharmacology and clinical use of available analgesic agents	ME	IAACQ, PEx
Basic training			
Neurobiology			
BT_PM 1.1	Describe the anatomy of the sensory pathways with particular reference to pain sensation	ME	PEx
BT_PM 1.2	Describe the anatomy of the autonomic nervous system	ME	PEx
BT_PM 1.3	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 sensitisation • Pre-emptive and preventive analgesia	ME	PEx
BT_PM 1.4	Describe the physiological mechanism of progression from acute to chronic pain	ME	PEx
BT_PM 1.5	Describe the injury response to acute pain	ME	PEx
BT_PM 1.6	Describe the applied physiology and psychology of neuropathic pain	ME	PEx
BT_PM 1.7	Outline the effects of pain and analgesia on injury-induced organ dysfunction	ME	PEx
BT_PM 1.8	Describe the alterations to physiology and perception of pain in the older patient	ME	PEx

Code	Learning outcome	Role	Assessment
Pharmacology			
BT_PM 1.9	Describe the pharmacology of the following agents applicable to pain management, including: • Opioids • Tramadol • Local anaesthetic agents (also refer to the *Regional and local anaesthesia* clinical fundamental) • NSAIDs • Paracetamol • NMDA antagonists • Anticonvulsants • Antidepressants • Corticosteroids • Inhalational analgesics - nitrous oxide, methoxyflurane	ME	PEx
BT_PM 1.10	Describe the effect of physiological change and pathological disturbance on the pharmacology of the agents listed in learning outcome BT_PM 1.9, with special reference to the elderly	ME	PEx
BT_PM 1.11	Describe the different modes of administration of analgesic agents and evaluate their clinical application	ME	PEx
Pharmacology of specific agents: Opioid agonists and antagonists			
BT_PM 1.12	Describe opioid receptors	ME	PEx
BT_PM 1.13	Describe the mechanisms of action of opioids, including tramadol	ME	PEx
BT_PM 1.14	Describe the actions of agonists, partial agonists, mixed agonists-antagonists and antagonists	ME	PEx
BT_PM 1.15	Discuss the pharmacokinetic and clinical implications of different routes of administration for commonly used opioids, including the oral, transdermal, subcutaneous, intramuscular and intravenous routes	ME	PEx
BT_PM 1.16	Outline the dose conversion between commonly used opioids	ME	PEx
BT_PM 1.17	Describe the pharmacokinetics of intravenous opioids and their clinical applications	ME	PEx
BT_PM 1.18	Describe the pharmacology of opioids deposited in the epidural space or cerebrospinal fluid	ME	PEx
BT_PM 1.19	Describe the adverse effects of opioids administered by systemic and neuraxial routes and their prevention and management	ME	PEx
Code	**Learning outcome**	**Role**	**Assessment**

BT_PM 1.20	Describe the potential adverse drug interactions between opioids and other agents	ME	PEx
BT_PM 1.21	Describe the pharmacology of opioid antagonists	ME	PEx
BT_PM 1.22	Describe the pharmacodynamics of individual opioids and evaluate their clinical applications	ME	PEx
Pharmacology of specific agents: NSAIDs			
BT_PM 1.23	Describe the prostaglandin pathways and their physiological role in the production of pain	ME	PEx
BT_PM 1.24	Classify non-steroidal anti-inflammatory drugs and outline their pharmacology in relation to enzyme inhibition, mode of administration and adverse effects	ME	PEx
BT_PM 1.25	Describe in detail pharmacology of paracetamol including mode of action, clinical utility, metabolism and toxicity, advantages and disadvantages of different routes of administration	ME	PEx
Pharmacology of specific agents: NMDA receptor antagonists			
BT_PM 1.26	Describe the location and role of NMDA receptors	ME	PEx
BT_PM 1.27	Describe in detail the pharmacology of ketamine including mode of action, clinical utility, metabolism and toxicity, advantages and disadvantages of different routes of administration	ME	PEx
Pharmacology of specific agents: Anticonvulsants			
BT_PM 1.28	Describe the pharmacology of anticonvulsants relevant to pain medicine, including gabapentin and carbamazepine	ME	PEx

Perioperative medicine			
Basic training			
Code	**Learning outcome**	**Role**	**Assessment**
BT_PO 1.2	Describe the features of a diagnostic test, including the concepts of sensitivity, specificity, positive and negative predictive value and how these are affected by the prevalence of the disease in question	ME	PEx
BT_PO 1.3	Describe the adverse effects of antimicrobial agents	ME	PEx
BT_PO 1.3a	Outline the pharmacology of commonly encountered illicit drugs and their interactions with drugs used in anaesthetic care	ME	PEx
BT_PO 1.4a	Outline the pharmacology of herbal medicines	ME	PEx
BT_PO 1.4b	Describe adverse effects and potential drug interactions of herbal medicines with particular reference to the perioperative period	ME	PEx
Respiratory anatomy and physiology			
BT_PO 1.6	Discuss the structure of the chest wall and diaphragm and the implications for respiratory mechanics	ME	PEx
BT_PO 1.7	Outline the anatomy of the lower airways	ME	PEx
BT_PO 1.8	Outline the anatomy of the pulmonary and bronchial circulations	ME	PEx
BT_PO 1.9	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	ME	PEx
BT_PO 1.10	Describe the properties of surfactant and relate these to its role in influencing respiratory mechanics	ME	PEx
BT_PO 1.11	Define compliance (static, dynamic and specific) and relate this to the elastic properties of the lung	ME	PEx
BT_PO 1.12	Discuss ‘fast’ and ‘slow’ alveoli, including the concept of ‘time constants’	ME	PEx
BT_PO 1.13	Describe the elastic properties of the chest wall and plot pressure-volume relationships of the lung, chest wall and the total respiratory system	ME	PEx
BT_PO 1.14	Explain the vertical gradient of pleural pressure and its significance	ME	PEx

Code	Learning outcome	Role	Assessment
BT_PO 1.15	Explain the physics of gas flow and the significance of the relationship between resistance and flow in the respiratory tract	ME	PEx
BT_PO 1.16	Describe the factors affecting airway resistance and how airway resistance may be measured	ME	PEx
BT_PO 1.17	Describe closing capacity and its relationship to airway closure and explain its clinical significance and measurement	ME	PEx
BT_PO 1.18	Describe the work of breathing	ME	PEx
BT_PO 1.19	Describe altered lung mechanics in common disease states	ME	PEx
BT_PO 1.20	Discuss lung volumes and capacities, their measurement and normal values	ME	PEx
BT_PO 1.21	Discuss dead space, its measurement and apply the Bohr equation and alveolar gas equation	ME	PEx
BT_PO 1.22	Describe the composition of ideal alveolar and mixed expired gases	ME	PEx
BT_PO 1.23	Describe the oxygen cascade	ME	PEx
BT_PO 1.24	Describe the alveolar exchange of oxygen and carbon dioxide	ME	PEx
BT_PO 1.25	Discuss diffusion capacity and its measurement	ME	PEx
BT_PO 1.26	Discuss normal ventilation-perfusion matching	ME	PEx
BT_PO 1.27	Discuss West's zones of the lung	ME	PEx
BT_PO 1.28	Describe the shunt equation	ME	PEx
BT_PO 1.29	Discuss regional ventilation-perfusion inequalities, venous admixture and the effect on oxygenation and carbon dioxide elimination	ME	PEx
BT_PO 1.30	Outline methods used to measure ventilation-perfusion inequalities	ME	PEx
BT_PO 1.31	Discuss the carriage of oxygen in blood, the oxyhaemoglobin dissociation curve, oxygen stores in the blood and their clinical significance and implications	ME	PEx
BT_PO 1.32	Discuss the carriage of carbon dioxide in blood, the carbon dioxide dissociation curve and their clinical significance and implications	ME	PEx
BT_PO 1.33	Discuss the difference between the pulmonary and systemic circulations	ME	PEx

Code	Learning outcome	Role	Assessment
BT_PO 1.34	Discuss pulmonary vascular resistance and the control of pulmonary vascular tone	ME	PEx
BT_PO 1.35	Discuss the physiological consequences of intermittent positive pressure ventilation and positive end-expiratory pressure	ME	PEx
BT_PO 1.36	Discuss the physiological effects of hypoxaemia, hyper and hypocapnia, and carbon monoxide poisoning	ME	PEx
BT_PO 1.37	Discuss the effect of the following on ventilation: • Changes in posture • Exercise • Altitude • Anaesthesia • Ageing • Morbid obesity	ME	PEx
BT_PO 1.38	Define humidity and outline the importance of humidification	ME	PEx
BT_PO 1.39	Outline the non-ventilatory functions of the lungs	ME	PEx
Respiratory pharmacology			
BT_PO 1.40	Describe the pharmacology of anti-asthma drugs, including beta 2 agonists, corticosteroids, anticholinergics, leukotriene antagonists and theophylline	ME	PEx
BT_PO 1.41	Outline the pharmacology of drugs used to treat pulmonary hypertension including nitric oxide	ME	PEx
BT_PO 1.41a	Discuss oxygen therapy including methods of delivery, indications and contraindications, physiological and pathophysiological effects	ME	PEx
Cardiovascular anatomy and physiology			
BT_PO 1.42	Describe the anatomy of the heart including the coronary circulation and territories supplied.	ME	PEx
BT_PO 1.43	Discuss the physiological basis of electrical activity and its relationship to mechanical events including the: • Ionic basis of automaticity the normal and abnormal processes of cardiac excitation • Physiological basis of the electrocardiograph in normal and common pathological states • Factors that may influence cardiac electrical activity • Correlation of the mechanical events of the cardiac cycle with the electrical and ionic events	ME	PEx

Code	Learning outcome	Role	Assessment
BT_PO 1.44	Describe the physiology of cardiac muscle and the mechanism of excitation contraction coupling	ME	PEx
BT_PO 1.45	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	ME	PEx
BT_PO 1.46	Describe the factors determining myocardial oxygen supply and demand and their clinical implications	ME	PEx
BT_PO 147	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	ME	PEx
BT_PO 1.48	Discuss the cardiovascular responses to: • Changes in posture • Exercise • Valsalva maneouvre • Positive pressure ventilation and PEEP • Pneumoperitoneum • Haemorrhage and hypovolaemia • Surgery and trauma	ME	PEx
BT_PO 1.49	Describe the cardiovascular changes that occur with ageing	ME	PEx
BT_PO 1.50	Describe the cardiovascular changes that occur with morbid obesity	ME	PEx

Code	Learning outcome	Role	Assessment
Cardiovascular pharmacology			
BT_PO 1.51	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	ME	PEx
BT_PO 1.52	Describe the mechanism of action and effects of sympathomimetic and anticholinergic drugs used clinically	ME	PEx
BT_PO 1.53	Describe the pharmacology and clinical application of adrenergic agonists	ME	PEx
BT_PO 1.54	Describe the pharmacology of commonly used alpha and beta receptor blocking agents, their clinical use, adverse effects and use in the perioperative period	ME	PEx
BT_PO 1.55	Outline clinically important drug interactions with the autonomic nervous system	ME	PEx
BT_PO 1.56	Describe the physiological and pharmacological basis of antiarrhythmic therapy including classification based on electro-physiological activity and mechanism of action	ME	PEx
BT_PO 1.57	Describe the pharmacology of antiarrhythmic agents and their clinical applications including the following agents: lignocaine, flecainide, beta blockers, amiodarone, sotalol, ibutilide, calcium antagonists, digoxin, adenosine and magnesium	ME	PEx
BT_PO 1.58	Describe the pharmacology of anti-hypertensive agents and their clinical application, including the following agents: clonidine, alpha-methyl dopa, alpha and beta blockers, nitric oxide, sodium nitroprusside and glyceryl trinitrate, calcium antagonists, ACE inhibitors and angiotensin receptor antagonists, hydralazine and the potassium channel activators	ME	PEx
BT_PO 1.59	Describe the pharmacology of drugs used to manage myocardial ischaemia/infarction, including: nitrates, beta blockers, calcium antagonists, anti-platelet agents, anti-coagulants and fibrinolytic agents	ME	PEx
BT_PO 1.60	Describe the pharmacology of drugs used to manage acute or chronic cardiac failure, including: sympathomimetics, phosphodiesterase inhibitors, digoxin, diuretics, ACE inhibitors, nitrates and beta blockers	ME	PEx

Code	Learning outcome	Role	Assessment
Renal and fluid and electrolytes			
BT_PO 1.61	Describe the functional anatomy of the kidneys and urinary tract	ME	PEx
BT_PO 1.62	Explain the physiology of renal blood flow	ME	PEx
BT_PO 1.63	Describe glomerular filtration and tubular function	ME	PEx
BT_PO 1.64	Explain the counter-current mechanisms in the kidney	ME	PEx
BT_PO 1.65	Explain the mechanisms involved in the regulation of renal function	ME	PEx
BT_PO 1.66	Outline the endocrine functions of the kidney	ME	PEx
BT_PO 1.67	Describe the role of the kidney in the handling of glucose, nitrogenous products and drugs	ME	PEx
BT_PO 1.68	Describe the principles of measurement of glomerular filtration rate and renal blood flow	ME	PEx
BT_PO 1.69	Describe the physiological effects and clinical assessment of renal dysfunction	ME	PEx
BT_PO 1.70	Explain the renal responses to hypovolaemia	ME	PEx
BT_PO 1.71	Explain the effects of anaesthesia on renal function	ME	PEx
BT_PO 1.72	Describe the function, distribution and physiological importance of sodium, potassium, magnesium, calcium and phosphate ions	ME	PEx
BT_PO 1.73	Describe the mechanisms involved in the maintenance of fluid and electrolyte balance	ME	PEx
BT_PO 1.74	Outline the constituents and functions of plasma	ME	PEx
BT_PO 1.75	Define osmotic pressure and explain the factors that determine it	ME	PEx
BT_PO 1.76	Describe the regulation of osmolality	ME	PEx
BT_PO 1.77	Outline the significance of oncotic pressure, colloid osmotic pressure and reflection coefficients	ME	PEx
BT_PO 1.78	Describe the regulation of acid/base balance	ME	PEx
BT_PO 1.79	Describe acid-base chemistry using the Henderson-Hasselbach equation and strong ion difference	ME	PEx

Code	Learning outcome	Role	Assessment
Renal and fluid and electrolytes			
BT_PO 1.80	Describe alterations to drug response due to renal disease	ME	PEx
BT_PO 1.81	Outline a physiological basis of classifying diuretics related to their site of action	ME	PEx
BT_PO 1.82	Describe the pharmacology of diuretics including mannitol, frusemide, thiazides, aldosterone antagonists and carbonic anhydrase inhibitors	ME	PEx
Metabolic and endocrine physiology			
BT_PO 1.82a	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	ME	PEx
BT_PO 1.83	Describe the physiological consequences of starvation	ME	PEx
BT_PO 1.84	Discuss the factors that influence metabolic rate	ME	PEx
BT_PO 1.85	Explain the control of blood glucose	ME	PEx
BT_PO 1.86	Describe the role of the hypothalamus in the integration of neuro-humoral responses	ME	PEx
BT_PO 1.87	Describe control of secretion and the functions of: • Pituitary hormones • Thyroid hormones • Adrenocortical hormones • Adrenomedullary hormones • Renin and angiotensin • Atrial natriuretic peptide	ME	PEx
BT_PO 1.88	Describe the regulation of plasma calcium including the actions and control of vitamin D, parathormone and calcitonin	ME	PEx
BT_PO 1.89	Outline the role of prostaglandins and other autocoids	ME	PEx

Code	Learning outcome	Role	Assessment
Endocrine pharmacology			
BT_PO 1.90	Describe the pharmacology of: • Insulin preparations • Oral hypoglycaemics • Corticosteroid drugs	ME	PEx
BT_PO 1.91	Outline the pharmacology of: • Thyroid hormone replacement and anti-thyroid drugs • Glucagon • Vasopressin and analogues	ME	PEx
Neurophysiology			
BT_PO 1.92	Outline the basic electrophysiology of nerve conduction	ME	PEx
BT_PO 1.93	Describe the physiology of sleep	ME	PEx
BT_PO 1.94	Outline the basis of the electroencephalogram	ME	PEx
BT_PO 1.95	Discuss the determinants and control of: • Intracranial and intraspinal pressure • Cerebral blood flow and autoregulation • Cerebral perfusion pressure • Spinal cord perfusion	ME	PEx
BT_PO 1.96	Discuss the significance of the blood brain barrier	ME	PEx
BT_PO 1.97	Describe the dynamics and metabolism of cerebrospinal fluid	ME	PEx
BT_PO 1.98	Describe cerebral and spinal cord metabolism including energy production, effects of temperature and factors leading to cell damage and cell death	ME	PEx
BT_PO 1.98a	Describe the physiology of skeletal muscle including mechanism of excitation contraction coupling and compare the physiology of skeletal muscle with that of cardiac muscle	ME	PEx
Neurological pharmacology			
BT_PO 1.99	Outline the pharmacology of anti-depressant, anti-psychotic, anti-convulsant, anti-parkinsonian and anti-migraine medication	ME	PEx
BT_PO 1.100	Outline the pharmacology of histamine antagonists	ME	PEx
BT_PO 1.101	Outline the pharmacology of drugs acting via effects on serotonin or serotonin receptors	ME	PEx
BT_PO 1.102	Discuss the clinical features and management of serotonin syndrome	ME	PEx

Code	Learning outcome	Role	Assessment
Gastrointestinal anatomy and physiology			
BT_PO 1.103	Describe the storage, synthetic, metabolic, immunological and excretory functions of the liver and identify the physiological consequences of hepatic disease	ME	PEx
BT_PO 1.104	Describe the anatomical and physiological considerations in hepatic blood flow, and the changes that occur with anaesthesia	ME	PEx
BT_PO 1.105	Describe the portal circulation and its significance	ME	PEx
BT_PO 1.106	Describe the laboratory assessment of liver function and hepatic failure	ME	PEx
BT_PO 1.107	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	ME	PEx
Gastrointestinal pharmacology			
BT_PO 1.108	Describe alterations to drug response due to hepatic disease	ME	PEx
BT_PO 1.109	Outline the pharmacological treatment of peptic ulcer disease and reflux	ME	PEx
Haematology, transfusion medicine and oncology			
BT_PO 1.110	Describe the physiological consequences of acute and chronic anaemia	ME	PEx
BT_PO 1.111	Outline the major haemoglobinopathies and their clinical significance	ME	PEx
BT_PO 1.112	Describe the physiology of haemostasis, including: • Coagulation • The role of platelets • Fibrinolysis	ME	PEx
BT_PO 1.113	Describe the physiological mechanisms of limiting and preventing thrombosis	ME	PEx
BT_PO 1.114	Outline the methods for assessing coagulation, platelet function and fibrinolysis	ME	PEx
BT_PO 1.115	Describe blood groups and methods of cross matching blood	ME	PEx

Code	Learning outcome	Role	Assessment
BT_PO 1.116	Outline the composition, indications and risks of use of the following blood components and products: • Packed red cells • Fresh frozen plasma • Cryoprecipitate • Platelets • Factor VIIa	ME	PEx
BT_PO 1.117	Describe the changes that occur during blood storage and their clinical implications.	ME	PEx
Pharmacology of haematology, transfusion medicine and oncology			
BT_PO 1.118	Describe the pharmacology of heparin and low molecular weight heparins including their side-effects	ME	PEx
BT_PO 1.119	Describe the mode of action of protamine and potential adverse reactions	ME	PEx
BT_PO 1.120	Describe the pharmacology of warfarin and other anticoagulant drugs	ME	PEx
BT_PO 1.121	Describe methods to reverse the effect of warfarin	ME	PEx
BT_PO 1.122	Classify and describe the pharmacology of anti-platelet drugs	ME	PEx
BT_PO 1.123	Outline the pharmacology of thrombolytic agents	ME	PEx
BT_PO 1.124	Outline the pharmacology of antifibrinolytic agents in particular tranexamic acid and aprotinin	ME	PEx
BT_PO 1.125	Outline the pharmacology of cancer chemotherapeutic agents with particular reference to problems that such agents may cause during the perioperative period	ME	PEx
Immunology			
BT_PO 1.126	Explain how the body defends against infection	ME	PEx
BT_PO 1.127	Outline the effects of anaesthesia and surgery on immune function	ME	PEx
BT_PO 1.128	Describe the immunological basis and pathophysiological effects of hypersensitivity	ME	PEx
BT_PO 1.129	Outline the principles of tissue/organ transplantation and the mechanisms of rejection of allogeneic organs	ME	PEx

Code	Learning outcome	Role	Assessment
Immunology related pharmacology			
BT_PO 1.130	Outline the pharmacology of antimicrobial drugs and their interactions with other drugs used during the perioperative period	ME	PEx
BT_PO 1.131	Explain the principles of antibiotic prophylaxis	ME	PEx
BT_PO 1.132	Outline the pharmacology of antiseptics and disinfectants, their clinical use and associated risks	ME	PEx

Regional and local anaesthesia			
Basic training			
Code	**Learning outcome**	**Role**	**Assessment**
BT_RA 1.1	Describe the physiology of nerve conduction	ME	PEx
BT_RA 1.2	Describe the physiological consequences of a central neuraxial block	ME	PEx
BT_RA 1.3	Discuss the pharmacology of local anaesthetic agents including: • Mechanisms of action • Comparative pharmacology of different agents • Toxicity • Use of adjuvant agents to enhance the quality or extend duration of block • Pharmacokinetics of drugs administered in the epidural and subarachnoid space	ME	PEx
BT_RA 1.4	Describe the anatomy of the vertebral column spinal cord and meninges relevant to the performance of central neuraxial block with appropriate surface markings.	ME	PEx
BT_RA 1.5	Describe the dermatomal innervations	ME	PEx
BT_RA 1.6	Describe the myotomal innervation	ME	PEx
BT_RA 1.7	Describe the pain and sensory pathways	ME	PEx
BT_RA 1.8	Describe the principles of ultrasound imaging and the safe use of ultrasound equipment for regional anaesthesia	ME	PEx
BT_RA 1.9	Describe the principles of nerve stimulation to locate nerves and the safe use of nerve stimulators	ME	PEx
Central neuraxial blocks			
BT_RA 1.14	Describe factors influencing dose and choice of anaesthetic agents for spinal anaesthesia and epidural anaesthesia/analgesia	ME	PEx
BT_RA 1.15	Describe how the baricity of the agents used and positioning of patients may affect the extent of block in spinal anaesthesia	ME	PEx
BT_RA 1.16	Describe the drugs that may be injected into the intrathecal or epidural space as adjuvant agents to a central neuraxial block and discuss their risks and benefits	ME	PEx
BT_RA 1.17	Describe the midline and paramedian approaches to the sub-arachnoid space and epidural space	ME	PEx

Resuscitation, trauma and crisis management			
Basic training			
Code	**Learning outcome**	**Role**	**Assessment**
Physiology			
BT_RT 1.1	Define shock	ME	PEx
BT_RT 1.2	Integrate knowledge of factors determining cardiac output to classify causes of shock	ME	PEx
BT_RT 1.3	Describe the physiological consequences of shock	ME	PEx
BT_RT 1.4	Describe oxygen delivery and outline the use of indicators of tissue oxygenation (base deficit, lactate, mixed venous oxygen saturation) in resuscitation	ME	PEx
BT_RT 1.5	Describe the systemic inflammatory response and its physiological effects	ME	PEx
BT_RT 1.6	Describe the physiological basis of anaphylactic and anaphylactoid reactions	ME	PEx
BT_RT 1.7	Describe blood groups and the physiological basis of transfusion reactions	ME	PEx
BT_RT 1.8	Outline the changes that occur in stored blood	ME	PEx
BT_RT 1.9	Describe physiological consequences of massive transfusion	ME	PEx
BT_RT 1.10	Outline the causes of hypoxaemia	ME	PEx
BT_RT 1.11	Describe the physiological consequences of hypoxaemia	ME	PEx
BT_RT 1.12	Outline the factors determining intracranial pressure and discuss its regulation	ME	PEx
BT_RT 1.13	Describe the cerebral circulation, the regulation of cerebral blood flow and factors leading to the loss of autoregulation	ME	PEx
BT_RT 1.14	Discuss cerebral perfusion pressure	ME	PEx
BT_RT 1.15	Describe the blood supply to the spinal cord and the regulation of spinal cord blood flow	ME	PEx
BT_RT 1.16	Discuss spinal cord perfusion pressure	ME	PEx

Code	Learning outcome	Role	Assessment
Pharmacology			
BT_RT 1.17	With reference to the management of shock, describe the pharmacology of vasopressors and inotropes, including: adrenaline, noradrenaline, phenylephrine, metaraminol, dopamine, dobutamine, phosphodiesterase inhibitors, vasopressin	ME	PEx
BT_RT 1.18	With reference to cardiopulmonary resuscitation, describe the pharmacology of adrenaline, vasopressin, amiodarone and lignocaine	ME	PEx
BT_RT 1.19	With reference to the treatment of malignant hyperthermia, describe the pharmacology of dantrolene	ME	PEx
Anatomy			
BT_RT 1.20	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	ME	PEx
BT_RT 1.21	Outline the anatomy relevant to the drainage of pericardial fluid	ME	PEx
BT_RT 1.22	Outline the anatomy relevant to drainage of the pleural space	ME	PEx
BT_RT 1.23	Outline the anatomy of the cerebral and spinal cord circulation	ME	PEx
Resuscitation of the shocked patient			
BT_RT 1.30	Outline how the clinical signs of shock may be altered by age	ME	PEx
Acute respiratory failure			
BT_RT 1.38	Define respiratory failure and differentiate between type 1 and type 2 respiratory failure	ME	PEx
BT_RT 1.39	Interpret blood gas analysis in respiratory failure	ME	PEx

Safety and quality in anaesthetic practice			
Introductory training			
Code	**Learning outcome**	**Role**	**Assessment**
IT_SQ 1.5	Outline the standards to which reusable anaesthetic equipment needs to be cleaned and/or treated. (Refer to College professional document *PS28 Guidelines on Infection Control in Anaesthesia*)	ME	PEx
Basic training			
BT_SQ 1.3	Outline the mandatory safety requirements for anaesthetic machines. (Refer to College professional document *PS54 Statement on the Minimum Safety Requirements for Anaesthetic Machines and Workstations for Clinical Practice*)	ME	PEx
Basic sciences relevant to anaesthesia equipment, measurement and safety			
BT_SQ 1.5	Describe basic physics applicable to anaesthesia in particular: • 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	ME	PEx
BT_SQ 1.6	Describe the methods of measurement applicable to anaesthesia, including clinical utility, complications and sources of error in particular: • SI units • Measurement of volumes, flows, and pressures, including transducers. • Measurement of blood pressure • Measurement of cardiac output • Measurement of temperature • Oximetry • Gas analysis, including capnography • Methods used to measure respiratory function, including: o Forced expiratory volume o Peak expiratory flow rate o Vital capacity o Flow-volume loops o Functional residual capacity and residual volume	ME	PEx

Code	Learning outcome	Role	Assessment
Environmental safety			
BT_SQ 1.7	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	ME	PEx
BT_SQ 1.8	Outline the causes of fires and explosions in the operating suite and discuss methods for prevention and management (refer to the *Resuscitation, trauma and crisis management* clinical fundamental)	ME	PEx
BT_SQ 1.9	Describe the hazards of anaesthetic gas pollution and the methods of scavenging anaesthetic gases	ME	PEx
BT_SQ 1.10	Describe the supply of medical gases (bulk supply and cylinder) and features to ensure supply safety including pressure valves and regulators and connection systems	ME	PEx
BT_SQ 1.11	Describe how medical suction is generated and how to set up and test suction systems, both fixed and portable	ME	PEx
BT_SQ 1.12	Describe the principles and safe operation of vaporisers	ME	PEx
BT_SQ 1.13	Describe and classify breathing systems used in anaesthesia. Evaluate their clinical utility and hazards associated with their use.	ME	PEx
BT_SQ 1.14	Describe different systems to deliver supplemental oxygen and the advantages and disadvantages of these systems	ME	PEx
BT_SQ 1.15	Outline how CO2 is absorbed in a circle system and the hazards associated with the use of CO2 absorption	ME	PEx
BT_SQ 1.16	Describe when a level 1 anaesthesia machine check is required. (Refer to College professional document *PS31 Recommendations on Checking Anaesthesia Delivery Systems*)	ME	PEx
BT_SQ 1.17	Discuss the safety of methods for maintaining body temperature during anaesthesia and sedation, including active warming of patients	ME	PEx
BT_SQ 1.18	Discuss the principles of surgical diathermy, its safe use and the potential hazards	ME	PEx
BT_SQ 1.19	Describe the principles of surgical lasers, their safe use and the potential hazards	ME	PEx
BT_SQ 1.20	Outline the pharmacology of radiological contrast agents	ME	PEx

Obstetric anaesthesia and analgesia

Code	Learning outcome	Role	Assessment
Obstetric physiology and pharmacology			
SS_OB 1.1	Describe the physiological changes and their implications for anaesthesia that occur during pregnancy, labour and delivery, in particular the respiratory, cardiovascular, haematological and gastrointestinal changes.	ME	PEx
SS_OB 1.2	Outline the reference ranges for physiological and biochemical variables in pregnancy	ME	PEx
SS_OB 1.3	Describe the transition from foetal to neonatal circulation and the establishment of ventilation	ME	PEx
SS_OB 1.4	Describe the utero-placental circulation and the principles of placental physiology as related to placental gas exchange and regulation of placental blood flow	ME	PEx
SS_OB 1.5	Describe the mechanism and consequences of aorto-caval compression in pregnancy	ME	PEx
SS_OB 1.6	Describe the changes in the anatomy of the maternal airway and their impact on airway management during anaesthesia	ME	PEx
SS_OB 1.7	Describe the changes in the anatomy of the maternal vertebral column, the spinal cord and meninges relevant to the performance of a central neuraxial block including epidural, spinal and combined spinal-epidural, with appropriate surface markings (refer to the *Regional and local anaesthesia* clinical fundamental)	ME	PEx
SS_OB 1.8	Describe the anatomy and physiology of pain in labour and childbirth	ME	PEx
SS_OB 1.9	Describe the influence of pregnancy on the pharmacokinetics and pharmacodynamics of drugs commonly used in anaesthesia and analgesia	ME	PEx
SS_OB 1.10	Describe the pharmacology of oxytocic agents with special reference to oxytocin derivatives, ergot derivatives and prostaglandins	ME	PEx
SS_OB 1.11	Describe the pharmacology of tocolytic agents with particular reference to beta 2 agonists, calcium antagonists, magnesium, inhalational anaesthetics, nitrates and NSAIDS	ME	PEx
SS_OB 1.12	Describe the pharmacology of agents used for the treatment of pre-eclampsia including magnesium, hydralazine and labetol	ME	PEx

Code	Learning outcome	Role	Assessment
SS_OB 1.13	Explain the factors which influence the transfer of drugs across the placenta to the foetus	ME	PEx
SS_OB 1.14	Outline the potential effects on the foetus and neonate of drugs administered during pregnancy	ME	PEx
SS_OB 1.15	Outline the potential effects on the neonate of drug administration in association with lactation	ME	PEx

Paediatric anaesthesia

Code	Learning outcome	Role	Assessment
Airway management			
SS_PA 1.1	Describe the anatomy of the neonatal airway, how this changes with growth and development and the implications for airway management	ME	PEx
Perioperative medicine – physiology			
SS_PA 1.21	Describe the foetal circulation	ME	PEx
SS_PA 1.22	Describe the circulatory and respiratory changes that occur at birth	ME	PEx
SS_PA 1.23	Define the thermoneutral zone, describe temperature regulation in the neonate and the physiological responses to lowered and raised environmental temperature, the effects of anaesthesia on these responses and how this changes with growth and development	ME	PEx
SS_PA 1.24	Describe the physiology of the cardiovascular, respiratory, renal and neurological systems in the neonate and the changes that occur with growth and development and the implications of this for anaesthetic care	ME	PEx
SS_PA 1.25	Describe the composition of body fluids in the neonate and explain the changes that occur with growth and development	ME	PEx
SS_PA 1.26	Describe glucose homeostasis in the neonate and explain the changes that occur with growth and development	ME	PEx
SS_PA 1.27	Describe vital signs for children of different ages	ME	PEx
General anaesthesia and sedation - clinical and applied pharmacology			
SS_PA 1.52	Describe how the pharmacokinetics of drugs commonly used in anaesthesia in neonates and children differ from adults and the implications for anaesthesia	ME	PEx
SS_PA 1.53	Describe the changes in the pharmacodynamics of volatile agents, analgesics, opioids and neuromuscular blocking agents in the neonate and the changes that occur with growth and development and the implications for anaesthesia	ME	PEx
SS_PA 1.54	Describe the pharmacology of agents used for premedication in children, including midazolam, clonidine, and ketamine	ME	PEx

Code	Learning outcome	Role	Assessment
Regional anaesthesia			
SS_PA 1.79	Describe the difference in pharmacokinetics of local anaesthetic agents in neonates and children from adults and the implications for regional blockade	ME	PEx
SS_PA 1.80	Describe the maximum safe doses of local anaesthetic agents in different age groups	ME	PEx