

Updated NCE Content Outline

For NCE exams administered ON or AFTER 1/2/2024

SEE content areas are uniform at 25% each

I. Basic Sciences (20%)

A. Anatomy and physiology

1. Cardiovascular
2. Respiratory
3. Central nervous system
4. Musculoskeletal
5. Endocrine
6. Hepatic and renal
7. Hematologic
8. Gastrointestinal
9. Immune

B. Pathophysiology

1. Cardiovascular
 - a. Ischemic heart disease
 - b. Valvular heart disease
 - c. Congenital heart defects
 - d. Cardiac conduction and rhythm abnormalities
 - e. Cardiovascular and peripheral vascular abnormalities
 - f. Infectious diseases
 - g. Pericardial diseases
 - h. Cardiomyopathy and heart failure
2. Respiratory
 - a. Obstructive diseases
 - b. Restrictive diseases
 - c. Infectious diseases
 - d. Pulmonary vascular abnormalities
 - e. Altered airway anatomy
3. Central nervous system

- a. Neurodegenerative diseases
 - b. Myelin diseases
 - c. Cerebrovascular diseases
 - d. Neuropathies
 - e. Psychiatric disorders
 - f. Spinal cord disorders
 - g. Intracranial tumor
 - h. Congenital abnormalities (e.g., cerebral palsy)
 - i. Seizure disorders
 - j. Intracranial hypertension
 - k. Thermoregulation
4. Musculoskeletal
- a. Myopathies/metabolic abnormalities (e.g., malignant hyperthermia)
 - b. Neuromuscular diseases
 - c. Skeletal diseases
 - d. Musculoskeletal disorders (genetic and acquired)
5. Endocrine
- a. Thyroid and parathyroid disorders
 - b. Pituitary disorders
 - c. Adrenal disorders
 - d. Pancreatic disorders (endocrine disorders)
 - e. Other endocrine disorders (thymus-, hypothalamus-, androgen-, and metabolic-related disorders)
6. Hepatic
- a. Infectious diseases
 - b. Biliary tract and bilirubin disorders
 - c. Cirrhotic disorders
 - d. Hepatovascular abnormalities
7. Renal
- a. Intrinsic kidney disorders
 - b. Acute kidney injury
 - c. Chronic kidney disease
8. Hematologic
- a. Anemias
 - b. Hemoglobin disorders
 - c. Coagulation disorders
9. Gastrointestinal
- a. Esophageal disorders
 - b. Gastric disorders
 - c. Pancreatic disorders (exocrine disorders)
 - d. Intestinal disorders
 - e. Tumors/secreting lesions
 - f. Malabsorption disorders

10. Immune
 - a. Infectious disorders (e.g., HIV, AIDS)
 - b. Hypersensitivity disorders (Type I-IV)
 - c. Autoimmune diseases
11. Other conditions
 - a. Cancer
 - b. Burns (inhalational, cutaneous)
 - c. Trauma
 - d. Substance use disorder (alcohol, nicotine, other)
 - e. Sepsis

C. Pharmacology

1. General principles
 - a. Pharmacodynamics
 - b. Pharmacokinetics
 - c. Pharmacology-related mathematics
2. Inhalation anesthetics
3. Intravenous anesthetics and antagonists
 - a. Barbiturates
 - b. Sedative/hypnotics (e.g., propofol, etomidate, ketamine, dexmedetomidine)
 - c. Benzodiazepines and benzodiazepine antagonists
 - d. Opioid agonists, agonist-antagonists, and antagonists
4. Depolarizing and nondepolarizing neuromuscular relaxants and antagonists
5. Local anesthetics
6. Lipid emulsion
7. Regional anesthesia adjuncts (neuraxial and peripheral)
8. Anticholinergics/cholinergic agonists
9. Non-opioid analgesics
10. Cardiovascular medications
 - a. Inotropes
 - b. Phosphodiesterase inhibitors
 - c. Cardiac glycosides (e.g., digitalis)
 - d. Alpha- and beta-receptor agonists and antagonists
 - e. Centrally acting alpha₂-adrenergic agonists
 - f. ACE inhibitors
 - g. Angiotensin II receptor inhibitors
 - h. Vasodilators
 - i. Nitric oxide
 - j. Antidysrhythmics
 - k. Calcium channel blockers
11. Bronchodilators

12. Psychopharmacologic therapy
 - a. Antidepressants
 - b. Antipsychotics
 - c. Antiparkinsonian drugs
 - d. Others
13. Prostaglandins
14. Histamine receptor antagonists
15. Antiemetics
 - a. 5-HT₃ receptor antagonists
 - b. Gastrointestinal prokinetic medications (metoclopramide)
 - c. Antacids
 - d. Other
16. Insulin
17. Hypoglycemics
18. Diuretics
19. Anticoagulants and antagonists
 - a. Heparin and low-molecular-weight heparins
 - b. Heparin reversal—protamine
 - c. Antiplatelet medications
 - d. Oral anticoagulants
 - e. Oral anticoagulant reversal
 - f. Thrombolytics
 - g. Thrombin inhibitors
20. Procoagulants (e.g., antifibrinolytics, DDAVP)
21. Antimicrobials and antivirals
22. Antiepileptics
23. Lipid-lowering agents
24. Herbal remedies and dietary supplements
25. Minerals and electrolytes
26. Dantrolene
27. Steroids (e.g., dexamethasone, hydrocortisone)
28. Tocolytics
29. Uterotonics
30. Intravenous dyes
31. Cannabinoids

D. Applied chemistry, biochemistry, physics, and mathematics

1. Chemistry and biochemistry
 - a. Aqueous solutions and concentrations
 - b. Acids, bases, and salts
 - c. Chemical reactions: oxidation, reduction, hydrolysis, and conjugation
 - d. Metabolism

- e. Cellular mechanisms of action
- f. Drug receptor interaction
- 2. Physics
 - a. Units of measurement
 - b. Gases and gas laws
 - c. Solubility, diffusion, and osmosis
 - d. Pressure and fluid flow
 - e. Electricity and electrical safety
 - f. Vaporization and humidification
 - g. Measurement of oxygen, carbon dioxide, and hydrogen ions
- 3. Nonpharmacology-related mathematics

II. Equipment, Instrumentation and Technology (20%)

A. Anesthetic delivery systems

- 1. High/low pressure gas sources
- 2. Regulators/manifolds
- 3. Flowmeters, valves, floats
- 4. Vaporizers
- 5. Proportioning systems
- 6. Pressure failure safety devices
- 7. Failsafe devices
- 8. Ventilator
- 9. Carbon dioxide absorbents
- 10. Anesthetic circuits
 - a. Rebreathing, circle system
 - b. Nonrebreathing
 - c. Modified nonrebreathing
- 11. Pneumatic and electronic alarm devices

B. Airway equipment

- 1. Face masks
- 2. Laryngoscope
 - a. Rigid
 - b. Video laryngoscope
 - c. Optically enhanced scopes
- 3. Flexible fiberoptic bronchoscope
- 4. Endotracheal tube
- 5. Endobronchial tube
 - a. Double-lumen tubes

- b. Bronchial blockers
- 6. Airways
 - a. Oral
 - b. Nasal
- 7. Tracheostomy tubes
- 8. Supraglottic airways (e.g., LMA)
- 9. Intubating supraglottic airways
- 10. Jet ventilation
- 11. Intubating stylets
- 12. Cricothyrotomy (needle and surgical)
- 13. Intubation aids (e.g., bougie, exchange catheter)

C. Monitoring devices

- 1. Central nervous system
 - a. Evoked potential
 - b. Intracranial pressure
 - c. Modified EEG monitor
 - d. Cerebral oximetry
- 2. Cardiovascular
 - a. Electrocardiogram (3-lead and 5-lead)
 - b. Arterial pressure monitoring
 - c. Noninvasive blood pressure monitoring
 - d. Central venous pressure monitoring
 - e. Pulmonary artery pressure monitoring/SvO₂
 - f. Hemodynamic monitoring
 - g. Precordial/esophageal stethoscope
 - h. Transesophageal echocardiogram
- 3. Respiratory
 - a. Capnography
 - b. Airway gas analysis
 - c. Pulse oximetry
 - d. Airway pressure
 - e. Blood gas analysis
- 4. Others
 - a. Peripheral nerve stimulator (qualitative and quantitative)
 - b. Temperature monitoring
 - c. Maternal/fetal monitoring

D. Patient warming equipment

- 1. Fluid/blood warmers
- 2. Forced air warming devices
- 3. Heat and moisture exchanger (HME)

4. Radiant warmers

E. Infusion devices (e.g., rapid infusers)

F. Imaging and imaging safety

1. Ultrasound
2. Fluoroscopy
3. Radiography

III. General Principles of Anesthesia (35%)

A. Ethical considerations

1. Autonomy, beneficence, nonmaleficence
2. Research ethics

B. Legal issues

1. Advance healthcare directives
2. Informed consent
3. Disclosure of errors/ injuries
4. Legal doctrines
5. Torts
6. Scope of practice
7. Standards of practice
8. Billing

C. Safety and wellness

1. Provider substance abuse disorder
2. Issues surrounding patient safety
3. Impaired provider
4. Wellness initiatives and peer assistance

D. Preoperative assessment and preparation of patient

E. Fluid volume assessment and management

1. Fluid/blood component therapy replacement (including plasma expanders)
2. Bloodless medicine (including blood salvage devices and hemodilution techniques)
3. Goal-directed fluid management (crossover with equipment)

4. Massive transfusion protocol
5. Thromboelastography

F. Positioning

1. Techniques
2. Physiologic alterations
3. Complications

G. Utilization and interpretation of testing data

1. Lab tests (blood gases, activated clotting time)
2. Diagnostic exams (including basic 12-lead ECG interpretation)

H. Airway management

1. Assessment
2. Techniques, procedures, and devices
3. Complications
4. Difficult airway management (difficult airway algorithm)

I. Local/regional anesthetics (technique, physiologic alterations, complications)

1. Anatomy
2. Infiltration
3. Topical
4. Neuraxial blocks
5. Peripheral blocks
6. Other blocks (airway, retrobulbar)
7. Ultrasound and/or nerve stimulator guided concepts and techniques
8. Management of complications (e.g., local anesthetic systemic toxicity)

J. Light, moderate, and deep sedation (monitored anesthesia care)

K. Total intravenous anesthesia

L. Pain

1. Pain theory (anatomy, physiology, pathology, and psychodynamics)
 - a. Acute
 - b. Chronic
2. Pain management
 - a. Acute
 - b. Chronic

- c. Multimodal pain therapy

M. Enhanced recovery after surgery (ERAS)

N. Hypotensive technique and risks

O. Postanesthesia care/respiratory therapy

P. Infection control

1. Provider (e.g., personal protective equipment, room air handling, ultraviolet sanitizers)
2. Patient (e.g., aseptic technique, workstation cleanliness, needle safety)

Q. Intraoperative fire safety

IV. Anesthesia for Surgical Procedures and Special Populations (25%)

A. Surgical and diagnostic anesthesia, including management of complications

1. Intra-abdominal
 - a. Hepatobiliary system
 - b. Gastrointestinal tract procedures
 - c. Endocrine organ procedures
 - d. Renal/genitourinary
 - e. Gynecologic procedures
 - f. Peritoneal procedures (including hernia repair)
2. Extrathoracic
 - a. Breast
 - b. Plastics and/or reconstructive
3. Head
 - a. Extracranial
 - i. Otolaryngological
 - ii. Ophthalmologic
 - iii. Nasal
 - iv. Craniofacial
 - v. Plastics and/or reconstructive
 - vi. Orthodontic/dental
 - b. Intracranial
 - i. Decompression (burr holes, ventriculoperitoneal shunt)
 - ii. Space-occupying lesion

- iii. Vascular
 - iv. Transsphenoidal hypophysectomy
 - v. Stereotactic procedures
4. Cardiac anesthesia
 - a. Open procedures (e.g., coronary artery bypass grafting)
 - b. Minimally invasive procedures (e.g., transcatheter aortic valve replacement/implantation [TAVR/TAVI], left atrial appendage closure implant, mitral clips)
 - c. Interventional cardiology (e.g., pacemakers, automated internal cardiac defibrillator devices, electrophysiology cases)
 - d. Management of patients with cardiac devices (e.g., ventricular assist device, extracorporeal membrane oxygenation, intraarterial balloon pump)
 5. Noncardiac intrathoracic (including open and thoroscopic approach)
 - a. Diaphragm
 - b. Endoscopic procedures (bronchoscopy, mediastinoscopy)
 - c. Esophagus
 - d. Lung
 - e. Mediastinum
 6. Neck
 - a. Larynx/trachea
 - b. Lymph node biopsies
 - c. Parathyroid/thyroid
 - d. Neck tumors
 7. Neuroskeletal
 - a. Cervical spine (anterior and posterior approach)
 - b. Laminectomy/discectomy fusions at all levels
 - c. Pain management procedures
 - d. Other
 8. Orthopedic
 - a. Arthroscopic procedures
 - b. Closed reduction
 - c. Fractures
 - d. Total joint replacements/arthroplasty
 - e. Procedures of the hand and foot
 9. Perineal and pelvic procedures
 - a. Gynecologic
 - b. Genitourinary
 - c. Anal/rectal
 10. Vascular (open versus endovascular)
 - a. Carotid
 - b. Thoracic
 - c. Abdominal (including renal)

- d. Extremity
 - i. Occlusive disease
 - ii. Vascular access
- e. Thromboembolic prevention
- f. Surgical management of portal hypertension
- 11. Non-operating-room anesthesia (NORA)
 - a. Diagnostic imaging and radiology
 - b. Electroconvulsive therapy
 - c. Interventional radiology
 - d. Radiation therapy
 - e. Endoscopy
- 12. Robotic/laparoscopic surgery
- 13. Other surgical procedures
 - a. Trauma
 - b. Burns
 - c. Organ transplants (including management of posttransplant patient for nontransplant surgery)
 - d. Organ procurement
 - e. Laser procedures

B. Anesthesia for special populations

- 1. Pediatrics
 - a. Anatomy, physiology, and pathophysiology
 - i. Normal
 - ii. Prematurity
 - iii. Congenital abnormalities
 - b. Pharmacology
 - c. Anesthesia techniques/procedures
 - d. Management of complications
- 2. Obstetrics
 - a. Anatomy, physiology, and pathophysiology
 - b. Pharmacology
 - c. Anesthesia techniques/procedures
 - d. High-risk parturients
 - e. Nonobstetric surgery in the parturient
 - f. Management of complications (e.g., amniotic fluid embolism, HELLP syndrome)
 - g. Postpartum hemorrhage
- 3. Geriatrics
 - a. Anatomy, physiology, and pathophysiology
 - b. Pharmacology
 - c. Anesthesia techniques/procedures

- d. Management of complications (e.g., postoperative cognitive dysfunction)
- 4. Obesity
 - a. Anatomy, physiology, and pathophysiology
 - b. Pharmacology
 - c. Anesthesia techniques/procedures (including bariatric)
 - d. Management of complications
- 5. Substance use disorder population
 - a. Medication-assisted therapy (MAT) (e.g., methadone, buprenorphine)
 - b. Pharmacologic interactions (e.g., acute intoxication)
 - c. Pain management
 - d. Management of complications
- 6. Immune compromised and oncology patients
 - a. Pharmacology
 - b. Anesthesia techniques/procedures
 - c. Management