



MGM INSTITUTE OF HEALTH SCIENCES

(Deemed University u/s 3 of UGC Act, 1956)

Grade 'A' Accredited by NAAC

Sector-01, Kamothe, Navi Mumbai - 410 209

Tel 022-27432471, 022-27432994, Fax 022 - 27431094

E-mail : registrar@mgmuhs.com | Website : www.mgmuhs.com

MGM 13 MD Anaesthesia

Program Outcomes:

PO1. Describe the development and history of anaesthesia as a specialty with knowledge of important personalities who have contributed towards it.

PO2. Demonstrate knowledge of Anatomy related to:

- Diaphragm, upper and lower airway lung, heart and coronary circulation, liver and kidney.
- Regional anaesthesia - field block, central neuraxial, blockade, block for acute pain states.
- Procedures like -Intramuscular injections, arterial and venous cannulations.
- Patient Positioning under anaesthesia.

PO3. Demonstrate knowledge of Physiology of various systems (respiratory, cardiovascular, hepatobiliary, renal, endocrine, during pregnancy, haematological, neuromuscular, regulation of temperature and metabolism, stress response, cerebral blood flow and ICP, central, autonomic and peripheral nervous systems, metabolic response to stress and trauma) in detail and translate its application in a problem solving manner.

PO4. Demonstrate knowledge of Biochemistry relevant to fluid balance and blood transfusion, preoperative fluid therapy, acid base homeostasis in health and diseases.

PO5. Demonstrate knowledge of commonly used drugs in anaesthesia practice (premedication, induction agents - intra-venous and inhalational, neuromuscular blocking agents and reversal of muscle relaxants) - general principles, concepts of 3 pharmacokinetics and pharmacodynamics, drug interactions with the other drugs taken concomitantly by the patient and anaphylactoid reactions.

PO6. Demonstrate knowledge of gas laws, medical gas supply system, fluidics, electricity, diathermy and oxygen therapy.

PO7. Demonstrate knowledge of 'principles of physics' that govern functions of basic anaesthesia delivery equipment, airway devices – (laryngoscopes, airways etc), breathing systems and monitors, fibre optics, Lasers, Pacemakers and defibrillators, monitoring equipment's (used for assessment of cardiac functions, temperature, respiratory functions, blood gases, intracranial pressure, depth of anaesthesia and neuromuscular block),

Sterilization of equipment's, manufacture, filling and transport of gases and liquid oxygen. etc.

PO8. Demonstrate knowledge of importance of pre-anaesthetic assessment and optimization of a patient; consisting of evaluation, interpretation of laboratory investigation as applied to the care of the patients in planning and conduct of general anaesthesia.

PO9. Demonstrate knowledge of basic life support, advanced cardiac, trauma life support, and neonatal resuscitation according to latest guidelines.

PO10. Demonstrate knowledge of principles of sterilization and universal precautions, selection, maintenance and sterilization of anaesthesia and related equipment, Infection control, cross contamination in OT and ICU. Immune response and anaesthesia.

PO11. Demonstrate knowledge of principles of artificial ventilation, management of unconscious patients, oxygen therapy, shock- (pathophysiology and management) and various protocols related to Intensive Care Unit.

PO12. Demonstrate knowledge pertaining to special anaesthetic techniques as relevant to:

- Outpatient anaesthesia, hypotensive anaesthesia, anaesthesia in abnormal environments including rural area and calamitous situations
- Associated medical disorders in surgical patients,
- Geriatric and paediatric anaesthesia, Emergency, ENT, orthopaedic, ophthalmology, obstetrics, dental, radio-diagnosis and radiotherapy.
- Induced hypothermia, incidental, environmental safety of patient.
- Malignant hyperthermia myasthenia gravis, GB syndrome and other neuromuscular diseases, obesity, COPD, Diabetes mellitus, bronchial asthma and hypertensive crises.
- Principles of anaesthetic management of neuro/cardiac/thoracic/vascular/Renal / Liver and Heart transplantation/burns and plastic surgery.
- Anaesthesia for patients with severe cardiac, respiratory, renal and hepatobiliary disorder posted for unrelated surgery.
- Demonstrate knowledge of post-operative care in the post-anaesthesia recovery room, in terms of management of Post-operative pain: various modalities nausea and vomiting.

PO13. Identified emergencies and postoperative complications. Special precautions to be taken in specific surgical patients.

PO14. Demonstrate knowledge of acute pain management, chronic pain therapy & therapeutic nerve blocks, acupuncture, acupressure and other non-conventional methods of treatment.

PO15. Describe documentation, medico-legal aspects of anaesthesia and concept of informed consent.

PO16. Demonstrate knowledge of research methodology and basics of biostatistics relevant to data collection, analysis, record keeping in anaesthesia, comparison and estimation of significance.

PO17. Demonstrate ability to interpret blood gas analysis and other relevant biochemical values, various function tests and basics of measurement techniques, ECG.

PO18. Explain blood coagulation mechanism, and their disturbances, rational use of blood and blood components.

PO19. Shock, types, pathogenesis and management of patients in shock, renal failure, critically ill and/or on ventilator, Multiple organ failure.

PO20. Demonstrate knowledge pertaining to care of terminally ill, Hospices management, Do not resuscitate orders.

PO21. Demonstrate knowledge of general principles of medical audit and Critical incident reporting.

PO22. Demonstrate knowledge of Ethics and clinical trial.

PO23. Demonstrate knowledge of Hospital, ICU and OT design and planning.

PO24. Demonstrate knowledge of Medical education including evidence based medical education.

PO25. Demonstrate knowledge of principles of human resources and material management.

PO26. Skill Development

- Spinal Anaesthesia
- Epidural
- Combined Spinal and Epidural
- Venous / Arterial Cannulation
- General Anaesthesia:
 - Use of mask, intubation with normal and with different types of tubes
 - Supraglottic devices
 - Use of Ambu bag.
- Different type of nerve blocks
 - PNS (Peripheral nerve stimulator)
- US Guided blocks.

SUBJECT SPECIFIC COMPETENCIES

The student during the training programme, should acquire the following competencies:

A. Cognitive domain

- Demonstrate knowledge of Anatomy related to;
 - ❖ Diaphragm, upper and lower airway, heart and coronary circulation ,
 - ❖ Regional anaesthesia -
field block, central neuraxial, blockade, block for acute
pain states
 - ❖ Procedures like -
Intramuscular injections, arterial and venous cannulations
and
 - ❖ Patient Positioning under anaesthesia

- Demonstrate knowledge of Physiology of various systems (respiratory, cardiovascular, hepatobiliary, renal, endocrine, pregnancy, haematologica l, neuromuscular, regulation of temperature and metabolism, stress response, cerebral blood flow and ICP, central, autonomic and peripheral nervous systems, metabolic response to stress and trauma) in detail and translate its application in a problem solving manner.
- Demonstrate knowledge of Biochemistry relevant to fluid balance and blood transfusion, perioperative fluid therapy, acid base homeostasis in health and diseases.
- Demonstrate knowledge of commonly used drugs in anaesthesia practice (premedication, induction agents - intra-venous and inhalational, neuromuscular blocking agents and reversal of muscle relaxants) - general principles, concepts of

pharmacokinetics and pharmacodynamics, drug interactions with the other drugs taken concomitantly by the patient and anaphylactoid reactions.

- Demonstrate knowledge of gas laws, medical gas supply system, fluidics, electricity, diathermy and oxygen therapy.
- Demonstrate knowledge of ‘principles of physics’ that govern functions of basic anaesthesia delivery equipment, airway devices – (laryngoscopes, airways etc), breathing systems and monitors, fiber optics, Lasers, Pacemakers and defibrillators, monitoring equipments (used for assessment of cardiac functions, temperature, respiratory functions, blood gases, intracranial pressure, depth of anaesthesia and neuromuscular block), Sterilization of equipments, manufacture, filling and transport of gases and liquid oxygen. etc.
- Demonstrate knowledge of importance of pre-anaesthetic assessment and optimization of a patient; consisting of evaluation, interpretation of laboratory investigation as applied to the care of the patients in planning and conduct of general anaesthesia.
- Demonstrate knowledge of basic life support, advanced cardiac, trauma life support, and neonatal resuscitation according to latest guidelines.
- Demonstrate knowledge of principles of sterilization and universal precautions, selection, maintenance and sterilization of anaesthesia and related equipment, Infection control, cross contamination in OT and ICU. Immune response and anaesthesia.
- Describe the development and history of anaesthesia as a specialty with knowledge of important personalities who have contributed towards it.
- Demonstrate knowledge of principles of artificial ventilation, management of unconscious patients, oxygen therapy, shock- (pathophysiology and management) and various protocols related to Intensive Care Unit.
- Demonstrate knowledge of post-operative care in the post-anaesthesia recovery room, in terms of management of
 - ❖ Post-operative pain: various modalities
 - ❖ Nausea and vomiting
 - ❖ Identified emergencies and postoperative complications.
 - ❖ Special precautions to be taken in specific surgical patients.
- Demonstrate knowledge of acute pain management, chronic pain therapy & therapeutic nerve blocks, acupuncture, acupressure and other non-conventional methods of treatment.
- Describe documentation, medico-legal aspects of anaesthesia and concept of informed consent.
- Demonstrate knowledge of research methodology and basics of biostatistics relevant to data collection, analysis, record keeping in anaesthesia, comparison and estimation of significance.

- Demonstrate ability to interpret blood gas analysis and other relevant biochemical values, various function tests and basics of measurement techniques, ECG.
- Explain blood coagulation mechanism, and their disturbances, rational use of blood and blood components.
- Demonstrate knowledge pertaining to special anaesthetic techniques as relevant to:
 - ❖ Outpatient anaesthesia, hypotensive anaesthesia, anaesthesia in abnormal environments including rural area and calamitous situations
 - ❖ Associated medical disorders in surgical patients
 - ❖ Geriatric and pediatric anaesthesia, Emergency, ENT, orthopedic, ophthalmology, obstetrics, dental, radio-diagnosis and radiotherapy.
 - ❖ Induced hypothermia, incidental, environmental safety of patient.
 - ❖ Malignant hyperthermia, myasthenia gravis, GB syndrome and other neuromuscular diseases, obesity, COPD, Diabetes mellitus, bronchial asthma and hypertensive crises..
 - ❖ Principles of anaesthetic management of neuro/cardiac/thoracic/vascular/transplantation/burns and plastic surgery.
 - ❖ Anaesthesia for patients with severe cardiac, respiratory, renal and hepatobiliary disorder posted for unrelated surgery
 - ❖ Shock, types, pathogenesis and management of patients in shock, renal failure, critically ill and/or on ventilator, Multiple organ failure
- Demonstrate knowledge pertaining to care of terminally ill, Hospices management, Do not resuscitate orders.
- Demonstrate knowledge of general principles of medical audit and Critical incident reporting.
- Demonstrate knowledge of Ethics and clinical trial.
- Demonstrate knowledge of Hospital, ICU and OT design and planning.
- Demonstrate knowledge of Medical education including evidence based medical education.
- Demonstrate knowledge of principles of human resources and material management.

B. Affective Domain:

1. Should be able to function as a part of a team, develop an attitude of cooperation with colleagues, and interact with the patient and the clinician or other colleagues to provide the best possible diagnosis or opinion.
2. Always adopt ethical principles and maintain proper etiquette in dealings with patients, relatives and other health personnel and to respect the rights of the patient including the right to information and second opinion.

3. Develop communication skills to word reports and professional opinion as well as to interact with patients, relatives, peers and paramedical staff, and for effective teaching.

C. Psychomotor domain

At the end of the course, the student should acquire skills in the following broad areas and be able to:

- Demonstrate ability as a **perioperative physician**, in terms of
 - ❖ Acquiring mastery in careful and relevant history taking, physical examination in clinical evaluation of the patient preoperatively.
 - ❖ Collecting and synthesizing preoperative data from parent hospital and other sources and to develop a rational strategy for the peri-operative care of the patient.
 - ❖ Thorough and systematic approach to preoperative evaluation of patients with and without systemic diseases, undergoing different types of operations.
 - ❖ Prioritizing problems, present cases clearly and systematically to attending consultants.
 - ❖ Developing working relationships with consultants in other specialties to assist in preoperative evaluation and get a good consultation.
 - ❖ Interacting with preoperative patients and developing effective counseling techniques for different anaesthetic techniques and peri-operative procedures.
 - ❖ Assessing and explaining risk of procedure and taking informed consent.
 - ❖ Managing information in preoperative evaluation and outcome enhancement and communication skill to patients and relatives.
 - ❖ Ability to choose and order the required investigations to be done in a particular patient peri operatively
- Demonstrate ability in performing
 - ❖ Pre-operative equipment check
 - ❖ selection of drugs
 - ❖ Preparation of work table etc.
- Identify conditions like difficult airway by following difficult airway algorithms.
- Demonstrate ability to establish topical airway anaesthesia for awake intubation
- Demonstrate management of a Failed intubation drill on a Mannequin according to latest guidelines
- Demonstrate ability to monitor and assess depth of anaesthesia
- Demonstrate abilities to manage body fluid composition; volume status; replacement of fluid and blood loss; use of whole blood and blood components.

- Demonstrate abilities to manage Electrolyte and acid base derangements; osmolarity and osmolality.
- Demonstrate acquisition of skills to initiate mechanical ventilation; select appropriate type and mode of ventilator; and monitor proper functioning of ventilator.
- Identify the need to perform intra-operative laboratory tests, blood gases, coagulation profile and interpret the results with clinical correlation
- Demonstrate ability to manage co-morbid conditions and anaesthesia
- Demonstrate ability to perform cannulation of arteries, central and peripheral veins.
- Demonstrate ability in using and interpreting the following routine non-invasive and invasive monitors intra-operatively:
 - a. Electrocardiogram with ST-segment analysis
 - b. Noninvasive blood pressure
 - c. Capnograph: values and changes in values and waveform.
 - d. Pulse oximetry: values and changes in values
 - e. Neuromuscular blockade monitor
 - f. Invasive arterial pressure: waveform and changes in the waveform
 - g. Central venous pressure: values and waveform
 - h. Pulmonary artery pressure: Values and waveforms, pulmonary capillary wedge tracing.
 - i) Cardiac output
 - ii) Mixed venous oxygen saturation
 - iii) Evoked potential
 - iv) Transesophageal echocardiography: basic understanding
- Demonstrate skills in providing basic life support, advanced cardiac life support, trauma life support and paediatric-neonatal life support, train medical and paramedical staff in BLS and ALS.
- Demonstrate mastery in common procedures like vascular access, use of latest invasive and non-invasive monitoring equipment, lumbar puncture, management of appropriate mechanical ventilation and total care of Intensive Care Patient.
- Demonstrate ability to administer general anaesthesia and regional anaesthesia for ASA I to V, under supervision.
- Demonstrate ability to give extradural block (EDB) lumbar and thoracic, Spinal Block, and Peripheral Nerve Blocks under supervision.
- Demonstrate ability to use ultrasound machine for giving blocks and venous cannulation.
- Demonstrate ability to plan and administer anaesthesia to all emergency patients under supervision including patients for Cardiac, Neurosurgery, Pediatric surgery,

and for all major surgeries, able to manage critically ill patients and treat intractable pain.

- Demonstrate following abilities in **Emergency Anaesthesia, Trauma and Resuscitation:**
 - ❖ Organize resources in case of mass casualty.
 - ❖ Perform triage.
 - ❖ Assess, transport and manage mass casualties / disaster management and camp anaesthesia.
 - ❖ Manage massive haemorrhage and massive blood transfusion.
 - ❖ Transport critically ill patient.
 - ❖ Perform anaesthetic management of geriatric patients with fracture neck of femur
 - ❖ Manage severe burns patients, rapidly progressing spinal compression, massive haemoptysis and lobectomy, peritonitis from various suspected causes, preparation and management of bowel obstruction, septicaemic shock, acute upper airway obstruction such as foreign body, epiglottitis, infections, cardiac tamponade from examples post cardiac surgery, malignant pericardial effusion, peri-operative management of rupture aneurysm of abdominal aorta
 - ❖ Basic Cardiac Life Support and Advanced Cardiac Life Support, Basic Trauma Life Support, Advanced Trauma Life Support, and Cerebral preservation.
 - ❖ Management of intra-operative cardiac arrest
 - ❖ Management of intra-operative bronchospasm
- Demonstrate ability to document a Medico-legal aspect.
- Demonstrate ability to provide special sedation /**anaesthesia requirements outside operating Room**, eg **Radiology**: for CT, MRI (especially in relation to dye allergy and embolization, **Onco radiotherapy**, **Electroconvulsive shock therapy** (modified ECT. **Non-invasive cardio-radiologic procedures** including balloon angioplasty and cardiac catheterization, **Non-invasive neuro-radiologic procedures**, **lithotripsy** etc .
- Demonstrate ability to analyze data and write a thesis, present scientific data, participate in anaesthesia audit.
- Demonstrate ability to critically review and acquire relevant knowledge from the journals about the new development in the specialty
- Demonstrate following abilities in the **Post Anaesthesia Care Unit (PACU)**
 - ❖ Assess the patient's recovery and condition for a safe discharge or transfer.
 - ❖ Observe, recognize and treat the commonly occurring problems likely to arise in the Post-anaesthesia Care Unit (PACU) especially those in relation to cardio-respiratory systems:
 1. Airway integrity and compromise.

2. Arrhythmia
 3. Hypertension
 4. Hypotension
 5. Pain prevention and pain relief
 6. Nausea and vomiting
 7. Decreased urine output
 8. Emergence delirium
 9. Delayed emergence from anaesthesia
 10. Shivering
 11. Post-obstructive pulmonary edema.
- ❖ Assess patient recovery and the parameters for transfer from the PACU to the ward, ICU, home.
 - ❖ Score the patient's condition according to the Aldrete system, including fast tracking after out-patient surgery.
- Demonstration of following abilities in **Intensive Care Unit**
 - ❖ **Understanding the spectrum of critical illnesses requiring admission to ICU.**
 - ❖ Recognizing the critically ill patient who needs intensive care -Trauma, burns, all types of shock, Sepsis, SIRS and ARDS, Poisoning, infectious patient (HIV, Hepatitis) and patients with metabolic disturbances.
 - ❖ Monitoring progress of patients by physiological scoring systems
 - ❖ Practicing infection control practices and control of nosocomial infections.
 - ❖ Inserting central venous lines, arterial lines using ultrasound and interpreting the data.
 - ❖ Managing cardiovascular instability, respiratory failure and postoperative pulmonary complications
 - ❖ Understanding of the operation of mechanical ventilators including different ventilatory modalities non-invasive ventilation, complications and modes of weaning.
 - ❖ Principles and application of Oxygen Therapy
 - ❖ Glycemic control in the critically ill patient
 - ❖ Practice of Hypothermia and prevention of cerebral injury after cardiac arrest
 - ❖ Delivering appropriate nutritional support - enteral and parenteral.
 - ❖ Proper use of sedative/hypnotic drugs in the ICU.
 - ❖ Practicing ethical and legal aspects of critical care
 - ❖ Good communication skills with patient and relatives.
 - ❖ Proper Sterilization of ICU equipment.

- Demonstration of following abilities in **Acute and Chronic Pain Management**
 - ❖ Assessment of patients with pain including: history taking, physical examination, and interpretation of investigations.
 - ❖ Classify types of pain - acute chronic, traumatic, cancer pain, etc. with the knowledge of Pain pathways in detail.
 - ❖ Practice the different modalities of physical therapy that may relieve both acute and chronic pain
 - ❖ Practice the acute pain, cancer pain guidelines and WHO treatment ladder.
 - ❖ Practice routes of administration and risk/benefits of drugs used for acute and chronic pain relief, patient controlled analgesia and treat the common pain syndromes.
 - ❖ Demonstrate practice of pain management in patients with problem drug use, drug dependency and addiction and identify the parameters for referral to a pain medicine specialist.
- Demonstrate Organization of acute pain service and role of acute pain nurse for pain assessment in various groups of patients, Physiological changes secondary to Pain, practice different modalities of pain control. Pharmacology and side effects of opioid analgesia and non-opioid analgesia, principle of patient-controlled analgesia and assessment of its efficacy, Pharmacology and side effects of epidural/intra-thecal opioid. Neurological assessment of epidural blockade and management of failed block. Management of regional blockade – brachial plexus, para-vertebral and intra-pleural block. Management of epidural abscess. Substance abuse and acute pain control. Pain control in concurrent medical diseases – COAD, IHD, bleeding tendency, geriatric. Pain control in burns patients. Pain control in trauma patients included multiple rib fracture
- Demonstration of abilities to manage **Chronic Pain**
 - ❖ Practice different modalities of chronic pain management - physical therapy, psychotherapy, (including cognitive behavioural approaches), neuro-ablation, neuro-augmentation, spinal opioid, interventional neuro-blockade, non-opioid analgesia.
 - ❖ Anatomy, indication, technique and complication of chemical sympathectomy (lumbar sympathectomy, stellate ganglion block, celiac plexus block).
 - ❖ Practice principles of management of cancer pain, principle of management of non-cancer neuropathic pain - phantom limb pain, post-herpetic neuralgia, complex regional pain syndrome, trigeminal neuralgia. Principle of management of non-cancer nociceptive pain - myofascial pain, lower back pain, intractable angina, burns, chronic pancreatitis, PVD.
 - ❖ Practice Epidural steroid injection (all levels) and long-term epidural catheterization.
 - ❖ Observe and practice following blocks: Infra-orbital nerve, Intercostal nerve

- ❖ Recognize complications associated with each blocks and know appropriate treatment of each
 - ❖ Know the indications for stimulation techniques such as transcutaneous electrical nerve stimulation (TENS), dorsal column stimulation, and deep brain stimulation.
 - ❖ Mechanisms and side effects of other therapies used for treating pain.
 - ❖ The principles of pain management in special patient groups including the elderly, children, disabled, intellectually handicapped and those unable to communicate.
 - ❖ Awareness of the principles for insertion and management of implantable drug delivery pumps.
 - ❖ Awareness of the basic principles of palliative care.
- **Demonstrate practice of Regional Anaesthesia**
 - ❖ Applying general principles of pharmacology of local anaesthetics and various adjuvants.
 - ❖ Familiarizing with the relevant anatomy for regional techniques.
 - ❖ Application of indications and contraindications to regional anesthetic technique including central neuraxial blocks, peripheral nerve blocks and sympathetic nerve blocks.
 - ❖ Assessing adequacy of regional anaesthesia, and learn techniques of supplementation of inadequate blocks.
 - ❖ Providing effective anxiolytics and sedation of patients by both pharmacologic and interpersonal technique.
 - ❖ Performing the following regional anaesthesia techniques:
 - Brachial plexus, cervical plexus, stellate ganglion block, lumbar plexus, lumbar sympathetic, Sciatic nerve block, Femoral nerve block, 3 in 1 block, Wrist block, Popliteal Nerve block, Trigeminal nerve block, Retro bulbar blocks, Paravertebral blocks, Intercostal blocks, Caudal block – adult and pediatric, Ankle block, Epidural block/Catheter, Subarachnoid block, Bier's block, All peripheral nerves of the upper and lower limbs.
- **Demonstrate practice of Thoracic Anaesthesia**
 - ❖ Pre-operative assessment of patients undergoing Thoracotomy (lung resection), thoracoscopy, video assisted thoracoscopy and mediastinoscopy
 - ❖ Various approaches and their relevant equipments for lung isolation.
 - ❖ Various double lumen tubes and their placement.
 - ❖ Application of Principle of chest drain.
 - ❖ Respiratory Physiology and management of one lung ventilation (OLV). Indications, contraindications and hazards of OLV.

- ❖ Application of the knowledge of Anatomy of lung and broncho-pulmonary segments.
 - ❖ Anatomy and techniques for intercostals nerve block and thoracic epidural. Management of thoracic epidural anaesthesia and analgesia
 - ❖ Anatomy, techniques and placement of paravertebral block/catheter.
 - ❖ Post-operative care of patients after lung surgery.
 - ❖ Peri-operative management of patients with myasthenia gravis.
 - ❖ Peri-operative management of patients with mediastinal mass.
 - ❖ Anaesthetic management of mediastinoscopy, major airway stenting.
 - ❖ Lung volume reduction surgery and problems.
- **Demonstrate practice of Cardiovascular Anaesthesia:**
 - ❖ Application of the knowledge of Anatomy and physiology of valvular disease, coronary arteries and their territories. Pulmonary circulation, coronary circulation, cerebral circulation, visceral circulation.
 - ❖ Application of the knowledge of Distribution of blood volume to different organs and systems and their control. Microcirculation. Venous system, venous pressure, its influence on various functions.
 - ❖ Regulation of blood pressure, hypotensive anaesthesia.
 - ❖ Anatomy and physiology of all operable congenital heart disease like ASD, VSD, PDA, TOF, transposition of great vessels.
 - ❖ Application of the knowledge of anatomy and physiology of vascular heart disease like co-arctation of aorta.
 - ❖ Assessment of cardiac patient with ischaemic heart, valvular heart disease and other diseases listed above. Understanding of cardiac catheterization, echocardiography, stress testing, and radio-nucleide imaging.
 - ❖ Application of Principle and complication of cardiopulmonary bypass
 - ❖ Application of Principle of trans-esophageal echocardiography
 - ❖ Application of Principle of circulatory support: inotropes, IABP, pacing
 - ❖ Coagulation and management of coagulopathy.
 - ❖ Off pump bypass
 - ❖ Intra-operative management of aortic surgery and major peripheral vascular surgery, aneurysm grafts, recanalisation procedures.
 - ❖ Understanding of the adult patient with congenital heart disease and their management during anaesthesia.
 - ❖ Postoperative cardiac critical care, including cardiovascular problems, analgesia.
 - ❖ Insertion of invasive monitoring for arterial monitoring, central venous pressure monitoring, pulmonary artery catheter insertion and interpretation.
 - ❖ Robotic cardiac surgery.

- **Demonstrate practice of Paediatric Anaesthesia**
 - ❖ Application of knowledge of Anatomical changes in paediatric patient and neonates.
 - ❖ Application of knowledge of Physiology and pharmacology in paediatric patient.
 - ❖ Guideline for pre-operative fasting in children and pre-medication.
 - ❖ Anaesthetic equipment: laryngoscopes, airways, endotracheal tubes, LMAs, PLMA and breathing circuit for children.
 - ❖ Anaesthesia management for premature and newborn.
 - ❖ Emotional problems for parent and child and principles of premedication. Consent by parents and their presence during induction. To become skilled in communicating with children, parents and other relatives.
 - ❖ Problems of transporting a sick pediatric patient from the ward to the operating room and back with regard to temperature maintenance, cardiovascular stability, ventilation and oxygenation.
 - ❖ Estimate preoperatively blood volume, hourly fluid requirements, fluid deficit, third space loss, acceptable blood loss and apply principles of fluid and blood replacement in the perioperative period.
 - ❖ Induce and maintain anaesthesia by inhalation, intravenous, intramuscular and rectal routes and monitor pediatric patients.
 - ❖ Understand the benefits, risks and techniques of regional anaesthesia in children. Anatomy and techniques of caudal, dorsal penile and inguinal regional block, spinal and epidural block
 - ❖ Learn to recognize and treat post anaesthesia complications like apnea, laryngospasm, acid-base and electrolyte disturbances, febrile and convulsing child and bleeding child.
 - ❖ Common problems related to common congenital syndromes presenting for surgery. Anaesthetic management of a child with concurrent disease – Down's, Pierre Robin syndrome, von Willebrand's disease, Goldenhar's, Sturge-Weber, Tracher-Colin, Prune-Belly, and cyanotic and non-cyanotic congenital heart disease.
 - ❖ Paediatric resuscitation: drugs, doses and defibrillation of children of all ages, from the very premature neonates to those children with complex coexisting disease.
 - ❖ Management of patients requiring paediatric intensive care, ventilatory management, and support of circulation.
 - ❖ Resuscitation of neonates and children of all ages. A period of one to two months in a PICU is recommended for all post graduate students undergoing advanced training in paediatric anaesthesia.
 - ❖ Paediatric pain management
 - ❖ Assessment of a child with URTI, with a heart murmur.
 - ❖ Management of fluid and electrolytes in children.

- ❖ Anaesthetic management of a malignant hyperthermia susceptible child.
- ❖ Anaesthetic management of FB bronchus, oesophagus, Wilm's tumour, congenital diaphragmatic hernia, tracheo-oesophagus fistula, thoracotomy.
- ❖ Anaesthesia for Fetal Surgery.
- ❖ Sedation techniques including the selection, management and monitoring of children for diagnostic and therapeutic procedures, with particular attention to working in areas outside the theatre suite.
- **Demonstrate practice of Transplant anaesthesia**
 - ❖ Application of knowledge of basic pathophysiology of renal and liver failure. Principles of anesthetizing an immuno-compromised patient.
 - ❖ Principles of anesthetizing patient with end stage renal/liver disease and patient with organ transplantation. Perioperative management.
- **Demonstrate practice of Neuroanaesthesia**
 - ❖ Application of basic knowledge of cerebral circulation and intra cranial pressure and its implications
 - ❖ Anaesthesia to patients with neurologic disease, head injury undergoing neurologic or non-neurologic surgery and for diagnostic procedures requiring anaesthesia.
 - ❖ Anesthetic implications of the most common neurosurgical procedures, transnasal, trans-sphenoidal pituitary surgery. Posterior fossa surgery. Surgery for supratentorial pathology.
 - ❖ Application of basic concepts behind electrophysiologic monitoring of the brain and spinal cord.
 - ❖ Application of knowledge of general principles of positioning the patient for surgery and the advantages and disadvantages of each position.
 - ❖ Effects of anaesthesia on the electroencephalogram (EEG) and evoked potentials.
 - ❖ Differential diagnoses and treatment alternatives of intraoperative intracranial hypertension (“tight brain”)
 - ❖ Management of Head Trauma, and its anesthetic management and various protocols regarding their management and associated trauma.
 - ❖ Intracranial surgery and spinal surgery, both routine and emergency.
 - ❖ Monitoring: techniques for detection and management of air embolism.
 - ❖ Lumbar puncture and CSF drainage.
 - ❖ Non-surgical management of the head trauma patient, Systemic complications of severe brain injury.
 - ❖ Management of subarachnoid haemorrhage and vasospasm.
 - ❖ Diagnosis and management of patients with brainstem death; and dealing with patient's relatives

- **The following are special procedures which the post graduate student must be able to perform**

Sr. No.	Name of procedure
1.	Blind Nasal intubation
2.	Failed intubation drill (includes Fiberoptic Laryngo/ Bronchoscope)
3.	Double Lumen Tube
4.	Bronchial Blocker placement
5.	Jet Ventilation
6.	Suctioning and physiotherapy of wet lung
7.	Intubation in Neonates
8.	Initiation and management of ventilation
9.	Combined Spinal Epidural
10.	Brachial Plexus Block
11.	Intravenous Regional Anaesthesia
12.	Elbow, Wrist, Digital, Sciatic, Femoral, Lateral Cutaneous Nerve of thigh, Ankle - each
13.	Cervical-Superficial and Deep, Stellate, Splanchnic - each
14.	Central Venous Line by Brachial, Jugular and Subclavian veins
15.	Radial and Femoral Artery cannulation
16.	CVP monitoring
17.	Pulmonary Capillary Wedge Pressure
18.	Neuro-muscular transmission Monitoring
19.	Anaesthetic Depth eg. BIS monitoring

- Demonstration of anesthetic abilities in the intraoperative period keeping into consideration the specific requirement of the surgical procedure – ENT, Orthopaedic, Gynaecology – Obstetrics, General surgery, Onchosurgery, replacement surgeries, urosurgery, vascular, plastic, Thoracic, Dental etc

Suggested Time Frame for Training the PG Students:

The student should be taught as per the following schedule to acquire the skills:

1. First 6 months:

- During the first 6 months, the student should be taught expertise in the management of uncomplicated cases not belonging to any super specialty (ASA I and II cases). To start with, the student will observe and slowly become independent in giving general anaesthesia and spinal anaesthesia to ASA I and II cases for minor and major surgery, under graded supervision.
- The postgraduate student should learn the basic principles of safe and effective anaesthesia, resuscitation, and both the prevention and treatment of pain,

perioperative care of the surgical patient, care of handling equipments, basic techniques in anaesthesia, and anaesthetic pharmacology, and electrical safety.

- He/she should select the thesis topic and submit the protocol for his thesis.

2. Next 18 months

- The student should widen his experience and should be able to undertake anaesthetic care of all routine cases, assist in the anaesthetic care for routine obstetric practice, understand basic principles of critical care, pain management, and participate in audit.
- The student should be trained in administration of general anaesthesia and regional anaesthesia for ASA I to V under supervision. The student should be able to give extradural block (EDB) lumbar and thoracic, Spinal Block, and Peripheral Nerve Blocks under supervision, and use of Ultrasound machine for giving blocks and venous cannulation. The student should learn paediatric and trauma life supports and maintain skills for basic and advanced cardiac life support.
- It is advised that they should be posted in the following specialties: general surgery including gastrointestinal surgery, transplant, ENT, Urology, Obstetrics, Dental Surgery, Eye, ICU, Pain Clinic and peripheral theatres like ECT, radiodiagnostic and therapeutic procedures (CT scan, MRI scan, angiography).
- The student should be able to analyze data and write a thesis. He/she should be able to present scientific data.

3. Last 12 months

- Thesis should be submitted minimum of 6 months before the final MD examination.
- The post graduate student should be given experience of various super-specialties like cardiothoracic and vascular surgery, neurosurgery and transplantation, and paediatric surgery. The student should be able to plan and administer anaesthesia to all emergency patients under supervision including patients for Cardiac, Neurosurgery, Pediatric surgery, and for all major surgeries. The aim at the end is to be competent and independent soon after the third year of junior residency in providing anaesthesia to elective and emergency cases.
- The post graduate student should be able to manage critically ill patients and treat intractable pain. They should also know how to organize resources in case of mass casualty. The curriculum should be able to provide 04 months of elective Intensive Care Unit posting (2 months during initial years under supervision and 2 months independently in the last six months).

4. At the end of 3 years, the post graduate student should have the skills to:

- Plan and conduct anaesthesia and provide post-operative care including pain relief for elective and emergency surgical procedures related to all surgical specialties.

- Carry out basic life support (BLS) and advanced life support (ALS) and train medical and paramedical staff in BLS and ALS.
- Manage patients admitted to an intensive care unit with the help of latest equipment.
- Manage patients suffering from acute and chronic intractable pain.
- Organize the hospital environment to manage mass casualty situation and camp anaesthesia.
- Critically review and acquire relevant knowledge from the journals about the new development in the specialty.
- Should be able to participate in anaesthesia audit.

Overall the student should acquire skills in the following practical competencies:

- ❖ Information management in preoperative evaluation and outcome enhancement and communication skill to patient and relatives.

COURSES OUTCOMES

Syllabus

The course content of **1st year** should cover the following:

1. **Anatomy related to:**

- Diaphragm, upper and lower airway
- Regional anaesthesia, field block, central neuraxial, blockade, block for acute pain states
- Intramuscular injections, arterial and venous cannulations and positioning.

2. **Physics related to:**

- Anaesthesia machine - assembly of necessary items.
- Airway equipment including laryngoscopes, airway devices
- Breathing systems
- Monitoring in anaesthesia with concepts of minimum monitoring
- Gas laws, medical gas supply system
- Fluidics
- Electricity and diathermy
- Oxygen therapy

3. **Physiology related to:**

- Theories of anaesthesia
- Respiratory, cardiovascular, hepatobiliary, renal and endocrine system, pregnancy, blood, muscle and N-M junction, Nerve impulse transmission, ECG, regulation of temperature and metabolism, stress response, cerebral blood flow and ICP.

- Central, autonomic and peripheral nervous systems.
- Metabolic response to stress and trauma.

4. **Pharmacology related to**

- General principles, concepts of pharmacokinetics and pharmacodynamics
 - Drug interactions in anaesthesiology, anaphylactoid reactions
 - Drugs used for premedication, induction of anaesthesia, general anaesthetics-intra-venous and inhalational, neuromuscular block and reversal of muscle relaxants.
5. **Biochemistry** relevant to fluid balance and blood transfusion, perioperative fluid therapy, acid base homeostasis in health and diseases.
 6. Theoretical background of the commonly used anaesthetic techniques of general and regional anaesthesia, general principles of pre-anesthetic assessment and medication, recovery from anaesthesia and post operative care, effects of positioning during anaesthesia.
 7. Introduction to the operation theatre, post-anaesthesia care rooms
 8. Introduction to acute, chronic pain and pain management.
 9. Documentation and medico-legal aspects of anaesthesia. Defensive anaesthesia. Concept of informed consent.
 10. Resuscitation - basic and advanced life support (cardiac and trauma life support), neonatal resuscitation.
 11. Intensive care of critical patients with introduction to artificial ventilation, management of unconscious patients, oxygen therapy, shock - pathophysiology and management.
 12. Introduction to Research methodology, basics of biostatistics.

The course content of **2nd year** should cover the following:

Anatomy related to blocks for chronic pain, chemical neurolysis and different organ systems.

1. **Physics related to:**

- equipments used in anaesthesia monitors, ventilators, vaporizers,
- fiberoptics.
- Laser
- Pacemaker and defibrillator
- Monitoring equipment used for assessment of cardiac functions, temperature, respiratory functions, blood gases, intracranial pressure, depth of anaesthesia and neuromuscular block.
- Sterilization of equipment
- Computers in anaesthesia

2. Pharmacology of drugs used in cardiovascular, respiratory, endocrine, renal diseases and CNS disorders.
3. Interpretation of blood gases and other relevant biochemical values, various function tests and basics of measurement techniques, ECG.
4. Blood coagulation mechanism, disturbances, blood components.
5. Special anaesthetic techniques as relevant to –
 - Outpatient anaesthesia, hypotensive anaesthesia, anaesthesia in abnormal environments including rural area and calamitous situations
 - Associated medical disorders in surgical patients
6. Geriatric and pediatric anaesthesia
7. Emergency, ENT, orthopedic, ophthalmology, obstetrics, dental, radio-diagnosis and radiotherapy.
8. Medical statistics relevant to data collection, analysis, record keeping in anaesthesia, comparison and estimation of significance.
9. Care of terminally ill, Hospices management. Do not resuscitate orders.
10. Postures and anaesthesia.
11. Induced hypothermia, incidental, environmental safety of patient.
12. Malignant hyperthermia, myasthenia gravis, GB syndrome and other neuromuscular diseases, obesity, COPD, Diabetes mellitus, bronchial asthma and hypertensive crises..
13. Third world anaesthesia.
14. Inherited metabolic diseases and anaesthesia.

The course contents of **3rd year** should cover the following:

1. Principles of anaesthetic management of neuro/cardiac/thoracic/vascular/transplantation/burns and plastic surgery.
2. Anaesthesia for patients with severe cardiac, respiratory, renal and hepatobiliary disorder posted for unrelated surgery
3. Shock, types, pathogenesis and management of patients in shock, renal failure, critically ill and/or on ventilator.
4. Multiple organ failure
5. Infection control, cross contamination in OT and ICU.
6. Immune response and anaesthesia.
7. Concept of cytokines, and other enzymes.
8. Selection, maintenance and sterilization of anaesthesia and related equipment
9. Chronic pain therapy and therapeutic nerve blocks.
10. Acupuncture, acupressure and other non-conventional methods of treatment.
11. Principles of neonatal resuscitation, ventilation and critical care.
12. Principles of human resources and material management.

13. General principles of medical audit. Critical incident reporting
14. Ethics and clinical trial.
15. Hospital, ICU and OT design and planning.
16. Medical education including evidence based medical education.



Dr. Rajesh B. Goel
Registrar

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