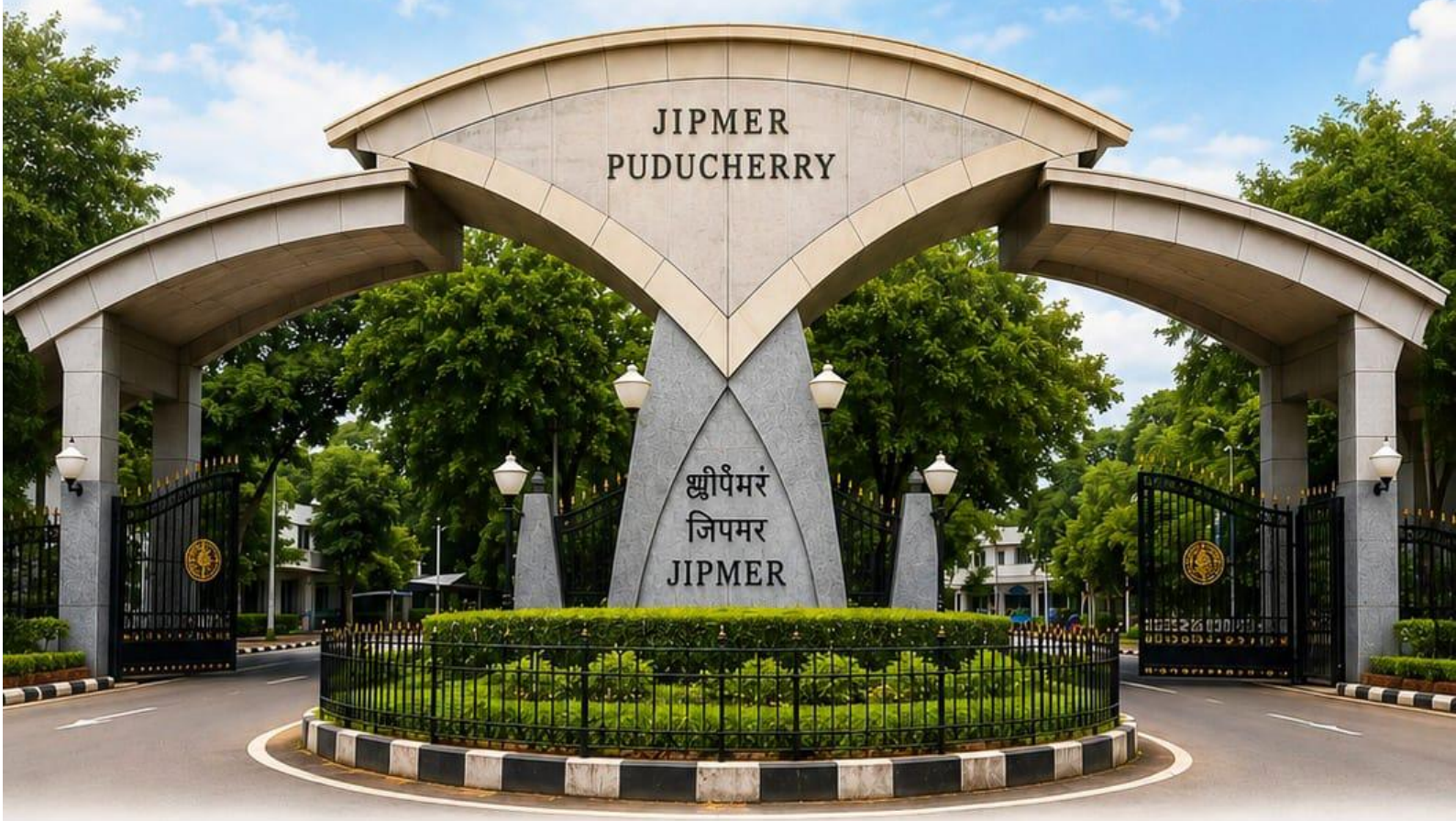
CURRICULUM
POSTGRADUATE

MD Anaesthesiology

From July 2026 session



JAWAHARLAL INSTITUTE OF POSTGRADUATE MEDICAL EDUCATION AND RESEARCH (JIPMER),
PUDUCHERRY – 605 006.

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This curriculum was approved at the 19th meeting of the Standing Academic Committee held on 28th January 2026 and ratified at the 22nd meeting of the Governing Body and will be applicable for students joining MD Anaesthesiology from the July 2026 session.

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GOAL OF THE COURSE

To produce honest and able clinical anaesthesiologists who can effectively provide anaesthesia, pain relief and critical care to patients. A thorough knowledge of cardiovascular, respiratory, neurological, hepatobiliary, renal and endocrine physiology and pharmacology of related drugs as relevant to patients undergoing anaesthesia. A basic idea of the relevant physical principles involved in the functioning of equipment used in anaesthesia. Knowledge to attain expertise of the commonly used techniques in general, regional and local anaesthesia to provide supportive and compassionate care to patients; using best possible evidence in medicine and while striving towards bringing advancements in the science of Anaesthesiology.

TERMINOLOGY

Key-capabilities

They refer to the practices carried out by the specialists as part of their professional services.

They represent the services required from them, by patients, students, other medical/paramedical staff or the society in general.

Thus, they refer to the specific tasks that the postgraduate will be expected to do after he completes the course.

For the purpose of training, the tasks are broken down into units that have distinct cognitive concepts, unless they are predominantly procedural, or attitude based.

Core ideas in practice of Key-capabilities

They refer to the ideas that underlie the practice of the specialists. They include ideas and concepts about structure and functioning of organs and organ systems in health and diseases, classification of diseases, equipment, tests, drugs, techniques, etc.

COURSE CONTENT:

1. Key-capabilities in the practice of Anaesthesiology and Critical Care (outline below, details in Annexure 1 (Part A))

2. Core ideas in the practice of key-capabilities (outline below, details in Annexure 1 (Part B))

(Please refer Annexure 1 for details)

OUTLINE

KEY CAPABILITIES	
1	Anaesthetic Physiology
2	Anaesthetic Anatomy
3	Anaesthetic Pharmacology
4	Anaesthesia Workstation
5	Pre-Anaesthetic Evaluation
6	Perioperative Monitoring
7	Skills in Anaesthetic Practice
8	Postoperative Care
9	Cardio-Thoracic Anaesthesiology
10	Neuro-Anaesthesiology
11	Obstetric Anaesthesiology
12	Paediatric Anaesthesiology
13	Pain Management
14	Critical Care
Learning objectives for key-capabilities in practice of Anaesthesiology	

CORE IDEAS IN THE PRACTICE OF KEY-CAPABILITIES	
1	**Basic Sciences** ● Anaesthetic Physiology ● Anaesthetic Anatomy ● Anaesthetic Pharmacology ● Anaesthesia Workstation ● Perioperative Monitoring
2	**Perioperative Care** ● Pre-anaesthetic evaluation ● Ordering of appropriate investigations ● Preoperative optimisation ● Choosing appropriate type of anaesthesia for the proposed intervention ● Developing skill to perform the required procedures ● Management of anticipated and unanticipated complications during perioperative period ● Postoperative Pain management ● Postoperative care
3	**Anaesthesia for subspecialties** ● Cardiovascular anaesthesia ● Thoracic anaesthesia ● Neuroanaesthesia ● Paediatric anaesthesia ● Obstetric anaesthesia ● Anaesthesia for organ transplantation ● Anaesthesia for Laparoscopic surgery ● Anaesthesia for Hepato-biliary & Gastrointestinal surgeries ● Anaesthesia for reconstructive surgeries ● Anaesthesia for robotic assisted surgeries ● Anaesthesia for endoscopic interventions ● Non-Operating Room Anaesthesia

4	**Pain Management** ● Assessment of patients with acute & chronic pain ● Pharmacological Pain management ● Basics of Interventional Pain management
5	**Critical Care** ● Care of a critically ill patient ● Cardiopulmonary Resuscitation ● Defibrillation & Synchronised Cardioversion ● Basics of Mechanical Ventilation ● Assessment & management of a patient with shock, ● Interpretation of blood gas analysis

LEARNING RESOURCES

(Suggested Books/ Online Resources)

Please refer to latest edition when available

S.No	Name of Book	Author	Edition	Publisher
1	Miller's Anaesthesia	Michael A. Gropper, Lars I. Eriksson, Lee A. Fleisher, Jeanine P. Wiener-Kronish, Neal H. Cohen, Kate Leslie	9th	Elsevier
2	Morgan and Mikhail's Clinical Anaesthesiology	David Mackey, John Butterworth, John Wasnick	7th	McGraw-Hill Education
3	Oxford Handbook of Anaesthesia	Rachel Freedman, Lara Herbert, Aidan O'donnell	5th	Oxford University Press
4	Yao & Artusio's Anaesthesiology: Problem-Oriented Patient Management	Fun-Sun F. Yao, Hugh C Hemmings, Vinod Malhotra, Jill Fong	9th	Wolters Kluwer
5	Stoelting's Anaesthesia and Co-existing Disease	Roberta L. Hines, Stephanie B. Jones	8th	Elsevier
6	Hadzic's Textbook of Regional Anaesthesia and Acute Pain Management	Admir Hadzic	2nd	McGraw Hill
7	Chestnut's Obstetric Anaesthesia: Principles and Practice	David H. Chestnut & Cynthia A. Wong & Lawrence C Tsen & Warwick D Ngan Kee & Yaakov Beilin & Jill Mhyre & Brian T. Bateman & Naveen Nathan	6th	Elsevier
8	Lee's Synopsis of Anaesthesia	Jeremy N. Cashman Bsc, Judith Dinsmore	15th	Elsevier
9	Understanding Anaesthesia Equipment	Jerry A. Dorsch, Susan E. Dorsch	1st Edition (SAE)	Wolters Kluwer
10	The ICU book	Paul L Marino	4th	Lippincott Williams & Wilkins
11	Gregory's Paediatric Anaesthesia	Dean B. Andropoulos, George A. Gregory	6th	Wiley-Blackwell
12	The Washington Manual of Critical Care	Kollef M H	3rd	LWW RS ELITE
13	Oxford Textbook of Critical Care	Andrew Webb	2nd	Oxford

				University Press
14	Critical Care Medicine: Principles of Diagnosis and Management in the Adult	Joseph E. Parrillo, R. Phillip Dellinger	5th	Mosby
19	Raj's Practical Management of Pain	Honorio Benzon, James P. Rathmell	4th	Mosby
20	Bonica's management of pain	Ballantyne J B	5th	Wolter Kluwer
21	Kaplan Cardiac Anaesthesia	Joel A. Kaplan	8th	Elsevier
22	Hensley: A practical approach to cardiac anaesthesia	Gravlee G.P	6th	Wolter Kluwer
25	Cottrell and Youngs Neuroanaesthesia	James E. Cottrell And William L. Young	5th	Elsevier

Suggested Journals

S. No	Journal Title Journal Home Page	Abbreviation Browse Journal in Medline	ISSN	Publisher
1	British Journal of Anaesthesia	BJA	1471-6771	Elsevier
2	Anaesthesia	Anaesthesia	1365-2044	Wiley
4	Anaesthesiology	Anaesthesiology	0003-3022	Wolters Kluwer
5	Anaesthesia and Analgesia	Anesth Analg	1526-7598	Wolters Kluwer
6	Journal of Pain	J Pain	1528-8447	Elsevier
7	Regional Anaesthesia and Pain Medicine	Rapm	1532-8651	BMJ Publishers
8	Acta Anaesthesiologica Scandinavica	Acta Anaesthesiologica Scandinavica	1399-6576	WILEY
9	Canadian Journal of Anaesthesia	Can J Anesth	1496-8975	Springer Nature
10	European Journal of Anaesthesiology	EJA	0265-0215	Wolters Kluwer
11	Indian Journal of Anaesthesia	IJA	0019-5049	Wolters Kluwer
15	Journal of Anaesthesia	J Anesth	0913-8668	Springer Nature

16	BMC Anaesthesiology	BMC Anesthesiol	1471-2253	Springer Nature
17	Paediatric Anaesthesia	Paediatr Anaesth	1155-5645	WILEY
18	Journal of Anaesthesiology Clinical Pharmacology	JOACP	2231-2730	Wolters Kluwer
19	American Journal of respiratory and Critical Care Medicine	AJRCCM	1535-4970	ATS Journals
20	Intensive Care Medicine	Intensive Care Med	1878-7584	Springer Nature
21	Critical Care	Critical Care	1364-8535	Springer Nature
22	Annals of Intensive Care	*Annals of Intensive Care*	2110-5820	Springer France
23	Pain	Pain	1872-6623	Wolters Kluwer
24	Pain Medicine	Pain Medicine	1681-1240	Oxford Press
26	Journal of Cardiothoracic and Vascular Anaesthesia	JCVA	1532-8422	Elsevier
28	Annals of Cardiac Anaesthesia	Annals of Cardiac Anaesthesia	0974-5181	Wolters Kluwer
29	Journal of Neurosurgical Anaesthesiology	Journal of Neurosurgical Anaesthesiology	1537-1921	Wolters Kluwer
30	Journal of Neuroanaesthesia and Critical Care	Journal of Neuroanaesthesia and Critical Care	2348-0548	Thieme Publishers

EDUCATIONAL STRATEGY

Academic Activity	Day	Timing
Lectures in Anaesthesiology	Monday	3.00-4.00 PM
Problem based learning (PBLD)	Tuesday	3.00-4.00 PM
Seminars in Anaesthesiology	Wednesday	3.00-4.00 PM
Journal Club	Thursday	3.00-4.00 PM
Review Meet	Friday	3.00-4.00 PM
OT table discussion	Every day	9.00-11.00 AM
Other didactic classes as and when deemed necessary	As required	Variable

Postings within the department

The postgraduate residents will be posted in different workplaces of the department on rotation at frequent intervals through the course. He/she will achieve the objectives of the posting in all these workplaces.

Sl. No.	Name of the Department	No. of Months
1.	General Surgery	3
2.	Obstetrics & Gynaecology	3
3.	Orthopaedics	2
4.	ENT	2
5.	OG EMS	2
6.	Urology	1
7.	CTVS	2
8.	Neurosurgery	1
9.	Surgical Gastroenterology	1
10.	Paediatric Surgery	2
11.	Plastic Surgery	1
12.	Surgical Oncology	1

13.	CCU	3
14.	PAC clinic	1
15.	NORA	2
16.	Pain clinic	1
17.	EMS/Trauma	4
18.	Relieving Team	3
19.	Periphery	1
	Total	**36 months**

Postings in department – month-wise

Semester	Gen Surgery	OG Elective	ENT / Ophthal	Ortho	CCU	OG EMS	EMS/ Trauma OT	SGE	Rel Team	PAC	Periphery	Peds. Sur	Plastic Surgery	NORA	CTVS	S. Onco	Urology	Pain Clinic	Neuro Surgery
I	1	1	1	1		1	1												
II	1	1			1			1	1	1									
III							1				1			1	1	1	1		
IV			1	1	1				1				1					1	
V		1				1	1					1			1				1
VI	1				1		1		1	1		1		1					

Peripheral Postings

The postgraduate residents will be posted in different departments/divisions of the hospital/institute during the first two years of their course. The resident will be assessed for their knowledge, skills and performance in the department of peripheral posting. Attendance and feedback from these postings will be sent by respective departments to Anaesthesiology.

Department	Basic Objectives	Duration
Cardiology	● Knowledge of the basic sciences as applicable to cardiology, including anatomy, physiology, pharmacology, physics. ● Knowledge of the pathophysiology, assessment and treatment of common cardiac problems like Angina, Myocardial ischemia/infarction, Congestive heart failure, Acute pulmonary oedema, Cardiogenic shock, arrhythmias, use of pacemakers and Cardioversion ● Development of clinical expertise with acutely ill cardiac patients ● Knowledge of specialized means of assessment and monitoring of the cardio vascular system - Electrocardiography, Treadmill test, Stress echocardiography test, Transthoracic Echocardiography ● Describe the pharmacology and administration of medications used in cardiac interventions, such as antiplatelet agents, anticoagulants, vasodilators, and other drugs relevant to the management of cardiovascular conditions. ● Gain experience in intraoperative monitoring techniques specific to cardiac and vascular procedures, including hemodynamic monitoring, interpretation of ECG, and other relevant monitoring modalities. ● Develop clinical skills necessary for basic resuscitation and life support as practiced in coronary care facilities. ● Recognize that prior to provision of anaesthetic care specific medical/cardiac intervention and modification of risk factors may be required.	2 weeks

Radiodiagnosis	● Knowledge regarding different radiological imaging modalities, such as X ray, Magnetic resonance imaging (MRI), computed tomography (CT), interventional radiology (IR), and ultrasound, understanding their principles, indications. ● Knowledge regarding special anaesthetic considerations: Dye allergies/ Anaphylaxis, Embolization, Examination for MRI ● Understand the specific anaesthesia considerations for different radiological interventions, such as sedation requirements, patient positioning, and managing anaesthesia-related challenges in the radiology suite. ● Describe the procedures performed in the radiology department and their anaesthesia requirements, such as image-guided biopsies, angiography, and pain management interventions. ● Be prepared to handle emergent situations during radiological procedures, including airway compromise, allergic reactions, or other critical events requiring immediate intervention. ● Emphasize the importance of infection control measures, sterile techniques, and patient safety protocols specific to the radiology suite environment. ● Understand the pharmacology of medications used for sedation, analgesia, and anaesthesia in the radiology suite. Learn appropriate monitoring techniques and their interpretation in this context.	2 weeks

(May include more departments as needed/available)

Dissertation

- A research project should be undertaken and dissertation must be submitted as per Postgraduate Research Monitoring Committee (PGRMC) guidelines of JIPMER.
- Two hard copies of the dissertation, prepared from the research project, should be submitted to the Dean (Academics) JIPMER, at two and half years of the course to become eligible to appear for the final examination at the end of the course, as per the guidelines of JIPMER.
- Six monthly interim presentations of the dissertations will be done to monitor the progress of the research work and take corrective measures when faced with difficulties.
- **Please refer to Postgraduate Dissertation Regulations and Postgraduate Examination Regulations document for further details**

Workplace Observation

Logbook

1. A consolidated record of the number of cases, done independently and with assistance, of each procedure type is entered**.** Each entry is made with date and is to be certified by faculty members.
2. Detailed work-up of cases selected every month from posting in different workplaces (2 cases with different clinical diagnoses) will be maintained by the resident and entered in the logbook.
3. Record of academic activities (at department, institute or outside institute level) to be entered in the logbook are as following
   i. Presentation in departmental seminars
   ii. Presentations in journal clubs presented (with Title, Journal & Article reference)
   iii. Conferences attended – National/International
   iv. Papers presented at conferences with title, name of the conference, date of presentation (with abstract book)
   v. Papers published in journals (with article reference)
   vi. Peripheral postings: Feedback forms/score sheet filled by faculty members in other departments during the peripheral postings
4. Record of co-scholastic activities, if any

Workplace observation scheme

(Recorded 4 monthly – submitted along with internal assessment marks)

The day to day activities in practice and learning by the resident will be observed and recorded in the "workplace observation form", at pre-decided time instances.

Assessment of logbook is to be done at the same time instances, and entry made in the 'workplace observation form' by the faculty.

Feedback, as part of formative assessment is given to residents, by faculty, during these time instances.

Residents are continuously observed, assessed and feedback is given. At the end of every posting, marks are given by the posting faculty in the workplace assessment form.

ASSESSMENT

Marks

Exam	Marks	Description
Theory exit examination	400 marks	This is the written exam at the end of the course. Four theory examination papers as given in the curriculum document of the course.
Practical exit exam	400 marks	This is the practical examination at the end of the course. The detailed scheme is given in the curriculum document of the course.
Internal Assessment	Internal assessment Theory: 50 marks	Two exams should be conducted - one at the end of first year and the other at the end of second year. Portions for the examination and pattern of the examination must be notified to the students at least one month in advance. The pattern of the internal assessment test will be similar to one paper of the theory exit examination. Two faculty members will evaluate the paper of each candidate in a blinded manner and the average of the 2 scores will be taken as the final score for the internal assessment. If a resident misses one of the tests due to medical reasons (medical certificate from a faculty member of the treating department and duly forwarded by the HoD to the Dean (Academic)), he/she can be permitted to appear in the test that is held for the next batch 6 months later. This can be permitted only once in the course period. If a resident does not attend an internal assessment test, or if he/she fails to attend the rescheduled test due to medical reasons, the score will be considered as 0 for the test. No retests or re-evaluation will be permitted under any circumstances. The internal assessment marks should be communicated to the students within two months of conducting the exams. Internal assessment test marks will be added to the final aggregate to the tune of 100 marks (theory and practical). There is no cut off of internal assessment test scores for determining eligibility to appear in the exit examination or to decide pass/fail solely based on the internal assessment test scores. However, when a student secures less than 50% marks in the internal assessment or when any

		concern is formally raised by the student with the Dean office, a review board with at least 3 faculty members should be constituted to review the student's performance with the student, recommend appropriate remedial measures, document the remedial plan, and submit a signed copy of the document to the Dean's Office. Additional periodic assessments can be held as part of formative assessment. Scores of these tests will not be considered for internal assessment and will not be considered for replacing scores of any of the internal assessment tests. Information to be provided to the Dean Office, before the final examination. 1. Dates of internal assessment examinations conducted 2. Names of faculty members involved in assessment against each date 3. Marks obtained by students in theory, practical and workplace-based observation in each exam session 4. Internal assessment marks for each student for Theory, Practical and Workplace based assessment. An average of the two theory and practical tests will be used to calculate scores for 50 and 25 marks respectively. Cumulative workplace-based assessment scores will be determined for 25 marks. 5. Copy of review documentations for periods of low performance of a student, if any, with remedial measures suggested by the departmental committee.
Internal Assessment (Practical and Workplace-based assessment)	Internal assessment Practical: 25 marks Internal assessment Workplace-based assessment: 25	For practical examinations, all members of the faculty of the department, from Assistant Professor to the senior-most faculty, shall participate in internal assessment on a rotating basis. The assessment shall be planned such that multiple faculty members are engaged for each student and different faculty members are engaged for the two assessments, wherever feasible. The pattern prescribed in the curriculum document shall be followed for practical assessments and the score shall be adjusted for 25 marks. Workplace-based assessment marks are given based on practice of the profession and affective domain attributes in the workplace and in the learning environment. Workplace observation proforma should be

	marks	provided to students at the time of joining the department. The method of workplace observation should be explained to the students at the beginning of the course.
Dissertation	100 marks	Dissertation marks will be calculated by the average of the scores provided by 2 external examiners. Approval of the dissertation with more than 50% scores awarded by the external examiners will be one of the eligibility criteria for appearing for the exit examination of the discipline.
Total	1000 marks	**Criteria for PASS:** 1. (a) A candidate will need to pass the final Theory Exit Exam and Practical Exit Exam independently. (b) A minimum of 50% marks in 'Theory Exit exam' (a minimum of 40% in each of the four papers) and 50% in 'Practical Exit exam' separately shall be mandatory 2. A candidate should also score 50% or above in the final aggregate marks (500 out of 1000) to pass in the degree course. If a student secures a pass score in theory and practical examination but fails in the aggregate score, he/she can re-appear in the exit examination of the subsequent session. There is no provision to improve internal assessment or dissertation scores.
Please refer to Postgraduate Examination Regulations document for further details		

<u>Theory Exit Exam</u>

Paper 1: Basic Sciences as applied to Anaesthesiology

- Anatomy related to anaesthesia
- physiology related to anaesthesia
- Basic principles of clinical pharmacology
- Anaesthetic drugs and adjuvants
- Fluids, Electrolytes, and Acid–Base Physiology
- Haemostasis and transfusion medicine
- Preoperative assessment
- Anaesthesia workstation and other equipment
- Monitoring
- Basic bio-statistics

Paper 2: Clinical Anaesthesiology

- Airway management
- Neuraxial anaesthesia
- Peripheral nerve blockade
- Anaesthesia for orthopaedic surgery
- Anaesthesia for endocrine disease
- Anaesthesia for ENT and Ophthalmologic surgery
- Anaesthesia for urological surgery
- Anaesthesia for elderly
- Anaesthesia for laparoscopic and robotic surgeries
- Post anaesthesia care unit and post -operative complications

Paper 3: Anaesthesia in relation to sub specialities

- Anaesthesia for Neurosurgery
- Anaesthesia for Thoracic Surgery
- Anaesthesia for Cardiac Surgery
- Paediatric Anaesthesia
- Obstetric anaesthesia
- Transplant anaesthesia
- Onco-anaesthesia
- Trauma anaesthesia and acute care

Paper 4: Resuscitation, Critical Care, Pain management and Recent advances in Anaesthesiology

- Resuscitation
- Critical Care
- Pain management: Acute and chronic, palliative care
- Recent advances in Anaesthesiology
- Non-operating room anaesthesia

Practical Exit Exam

Components: The practical examination should be as structured.

Clinical Cases	No	Duration	Marks
Long case	1	40 minutes	150
Short cases	2	15 minutes each	150

Structured Assessment (For clinical cases)

Segment	Percentage
Oral skills / presentation	10%
Diagnosis / investigations	10%
Preanaesthetic Preparation	20%
Anaesthetic management	40%
Postoperative complications & management	20%

Viva-Voce (Structured)

	Stations	Marks
1.	Problem solving situations, Investigations, ECG, X Rays etc.	25
2.	Drugs/Anaesthetic	25
3.	Equipment for Anaesthesia/Intensive Care	25
4.	CPR Assessment on Mannequins	25
	Total	**100**

Segment	Total Marks
Theory (Papers 1-4)	400
Practical	300
Viva Voce	100
Grand Total	**800**

MODEL THEORY QUESTION PAPERS

MD ANAESTHESIOLOGY

PAPER I

Applied Basic Sciences in Relation to Anaesthesiology

Answer all questions.

Draw diagrams where necessary.

Time: 3 Hours Maximum Marks: 10 x 10 = 100

1. Describe the various bronchopulmonary segments.
2. Describe the 'Circle of Willis' and discuss how autoregulation of blood flow occurs to the brain.
3. What is 'Hypoxic pulmonary vasoconstriction'? Discuss its significance in anaesthesia
4. Describe the Biological role of oxygen in our body. Write short notes on Oxygen cascade and oxygen flux.
5. Write short notes on Benzodiazepines.
6. Describe the pharmacodynamics, pharmacokinetics, side effects and contraindications of thiopentone.
7. Classify local anaesthetics. Discuss and compare the toxic effects of amide local anaesthetics.
8. Student's t-Test.
9. What is the principle of pulse oximetry? Briefly discuss the clinical utility of this monitoring tool in the perioperative period.
10. Classify breathing systems. Give the functional analysis of Mapleson D system in controlled ventilation.

MD ANAESTHESIOLOGY

PAPER II

Answer all questions.

Draw diagrams where necessary.

Time: Three Hours **Maximum Marks: 100 (10x10 marks)**

1. Preparation and perioperative management of a Myasthenic patient posted for thymectomy (3+7)
2. Preparation and perioperative management of Pheochromocytoma (4+6)
3. Anaesthestic management of a 30-year-old patient posted for renal transplant surgery (10)
4. Perioperative management of a 25-year-old female suffering from PIH, posted for emergency LSCS (10)
5. One year old suspected of a foreign body aspiration is posted for emergency bronchoscopy management (10)
6. Describe the preoperative optimization risk management of a patient with cirrhosis for liver transplant (5+5)
7. What are the non- pharmacological options available to provide labour analgesia? How would you provide labour analgesia to a parturient with mitral stenosis? (5+5)
8. Pre – operative evaluation and anaesthesia management of a 60-year-old patient with diabetic ketoacidosis scheduled for emergency below knee amputation of left leg. (4+6)
9. a) Celiac plexus block (5)
   b) Brachial block (5)
10) a) Target controlled analgesia (5)
    b) Anticoagulants and Regional Anaesthesia (5)

MD ANAESTHESIOLOGY

PAPER III

Answer all questions.

Draw diagrams where necessary.

Time: Three Hours **Maximum Marks: 100 (10x10 marks)**

1. Draw with level diagram of ventilating rigid bronchoscope. Describe Anaesthetic and ventilation strategy during bronchoscopy for a one-year child with left foreign body bronchus.
2. Preoperative evaluations and anaesthetic management of a patient with Congenital Diaphragmatic hernia.
3. Anaesthesia for two-year child posted for bilateral cleft palate with micrognathia.
4. Anaesthetic management of a patient with blunt chest trauma and cardiac tamponade.
5. Describe Pulmonary artery catheter (PAC) with diagram and enumerate hemodynamic Parameters that can be measured by the Pulmonary Artery Catheter.
6. (a) What are the advantages of "off pump" coronary artery bypass grafting (OPCAB) compared to "on bypass" technique?
   (b) What causes haemodynamic instability during OPCAB?
   (c) Which strategies help to minimise this haemodynamic instability in OPCAB? Mark-10 (2+3+5)
7. Margin of safety in positioning double-lumen endotracheal tubes for lung isolation. Describe with diagram.
8. Managements of post-operative bleeding after open heart surgery.
9. Airway consideration for a 6-month child with Occipital cervical encephalocele.
10. Diagnosis and management of air embolism during sitting position craniotomy.

MD ANAESTHESIOLOGY

PAPER IV

Answer all questions.

Time: Three Hours **Maximum Marks: 100**

1. Classify and describe various Oxygen delivery devices.
2. Discuss Driving pressure and Mechanical power of ventilation and its implication in lung protective ventilation.
3. A 65-year-old lady weighing 90 kgs underwent laparoscopic low anterior resection for carcinoma rectum. She was extubated on table. On postoperative day 2, she has developed tachypnoea and desaturation. Discuss the differential diagnosis for her clinical deterioration. How will you manage her further?
4. How is Nano technology used in anaesthesia and pain management?
5. What are the applications of Artificial Intelligence in anaesthesia and critical care?
6. Describe the anatomy, indications, procedure, and complications of stellate ganglion block.
7. Write short notes on:
    a. Remimazolam
    b. Esketamine
8. A 50-year-old man is admitted to the emergency department with hollow viscus perforation and peritonitis. He is being posted for emergency laparotomy. On preoperative assessment, he is found to be dehydrated and in shock (HR: 144/min, BP: 80/40). His ABG is pH: 7.3, pCO2: 28 mmHg, HCO3: 11meq/L, Lactate: 5mmol/L.
    a. How will you resuscitate him?
    b. Critically appraise the role of monitoring lactate in critically ill patients.
9. A 40-year-old lady is planned for right modified radical mastectomy. Describe various modalities of pain relief, including nerve blocks that is available for this procedure.
10. Describe the working principles and use of near infra-red spectroscopy (NIRS) in anaesthesia and critical care.

Annexure 1 (Part A)

Levels of performance: 1-knows; 2-can do with strict supervision; 3- can do with loose supervision; 4-can do independently; 5-can teach

Key Capabilities in practice of Anaesthesiology

S.no	Key Capabilities	Minimum expected level of performance at various time points					
		1st Sem.	2nd Sem.	3rd Sem.	4th Sem.	5th Sem.	6th Sem.
1	**Anaesthetic Physiology**						
1a.	To describe the physiology of the following organs systems relevant to Anaesthesiology: Central Nervous System (CNS), Cardiovascular system (CVS), Respiratory System (RS), Renal & Endocrine system, Gastrointestinal & Hepatobiliary system, Autonomic nervous system	1				5	
1b.	To describe Physiological changes in Pregnancy	1				5	
1c.	To describe Neonatal & Paediatric Physiology		1			5	
1d.	Implications of Neuromuscular Junction	1				5	
1e.	Acid-Base System of humans	1				5	
1f.	Thermoregulation in adults, neonate and children		1			5	
1g.	Distribution of Water in Human body	1				5	
1e.	To describe the Electrolyte Balance		1			5	
2	**Anaesthetic Anatomy**						
2a.	To acquire knowledge on Anatomy of the Airway	1				5	
2b.	Anatomy of Cervical, Thoracic, Lumbar spines	1				5	
2c.	Anatomy of Intrathecal, Epidural & Paravertebral Spaces	1				5	
2d.	To acquire knowledge on Anatomy of Brachial Plexus		1				5
2e.	Anatomy of Sympathetic Plexuses in humans			1			5
2f.	To acquire knowledge on Anatomy of Great Veins & Arteries		1				5

Levels of performance: 1-knows; 2-can do with strict supervision; 3- can do with loose supervision; 4-can do independently; 5-can teach

S.no	Key Capabilities	Minimum expected level of performance at various time points					
3	**Anaesthetic Pharmacology**						
3a.	Pharmacokinetics & Pharmacodynamics of Intravenous Fluids (Crystalloids & Colloids)	1				5	
3b.	Pharmacokinetics, Pharmacodynamics, Mechanisms of action, adverse effects, contraindications, uses, and drug interactions of Intravenous Anaesthetic agents	1				5	
3d.	Pharmacokinetics, Pharmacodynamics, Mechanisms of action, adverse effects, contraindications, uses, and drug interactions of Inhalational Anaesthetic agents	1				5	
3e.	Pharmacokinetics, Pharmacodynamics, Mechanisms of action, adverse effects, contraindications, uses, and drug interactions of Analgesic Drugs		1			5	
3f.	Pharmacokinetics, Pharmacodynamics, Mechanisms of action, adverse effects, contraindications, uses, and drug interactions of Skeletal Muscle Relaxants and their antagonists		1			5	
3g.	Pharmacokinetics, Pharmacodynamics, Mechanisms of action, adverse effects, contraindications, uses, and drug interactions of Anticholinergics		1			5	
3h.	Pharmacokinetics, Pharmacodynamics, Mechanisms of action, adverse effects, contraindications, uses, and drug interactions Vasopressors, Inotropic Agents		1				5
4	**Anaesthesia Workstation**						
4a.	Type of Breathing Systems	1				5	
4b.	Type, Design and functioning of Vaporisers	1				5	

Levels of performance: 1-knows; 2-can do with strict supervision; 3- can do with loose supervision; 4-can do independently; 5-can teach

S.no	Key Capabilities	Minimum expected level of performance at various time points					
4c.	Various types of Gas Cylinders	1				5	
4d.	Safety features in Anaesthesia Workstation		1				5
4e.	Hypoxia Prevention Systems		1				5
4f.	Flow Meters	1				5	
4g.	Pre-Anaesthetic Check-up of Anaesthesia Machine	1		5			
5	**Pre-Anaesthetic Evaluation**						
5a.	Airway Evaluation	1	2		4	5	
5b.	Assessment of patient pertaining to the specific pathology	1			4		
5c.	Assessment of Common Non-communicable diseases	1	2				
5d.	Ordering of appropriate Investigations	1	2				
5e.	Interpretation of ECG, CXR and other laboratory investigations		1				
5f.	Pre-operative Optimisation		1	2	3	4	5
5g.	Stratifying the perioperative risk of the patient (Cardiac, Pulmonary, CNS individualised to each patient's pathology)		1	2	3	4	5
5h.	Assessment of Effort Tolerance	1			4	5	
5i.	Perioperative Thromboprophylaxis and its bridging		1	2	3	4	
5j.	Continuation & Discontinuation of various drugs during perioperative period		1	2	3	4	
6	**Perioperative Monitoring**						
6a.	Use of standard monitoring devices with trouble shooting, including non-invasive blood pressure (BP) cuff, electrocardiogram (ECG), pulse oximeter, capnography, and temperature monitoring	1					5

Levels of performance: 1-knows; 2-can do with strict supervision; 3- can do with loose supervision; 4-can do independently; 5-can teach

S.no	Key Capabilities	Minimum expected level of performance at various time points					
6b.	Monitoring and Interpretation of data from arterial and central venous pressure monitoring		1			4	5
6c.	Neuromuscular monitoring (NMT) and EEG based monitors (BIS, Entropy)		1			4	
6d.	Advanced monitoring devices (e.g., motor evoked potentials [MEPs], somatosensory evoked potentials [SSEPs], cardiac output monitoring			1		4	
6e.	Advanced monitoring techniques for assessing cardiac function (e.g., pulmonary artery catheterization, trans-oesophageal echocardiography)						
6f.	Monitoring of ventilator parameters			1		4	
7	**Skills in Anaesthetic Practice**						
7a.	Intraoperative Fluid Management	1		2	3	4	
7b.	Administration of Blood & its Products	1		2	3	4	
7c.	To perform Spinal Anaesthesia	1		2	3	4	5
7d.	To perform Epidural Anaesthesia	1		2	3	4	5
7e.	To administer General Anaesthesia	1		2	3	4	5
7f.	To secure the airway with Endotracheal Tube (ETT) & Supraglottic Airway Device (SAD)	1	2	3	4		5
7g.	To perform intubation with Video-laryngoscope		1	2		4	
7h.	To perform Fibreoptic Guided Intubation			1	2	3	
7i.	To perform emergency invasive airway access				1	2	3
7j.	To administer total intravenous anaesthesia (TIVA)				1	2	3
7l.	To secure intraarterial catheter		1	2		3	4
7m.	To secure Central Venous Access		1	2		3	4

Levels of performance: 1-knows; 2-can do with strict supervision; 3- can do with loose supervision; 4-can do independently; 5-can teach

S.no	Key Capabilities	Minimum expected level of performance at various time points					
7n.	To perform Peripheral Nerve Blocks		1		2	3	4
7o.	To perform Fascial Plane Blocks		1		2		3
7p.	To obtain knowledge on Perioperative Ultrasonography		1		2		3
8	**Postoperative Care**						
8a.	To learn to provide Post-operative Pain Management	1	2		3	4	5
8b.	Post-operative Fluid Management	1	2				
8c.	Deep Breathing exercises		1	2	3	4	
8d.	Thromboprophylaxis			1	2	3	
8e.	Early ambulation		1	2	3		4
9	**Cardio-Thoracic Anaesthesiology**						
9a.	Preoperative Assessment of patient with Cardiac diseases			1	2	3	4
9b	Anatomy, Design & Physiology of Cardiopulmonary Bypass (CPB)			1	2	3	
9c.	Cannulation for initiation of CPB			1			
9d.	Preparation for Pre-CPB			1	2	3	
9e.	Anticoagulation during CPB & its monitoring			1	2	3	
9f.	Management during CPB			1	2	3	4
9g.	Monitoring during CPB			1	2	3	4
9h.	Checklist for Weaning from CPB			1	2	3	4
9i.	Deep Hypothermic Cardiac Arrest				1	2	
9j.	Physiological Changes with Cross Clamping of Aorta at different levels			1	2	3	
9k.	Postoperative care of patient undergoing Cardiac Surgery				1	2	
9l.	Physiology of One Lung Ventilation (OLV)			1	2	3	
9m.	Methods of Lung Isolation			1	2	3	

Levels of performance: 1-knows; 2-can do with strict supervision; 3- can do with loose supervision; 4-can do independently; 5-can teach

S.no	Key Capabilities	Minimum expected level of performance at various time points					
9n.	Intercostal drain and bottles systems			1	2	3	
9o.	Blood Conservation Strategies			1	2	3	
10	**Neuro-Anaesthesiology**						
10a.	To manage the patient with Traumatic Brain Injury (TBI)		1	2		3	
10b.	Measurement of Intracranial Pressure (ICP)				1		
10c.	To manage the Intra-operative Tight Brain			1	2	3	
10d.	To manage the Spine Surgery in Prone position			1	2	3	
10e.	To administer Barbiturate Coma				1	2	3
11	**Obstetric Anaesthesiology**						
11a.	To manage obstetric patient posted for Lower Segment Caesarean Section (LSCS)		1	2	3	4	
11b.	Airway management of pregnant woman				1	2	3
11c.	Postoperative Pain Management for LSCS		1	2	3	4	
11d.	To provide Labour Analgesia				1	2	3
11e.	Management of PPH			1	2	3	4
11f.	Cardio-pulmonary resuscitation of a pregnant woman			1	2	3	4
12	**Paediatric Anaesthesiology**						
12a.	Inhalation induction of a child				1	2	3
12b.	Oral premedication			1	2	3	4
12c.	Caudal Analgesia			1	2	3	4
12d.	Assessment of pain in a child			1	2	3	
12e.	Fluid management in a child			1	2	3	4
12f.	Difficult airway management in a child				1	2	3
12g.	To manage neonatal emergencies				1	2	3
12h.	Paediatric Sedation (CT,MRI,Cath lab)				1	2	3

Levels of performance: 1-knows; 2-can do with strict supervision; 3- can do with loose supervision; 4-can do independently; 5-can teach

S.no	Key Capabilities	Minimum expected level of performance at various time points					
13	**Pain Management**						
13a.	Assessment of a patient with acute & chronic Pain			1	2	3	
13b.	Prescription of Analgesia as per the need of the patient			1	2	3	
13c.	Basic Knowledge on Interventional Pain Management				1	2	
14	**Critical Care**						
	Basics of Mechanical Ventilation		1	2	3		4
	Basic care of critically ill patient		1	2	3		
	Cardiopulmonary Resuscitation		1	2	3	4	5
	Resuscitation of patient with Shock			1	2	3	4
	Blood Gas Analysis		1	2	3	4	
	Ultrasonography of Lungs		1	2	3	4	
	Perioperative Ultrasound		1	2	3		

Learning Objectives for Key Capabilities

1. Anaesthetic Physiology

- Must describe the constituents of intracranial space, cerebral autoregulation, cerebro-spinal fluid production (CSF) and its path of flow, specific gravity, biochemical properties of CSF.
- Must describe about the cardiac cycle, determinants of cardiac output, systolic & diastolic blood pressure, factors affecting vascular tone and delivery of blood flow to the end-organs.
- Should describe the anatomy (lobes & segments in each lung), blood supply of each lung, physiology of gas exchange, factors affecting airway tone, lung volumes and capacities with their anaesthetic implications, and about hypoxic pulmonary vasoconstriction.
- Must describe the blood supply and regulation of blood flow to the kidneys, about glomerular filtration rate (GFR) and its implications in anaesthetic practice.
- Should describe the autoregulation of blood flow to liver and function of the liver, interpretation of the liver function tests.
- Should describe the assessment of sympathetic & parasympathetic systems

2. Anaesthetic Anatomy

- Should describe anatomy of cervical, thoracic, lumbar, and sacral spines
- Should describe anatomy of the spinal cord, nerve roots, dermatomes
- Should describe the innervation of various parts of the human body
- Should describe the blood supply of the spinal cord & autoregulation
- Should describe the anatomy of intrathecal space
- Must describe the anatomy of epidural space
- Should describe the anatomy of paravertebral space
- Should describe the Anatomy of Airway
- Should describe the blood supply and innervation of the airway
- Should describe the anatomy of the brachial plexus and innervation of the upper limb by the nerve roots
- Should describe the innervation of the lower limb by the nerve roots
- Should describe the anatomy of sympathetic plexus in the body and their functions

3. Anaesthetic Pharmacology

- Should describe composition of various IV fluids, distribution of IV fluid in the body after administration, pharmacokinetics of IV fluids
- Should master pharmacokinetics, pharmacodynamics, mechanisms of action, adverse effects, contraindications, uses, and drug interactions of IV induction agents, skeletal muscle relaxants and opioids
- Should describe pharmacokinetics, pharmacodynamics, mechanisms of action, adverse effects, contraindications, uses, and drug interactions of inhalational anaesthetic agents
- Should describe pharmacodynamics of inotropes and vasopressors, their dosage and preparation as per patient's body weight

4. Anaesthesia Workstation

- Should describe types of Mapleson's breathing systems and their functional analysis
- Must describe type of vaporisers, designing and functioning of vaporisers, and safety features in vaporisers
- Should identify the types of gas cylinders and their flow meters
- Must describe the safety features in anaesthesia workstation that can prevent in delivery of hypoxic gas mixtures and delivery of inadequate depth of anaesthesia
- Should describe the pre-use check-up of anaesthesia workstation

5. Pre-Anaesthetic Evaluation

- Acquire knowledge in history taking and physical examination, ordering and interpreting investigation in normal patients undergoing surgeries.
- Should be able to categorise the perioperative risk as per ASA physical status and should be able to assess the effort tolerance
- Should be able to perform cardiac, pulmonary, and renal risk stratification during peri-operative period.
- Must assess the severity of the comorbid conditions and advise required optimization before surgery in various specialties.
- Should be able to assess and risk stratify the patients undergoing cardiac surgery, thoracic surgery, neurosurgery, and critically ill patients coming for surgery.
- Should be able to order appropriate investigations and be able to interpret them.
- Should be able to decide which medications to be continued or discontinued during perioperative period.

- Should be able to risk stratify patients at risk of developing deep venous thrombosis and start on thromboprophylaxis during perioperative period. Should be able to bridge anticoagulation during perioperative period.

6. Perioperative Monitoring

- Basic principles of the standard anaesthesia monitoring devices should be understood and its applications in the daily anaesthesia practice
- Knowledge regarding setting up and requirement of anaesthesia specific monitoring devices on case-to-case basis
- Early identification of the problem by vigilant monitoring of the available standard monitors, and resolution
- Describe the importance of availability of anaesthesia person throughout the peri-operative period.
- Knowledge regarding minimum monitoring requirements during transport.
- Complete documentation of the anaesthesia record with vital parameters, monitoring devices used.
- Complete knowledge of the interpretation of the waveforms like spirometry, arterial, ventilator graphics, vital parameter waveforms.
- Communication and actively involvement in the discussion with colleagues regarding perioperative monitoring and its requirements.
- Knowledge regarding limitations of the perioperative monitoring devices and its clinical implications and troubleshooting of the monitors.

7. Skills in Anaesthetic Practice

- Should have knowledge on available IV fluids in medical practice, their composition, rate of infusion and their adverse consequences.
- Should acquire knowledge on various blood and its products, their indications, complications & their management, massive transfusion protocol.
- Should acquire knowledge on anatomy of the central neuroaxis, anatomy of spines, dermatomal & myotomal innervations by the nerve roots.
- Should master in performing the central neuroaxial block (Subarachnoid anaesthesia, Epidural analgesia & anaesthesia), the required equipment, sterile precautions, physiological consequences, complications, and their management.

- Should learn to preoxygenate the patient, induce, and maintain general anaesthesia, able to provide optimal analgesia and reverse the loss consciousness at the end of the surgery.
- Should acquire knowledge on airway anatomy, should be able to open the obstructed upper airway.
- Should acquires skills on facemask ventilation, placement of SAD, and ETT.
- Should be able to utilise the videolaryngoscope for patients with difficult airways.
- Should describe using the FOB, anaesthetising the airway, performing FOB guided intubation in an anaesthetised as well as awake patient who has difficult airway and/or compromised airway.
- Should be able to perform emergency airway access whenever there is situation of cannot ventilate and cannot intubate.
- Should have knowledge on various models of TIVA and should be able to administer TIVA.
- Must acquire knowledge on anatomy & course the arteries and able to cannulate them for continuous intra-arterial blood pressure monitoring.
- Should have knowledge on anatomy & course of great veins (Internal Jugular Veins, subclavian veins, and femoral veins). Should master in securing central venous access (CVC) by landmark technique and with real-time ultrasonography guidance.
- Should acquire knowledge on the anatomy of the peripheral nerves and plexus; should be able to perform the peripheral nerve blockade by USG and peripheral nerve stimulator guidance.
- Should have knowledge on fascial planes that supply sensory nerves to various dermatomes and able to perform fascial plane blocks to supplement analgesia.
- Should acquire knowledge to utilise ultrasonography (USG), Colour Doppler and its knobology. Should learn perioperative USG to diagnose the probable cause for hemodynamic instability, for cannulation of great veins and arteries, to perform peripheral nerve blockade and to perform fascial plane blocks.

8. Postoperative Care

- Should acquire knowledge to assess the postoperative pain in an awake as well as patient who are sedated and prescribe analgesics to the alleviate the acute pain.
- Should have knowledge to provide multimodal analgesia as per the requirement of the patient.

- Should be able to prescribe the required postoperative fluid.
- Should be able to teach deep breathing exercises, incentive spirometry in preoperative and postoperative period.
- Should acquire knowledge to stratify the risk of developing DVT and start non-pharmacological and/or pharmacological thromboprophylaxis in the postoperative period.
- Should encourage early oral/enteral feed in the postoperative period.
- Should encourage early ambulation in the postoperative period.

9. Cardio-Thoracic Anaesthesiology

- Should be able to assess the patients with cardiac diseases.
- Should be able to interpret echocardiography reports of these patients.
- Should describe anatomy of cardio-pulmonary bypass (CPB) circuit and its assembly.
- Should acquire knowledge on physiology of CPB.
- Should describe the constituents of cardioplegia and types of cardioplegia.
- Should describe order of cannulation of the Aorta and great venous system.
- Should be able to provide appropriate anticoagulation and its monitoring during CPB.
- Should acquire knowledge on pre-bypass, on bypass and weaning checklists.
- Should describe anaesthetic implications of deep hypothermic arrest.
- Should acquire knowledge on the haemodynamic changes to clamping of Aorta at the different levels and to initiate appropriate therapy to counter the changes in haemodynamics.
- Must describe the care of post-cardiac surgery patient.
- Should be able to provide lung isolation wherever indicated and should have knowledge on physiology of one lung ventilation.
- Should acquire knowledge on intercostal drains and drainage bottle systems.
- Acquire knowledge on blood conservation strategies.

10. Neuroanaesthesiology

- Should learn the effect of drugs and inhalational agents on cerebral blood volume and flow, intracranial pressure, cerebral metabolic rate of oxygen.
- Should learn complete neurological examination.

- Should learn the management of neurosurgery for space occupying lesions (SOLs)/ brain tumours (supratentorial and infratentorial), neurovascular lesions (intracranial aneurysms), spinal cord pathologies, spinal cord trauma, posterior fossa lesions, skull base lesions, stroke, pituitary lesions.
- Should learn the management of acute neurological emergencies like traumatic brain injury, aneurysm
- Should have knowledge regarding imaging related to CNS and distinguish imaging characteristics of SAH, epidural hematomas, subdural hematomas, intra - parenchymal haemorrhage and relate to anatomic structure
- Should have knowledge related to anaesthesia for MRI including problems of magnetic fields.
- Should have the knowledge regarding principles of neurological monitoring like ICP (intracranial pressure), Evoked potentials, EEG based monitoring (BIS, ENTROPY) and its clinical implications and management.
- Should learn the management of paediatric neurosurgery for congenital hydrocephalus, encephaloceles/ meningomyeloceles, craniosynostosis, neural tube defects and other congenital brain and spinal cord deformities and paediatric brain tumours.
- Should learn the difficult airway management related to neurosurgical patients like cervical spinal cord, acromegaly.
- Should learn the perioperative cerebral protection strategies, fluid and electrolyte balance and its clinical implication in case to case basis.
- Should learn the positioning (supine, prone, sitting, lateral), clinical implications related to positioning.
- Should learn resuscitation of a head injured, spinal cord injury and use of minimal invasive, invasive hemodynamic monitoring techniques, techniques for detection and management of air embolism.
- Management of a brain-dead donor.
- Should learn Scalp block and other relevant nerve block techniques.

11. Obstetric Anaesthesiology

- Should learn regarding the anatomy and pathophysiological changes associated with pregnancy on various organ systems and the impact of those changes on the conduct of anaesthesia.
- Complete understanding of the pain pathway of the stages of labour and effective management of labour analgesia by various techniques.
- Complete understanding of the advantages and disadvantages of the general, regional anaesthesia in different risk groups of labouring women and appropriate decision making on case to case basis.
- Placement and Management of Spinal, Epidural Analgesia and pharmacological effects of drugs used should be understood.
- Should learn perioperative care and anaesthesia management in obstetric patient with cardiac disease, pregnancy induced hypertensive diseases, specific valvular cardiac disease, cardiomyopathy of pregnancy, acute fatty liver of pregnancy including indications for placement of invasive monitoring.
- Should learn anaesthetic considerations of the pregnant patient for non-obstetrics surgery in different trimester.
- Recognize and knowledge regarding anaesthetic considerations for obstetric emergencies like antepartum haemorrhage, post-partum haemorrhage, amniotic fluid embolism, ectopic pregnancy.
- Should follow aspiration prophylaxis, rapid sequence induction and management of pulmonary aspiration during general anaesthesia
- Should learn difficult airway management of pregnant patients, failure to intubate algorithm and equipment needed.
- Complete knowledge of the indications, contraindications, and side effects of anaesthetic drugs and pharmacological agents effecting uterine tonicity.
- Should have knowledge regarding, Foetal evaluation and monitoring
- Knowledge of the fluid management, drug interactions of anaesthesia drugs with other drugs should be known.
- Should learn the effects of anaesthesia drugs on foetus through uterine placental transfer during pregnancy.
- Should learn resuscitation guidelines of the pregnant patient including the neonate.
- Should have knowledge regarding caesarean section indications and urgency.

12. Paediatric Anaesthesiology

- Should be able to prescribe oral premedication.
- Should be able to induce the child with inhalational induction.
- Should describe anatomy of caudal space, procedure to perform caudal block.
- Should acquire knowledge to assess the pain in a child and provide analgesia as required during perioperative period.
- Should acquire knowledge on requirement of fluid and electrolytes in children at various age groups and prescribe accordingly.
- Should be able to assess the airway of a child and predict difficult airway.
- Able to plane for managing child with difficult airway.
- Should have knowledge on neonatal physiology and should be able to manage neonatal emergencies under supervision.
- Should have knowledge on limitations of providing sedation in non-operating room anaesthesia like CT, MRI, catheterization lab procedures; should be able to provide sedation at appropriate doses without resulting in airway obstruction.

13. Pain Management

- Must be able to assess the intensity and source of acute and chronic pain.
- Should be able to advice analgesics as per the need of the patient.
- Should have indications, contraindications, complications of interventional pain management.

14. Critical Care

- Should acquire knowledge on basics of mechanical ventilation.
- Should be able to provide care of critically ill patients
- Should excel in cardiopulmonary resuscitation (CPR) and should be able to teach CPR to the medical and non-medical personnel
- Should be able to resuscitate patients with shock
- Able to interpret blood gas reports and intervene as required.
- Acquire knowledge on basics of USG of lungs.
- Should acquire knowledge on perioperative USG for vascular cannulation, to assess LV function and able to assess the probable cause for haemodynamic instability.

Annexure 1 (Part B)

Core ideas for the mentioned key capabilities

S.no	Core ideas for the mentioned key capabilities	1st Sem.	2nd Sem.	3rd Sem.	4th Sem.	5th Sem.	6th Sem.
1.	**Basic Sciences** Anaesthetic Physiology Anaesthetic Anatomy Anaesthetic Pharmacology Anaesthesia Workstation Perioperative Monitoring	1	2	3		4	
2.	**Perioperative Care** Pre-anaesthetic evaluation Ordering of appropriate investigations Preoperative optimisation Choosing appropriate type of anaesthesia for the proposed intervention Developing skill to perform the required procedures Management of anticipated and unanticipated complications during perioperative period Postoperative Pain management Postoperative care	1	2	3		4	
3.	**Anaesthesia for subspecialties** Cardiovascular anaesthesia Thoracic anaesthesia Neuroanaesthesia Paediatric anaesthesia			1	2	3	4

S.no	Core ideas for the mentioned key capabilities	1st Sem.	2nd Sem.	3rd Sem.	4th Sem.	5th Sem.	6th Sem.
	Obstetric anaesthesia Anaesthesia for organ transplantation Anaesthesia for Laparoscopic surgery Anaesthesia for Hepato-biliary & Gastrointestinal surgeries Anaesthesia for reconstructive surgeries Anaesthesia for robotic assisted surgeries Anaesthesia for endoscopic interventions Non-Operating Room Anaesthesia						
4.	**Skills to be acquired** Subarachnoid block Epidural anaesthesia Peripheral nerve block Vascular cannulation Placement of SAD Laryngoscopy and Intubation Videolaryngoscopic guided intubation Fibreoptic bronchoscopic guided intubation Invasive airway access	1	2	3	4		5
5.	**Pain Management** Assessment of patients with acute & chronic pain Pharmacological Pain management Basics of Interventional Pain			1	2	3	4

S.no	Core ideas for the mentioned key capabilities	1st Sem.	2nd Sem.	3rd Sem.	4th Sem.	5th Sem.	6th Sem.
	management						
6.	**Critical Care** Care of a critically ill patient Cardiopulmonary Resuscitation Defibrillation & Synchronised Cardioversion Basics of Mechanical Ventilation Assessment & management of a patient with shock, Interpretation of blood gas analysis		1	2	3	4	

Learning objectives for Core ideas

1. Basic Sciences

Anaesthetic Anatomy

- Relevant anatomy of respiratory system involved in gas exchange process, diaphragm, larynx, and upper and lower airway.
- Relevant anatomy of cardiovascular and central nervous systems.
- Anatomy of musculoskeletal system and neuromuscular transmission.
- Learn relevant anatomy of peripheral nerves and surface anatomy for regional anaesthesia and venous cannulations.
- Anatomical areas of interest to the anaesthetist are orbit of the eye, base of skull, vertebral column, spinal cord, and meninges, axilla.

Anaesthetic Physiology

- Theories of mechanism of production of anaesthesia.
- Respiratory, cardiovascular. hepatobiliary, renal, and endocrine system.
- Pregnancy, blood coagulation
- Muscle & neuromuscular junction
- Regulation of temperature & metabolism, stress response
- Cerebral blood flow and ICP

Principles of physics and use of equipment in anaesthesia

- Anaesthesia delivery system - checking the machine and assembly of necessary items (daily checklist).
- Airway equipment including tracheostomy/equipment for airway management –anatomical facemask, oropharyngeal or nasopharyngeal airway, supraglottic airway devices (PLMA, i-gel, Air-Q, LMA supreme, etc), videolaryngoscopes, fibreoptic laryngoscope, emergency cricothyrotomy (needle cannula and Melker's cricothyrotomy) and manujet/automatic jet ventilator.
- Breathing systems - continuous flow systems, draw over system - Assembly and checking.
- Monitoring in anaesthesia with concepts of minimal monitoring.
- Safety in anaesthesia equipment.
- Medical gases - storage and central pipeline system.
- Medical gases - gas plant, central pipeline, scavenging system.
- Reducing valves
- Anaesthesia delivery systems and workstations, Humidifiers
- Flowmeters
- Vaporizers - Characteristics and functional specifications.
- Breathing systems –Assembly, functional analysis. APL and flow directional valves.
- Minimum monitoring standards requirements.

Anaesthetic Pharmacology

- General pharmacological principles.
- Concepts of pharmacokinetics and pharmacodynamics.
- Uptake and distribution of inhaled anaesthesia agents.
- Drugs used in anaesthesia
- Drugs used for treatment of diseases and interaction of these drugs with anaesthetic drugs.
- Pharmacology of drugs used in cardiovascular, respiratory, endocrine, renal diseases, and CNS disorders.
- Principles of monitoring equipment used for assessment of
    i. Cardiac function viz. rhythm, pulse, venous and arterial pressures, cardiac output.

ii. Temperature
iii. Respiratory function: rate, volumes, compliance, resistance, plateau pressure, driving pressure
iv. Intracranial pressure, depth of anaesthesia
v. Neuromuscular block.

2. Perioperative Care

- Preoperative assessments and medication - General principals.
- Theoretical background of the commonly used anaesthetic techniques of general and region anaesthesia viz.
    i. GA - Intravenous, inhalational, endotracheal etc. using spontaneous and controlled mode ventilation.
    ii. RA – Spinal, epidural, combine spinal and epidural (CSE)
    iii. Local anaesthesia
    iv. Tumescent anaesthesia
    v. Monitored anaesthesia care
    vi. Effect of positioning
- Oxygen therapy
- Introduction to the operation theatre, concepts of PACU and ICU
- Recovery from anaesthesia.
- Biochemistry relevant to Anaesthesiology
    i. Fluid balance &blood and blood component transfusions, artificial blood &perioperative fluid therapy.
    ii. Acid base homeostasis in health and diseases.
- Theoretical background on disorders of
    i. Cardiovascular system.
    ii. Respiratory system
    iii. Hepatobiliary system.
    iv. Genito-Urinary system.
    v. Endocrine system
    vi. Pregnancy.
- Documentation and medico-legal aspects of anaesthesia. Stress the importance of accurate documentation.

- Anatomical, physiological, pharmacological, and biochemical aspects of pain and pain management.

3. Anaesthesia for Subspecialties

- Anaesthetic management in special situations - Emergency, ENT, Ophthalmology, Obstetrics, Obstetric analgesia. Plastic, Dental, Radio-diagnosis and Radiotherapeutic procedures and patients with systemic diseases.
- Special anaesthetic techniques as relevant to outpatient anaesthesia, hypotensive anaesthesia, anaesthesia in abnormal environments and calamitous situations.
- Paediatrics — Prematurity, Physiology, anatomy of neonate vs. adult.
- Principles of paediatric anaesthesia, management of neonatal surgical emergencies, regional anaesthesia in infants.
- Basics of orthopaedic anaesthesia.
- Day care anaesthesia.
- Rural anaesthesia - anaesthesia for camp surgery.
- Anaesthesia for otorhinolaryngology with special emphasis on difficult airway management.
- Blood and blood component therapy. Anaesthetic implications in coagulation disorders.
- Monitored anaesthesia care.
- Anaesthetic implication in diabetic mellitus, thyroid, parathyroid disorders, phaeochromocytoma, and Cushing's disease.
- Principles of geriatric anaesthesia
- Anaesthesia outside the OR and in special situation
- Principle of management in Trauma and mass casualties
- Anaesthetic management of neuro-anaesthesiology, cardiac anaesthesiology, thoracic, vascular and transplantation anaesthesiology.
- Principles and protocols of management of patients in critical care unit
- Principles of neonatal ventilation and critical care.
- Principles of human resources and material management.
- General principles of medical audit
- Principles of one lung ventilation (OLV) and methods of achieving OLV

4. Skills to be acquired

- Plan and conduct anaesthesia, recovery, and postoperative pain relief for elective and emergency surgery 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 unconscious patients

  Airway management and long-term management of unconscious patient.
- Care of critically ill patient.
- Management of patients suffering from chronic intractable pain.
- Organize the Hospital environment to manage mass casualty situation.
- Critically review and acquire relevant knowledge from the journals about the new development in the specialty.
- Should be able to participate in anaesthesia audit.

5. Pain Management

- Assessment of patients with acute & chronic pain
- Ability to prescribe analgesics as per the source of origin of pain
- Basics of interventional pain management

6. Critical Care

- Cardiopulmonary Resuscitation:
  i. Theories of cardiac pump, thoracic pump, and defibrillation.
  ii. Basic life support and advanced cardiac life support according to recent guidelines published by American Heart Association.
  iii. Resuscitation of a patient with overdose of drug/poisons.
  iv. Management of unconscious patient.
- Resuscitation of a severely injured patient.
- Neonatal resuscitation.
- Basics of mechanical ventilation.
- Shock – pathophysiology, clinical diagnosis, and management

Annexure 2

Consolidated List of Procedures

S. No	Procedure	I Year	II Year	III Year
1.	Airway management –Use of anatomical facemask, oropharyngeal or nasopharyngeal airway			
2.	Airway management with oral Endotracheal Tube			
3.	Airway management with Supraglottic Airway Device			
4.	Nasal intubation			
5.	Intubation with Video laryngoscope			
6.	Fibreoptic guided intubation			
7.	Failed intubation drill			
8.	Airway anaesthesia techniques			
9.	Double Lumen Tube placement			
10.	Bronchial Blocker placement			
11.	Jet Ventilation			
12.	Emergency invasive airway access			
13.	Intubation in Neonates and paediatric patients			
14.	Spinal anaesthesia			
15.	Epidural anaesthesia			
16.	Combined spinal epidural			
17.	Brachial Plexus Block			
18.	Peripheral Nerve Blocks			
19.	Fascial Plane Blocks			
20.	Caudal block			
21.	Radial and Femoral Artery cannulation			
22.	Neuro-muscular transmission Monitoring			

23.	Anaesthetic Depth monitoring			
24.	Central venous cannulation			
25.	Perioperative Ultrasonography for ultrasound of lung, FAST, Echocardiography			
26.	Transoesophageal echocardiography			
27.	Total intravenous anaesthesia (TIVA)			
28.	Suctioning and physiotherapy of wet lung			
29.	Humidification techniques			
30.	Initiation and management of ventilation			
31.	Extubation techniques			
32.	High flow nasal oxygenation			

Annexure 3

Workplace assessment form

Place of posting: UNIT 1 / 2 / 3 Reporting time: on time/late

Number of leaves taken: authorised: Unauthorised

absenteeism, if any

Duration of posting: From ……. To …….

	Scores	0	1	2	3
	Score 0- Not attempting to meet expectations **Score 1-** Attempting to, but yet to meet expectations **Score 2-** meets expectations **Score 3-** Proficient, independently exhibits responsibility and standards beyond minimum expectations				
1	Displays adequacy of literature search and justifies rationale for management and surveillance				
2	Maintains Meticulousness and Comprehensiveness of Records-in ➢ File and Digital data management				
3	Communication with patient and care taker				
4	Team-based work and Leader ship ➢ Coordinates with Seniors and Colleagues ➢ Shows interest in teaching juniors				
5	Accepts feedback, self reflects and demonstrates willingness to change				
	Total marks (Maximum possible marks =30)				
	Logbook Scoring (20 marks)				
Signature of Faculty					