COMPETENCY BASED POSTGRADUATE TRAINING PROGRAMME

FOR

DM- CARDIAC ANAESTHESIA

AT

AIIMS NAGPUR

Program Outcomes

- An understanding of the pathophysiology of acquired and congenital heart diseases
- The expertise for the anaesthetic management of acquired and congenital heart diseases.
- The knowledge and skill for the postoperative intensive care management of both adult and pediatric cardiac surgical patients.

AIMS AND OBJECTIVES

Super specialty-oriented Goals

The goals of the 3-year DM course in Cardiothoracic and Vascular Anaesthesia are to train a qualified MD/DNB in Anaesthesia to:

- Practice independently and ethically in Cardiothoracic and Vascular Anaesthesia and perioperative care, with a strong foundation in scientific knowledge and skills.
- Manage responsibilities in surgical suites, postoperative ICUs, and related specialties such as Cardiology and Cardiac Radiology for perioperative and procedural care.
- Stay updated on advancements in the specialty and demonstrate a commitment to continuous professional development.
- Serve as a motivated teacher, eager to train and share knowledge with peers and learners.
- Address community health needs ethically, in alignment with national health policies.
- Cultivate a spirit of scientific inquiry with skills in research methodology and epidemiology.

Super specialty-oriented Objectives

The objectives laid out to reach the goals of the DM program in Cardiothoracic and Vascular Anaesthesia may be categorized as follows:

- Knowledge (Cognitive domain)
- Skills (psychomotor domain)
- Attitude, communication abilities, human values and ethical practice

A candidate registered for the DM program should achieve these objectives by the completion of training program. Thus, at the completion of training the candidate must be able to:

Cognitive Domain

S.No.	Competencies
1.1	Demonstrate understanding of the basic sciences relevant to Cardiothoracic and Vascular Anaesthesia.
1.2	Reveal comprehension of the anaesthetic management of common and uncommon surgical conditions related to cardiac, thoracic, and vascular diseases, in patients of all age groups, with thorough knowledge of the etiology, pathophysiology, and surgical treatment of the disease state.
1.3	Describe the theory underlying the etiology, mechanism, and management of critical conditions requiring cardiopulmonary-cerebral resuscitation.
1.4	Demonstrate understanding of principles, pathophysiology, components, conduct, and complications of cardiopulmonary bypass and cardiac assist devices.
1.5	Show understanding of the principles, pathophysiology, and complications of major vascular surgery.
1.6	Assimilate and practice principles of critical care in postoperative cardiac, thoracic, and vascular surgical intensive care units and cardiology care units.
1.7	Recognize disease conditions beyond the area of competence and follow the appropriate referral mechanism prior to subjecting the patients to anesthesia.
1.8	Provide advice regarding the anaesthetic management of cardiac, thoracic, and vascular surgical cases and conduct this management effectively.

S.No.	Competencies
1.9	Regularly update knowledge through self-study, attending CMEs, workshops, conferences, and seminars relevant to the specialty.
1.10	Teach and guide team colleagues, students, and paramedical staff.
1.11	Reveal understanding of medicolegal aspects of cardiothoracic and vascular anesthesia.
1.12	Demonstrate knowledge of administrative aspects of the Cardiothoracic and Vascular Operation Suite complex.
1.13	Undertake audit, use information technology media, and conduct research, both clinical and biomedical, publishing work and presenting at various scientific events.

Psychomotor Domain

S.No.	Competencies
2.1	Evaluate patients scheduled for cardiac, thoracic, and vascular surgery in the preoperative period by taking relevant history, examining the patient, ordering relevant investigations, and interpreting them to obtain additional information about surgical conditions or associated medical conditions, which necessitates modifications of the proposed anesthetic management.
2.2	Administer appropriate anesthesia to cardiac, thoracic, and vascular surgical procedures independently.
2.3	Perform invasive procedures necessary for optimal patient care during the perioperative period.
2.4	Provide basic and advanced cardiac life support.
2.5	Demonstrate intensive care skills necessary for management of patients in postoperative cardiac, thoracic, and vascular surgical intensive care units and cardiology care units.
2.6	Shoulder responsibility for patient monitoring in the perioperative period.
2.7	Adapt ethical principles, professional honesty, and integrity in all aspects of cardiothoracic and vascular anesthesia practice.
2.8	Deliver anesthesia care in all needs of the specialty, irrespective of the social status, caste, creed, or religion of the patient.

S.No.	Competencies
2.9	Develop communication abilities in explaining the various options available in anesthetic management, critical care, and pain management, and obtain true informed consent from patients.
2.10	Provide leadership in the operating suite and get the best out of teamwork in a congenial working atmosphere.
2.11	Apply high moral and ethical standards while carrying out human and animal research.
2.12	Be humble and accept limitations in knowledge and skill, and ask for help from colleagues when needed.
2.13	Respect patient's rights and privileges, including the right to information and the right to seek a second opinion.

Affective Domain

S.No.	Competencies
3.1	Adopt ethical principles in all aspects of Cardiothoracic and Vascular Anesthesia practice/research, including professional honesty, integrity, and humility.
3.2	Demonstrate respect, compassion, and integrity while dealing with patients, their relatives, and support staff.
3.3	Develop the skill of listening patiently to the concerns of patients and their families and respect their wishes and treatment decisions.
3.4	Educate and counsel patients effectively and empathetically.
3.5	Demonstrate the ability to lead the consult service through interactions with referring and primary doctors and multimodality teams.
3.6	Understand teamwork, including effective and equitable distribution of roles among team members, and lead a surgical team in both emergency and elective settings.
3.7	Develop mutual respect and effectively interact with professional colleagues in ancillary branches to plan effective multimodality treatment plans.
3.8	Be a sound and effective communicator and teacher, and be able to teach the basic concepts of Cardiothoracic and Vascular Anesthesia to undergraduate and postgraduate students as well as support staff.

S.No.	Competencies
3.9	Understand the importance of and perform the required documentation and follow-up of patients.
3.10	Adhere to ethical standards and maintain professionalism while using social media platforms for teaching, learning, and communicating.
3.11	Develop skills for effective public health communication and education using various tools.
3.12	Maintain the highest ethical standards in both clinical practice and research.
3.13	Independently manage emergency situations related to cardiovascular diseases and associated procedures/surgeries.
3.14	Perform administrative tasks such as auditing patient care and surgeries, morbidity, and mortality assessment, and present these in departmental meetings.
3.15	Develop public speaking and interactive skills required to effectively present institutional data and research at national and international conferences and forums.
3.16	Develop an aptitude for establishing, developing, and leading a new Cardiothoracic and Vascular Anesthesia department.
3.17	Be humble and accept limitations in knowledge and skills to ask for help from colleagues when needed.

SELECTION OF CANDIDATES

Eligibility

Candidate seeking admission for D.M course in Cardiac Anaesthesia must possess recognized postgraduate degree of MD in Anaesthesia from INI / NMC recognized institute (or its equivalent recognized degree).

SELECTION OF CANDIDATES

The selection shall be through the entrance test conducted by the competent authority.

Duration of the study

For this postdoctoral course, the training shall be of 3 years duration and will follow the full-time residency pattern. During these years, the candidate shall work as senior

resident, who will perform clinical, teaching, research and administrative activities as prescribed in the curriculum.

COURSE SYLLABUS

DETAILED SYLLABUS

BASIC SCIENCES

- ANATOMY: Cardiac embryology, development of heart, pulmonary and vascular anatomy, coronary artery anatomy
- PHYSIOLOGY: Cardiac cellular physiology, hemodynamic, autonomic nervous system, cardiac functions, blood physiology, coagulation cascade and cardiac action potential.
- Cardiac arrhythmias
- Pulmonary: Pulmonary physiology, Pulmonary function tests, blood gas analysis, physiology of ventilation.
- Pulmonary airway mechanics, one lung ventilation. Thoracotomy and pulmonary physiology. Renal, hepatic, CNS, endocrinal system, others, metabolic effects of surgery, Endocrines response to anaesthesia and surgery
- PATHOPHYSIOLOGY: Heart failure, congenital defects, COAD, cardiopulmonary reserves, acquired cardiac & pulmonary diseases. Vascular pathology.
- Immunological response, metabolic response during CPB
- PHARMACOLOGY: Total circulatory arrest. Pharmacokinetics & Phramacodynamics of Anaesthetic and vasoactive drugs. Biochemical reactions, applied concepts. Drugs related to anaesthesia practice. Cardiovascular drugs. Bronchodilators
- Current concepts in antibiotic usage. Anti-arrhythmic drugs, nitric oxide
- PHYSICS: Basic concepts. Analyzing, measuring & monitoring devices, electronics, computing of patients data. Laser in cardiac surgery, robotic technique

- EQUIPMENT: Computer application, Maintenance monitoring techniques, Equipment in OT, Equipment for transport of patients,
- ICU equipment

MONITORING IN ANAESTHESIA

Invasive & Non-Invasive monitoring techniques Peri-operative periods in cardiothoracic center:

- Understanding of basic concepts of monitoring
- Indications, cost effectiveness, complications
- Equipment usage & knowledge of accessories Knowledge of the following monitoring —
  - Cardiac functions: ECG, ABP, Calculation of cardiac output, resistance, Flow, Echo, Doppler's & (CAT, PET, NMR)
  - Pulmonary functions: PFT, Blood gases, Acid-base Pulmonary Airway mechanics.
  - Coagulation Profile: Temp. renal, B. Sugar, Enzymes. ACT Heparin & Protamine regulation, thromboelastography.
  - Neuromuscular blockade: And other Recent advances in monitoring. BIS cerebral oximetry, evoked potential monitoring, CNS monitoring during CPB.

CLINICAL SCIENCES

- **PAEDIATRIC**:
  - history of pediatric cardiac anesthesia, pediatric heart disease in developing world
  - DEVELOPMENT ISSUES: intrauterine development of cardiovascular system, intrauterine development of cardiovascular system, pediatric anesthesia pharmacology
  - PREOPERATIVE EVALUATION: preoperative evaluation and preparation of pediatric patient with cardiac disease, cardiac catheterization and other radiographic examinations, pediatric electrocardiography and cardiac electrophysiology, pediatric

echocardiography.

• PRINCIPLES OF PER OPERATIVE MANAGEMENT: anesthetic and per operative management, monitoring of the pediatric cardiac patient, physiology and techniques of extracorporeal circulation in pediatric cardiac patient, profound hypothermia and circulatory arrest, vital organ preservation during surgery for congenital cardiac disease, management of post bypass myocardial dysfunction, hemostasis, coagulation and transfusion in pediatric cardiac patient, management of post bypass pulmonary hypertension and respiratory dysfunction.

- ANESTHESIA FOR CARDIAC SURGICAL PROCEDURES: septal and endocardial cushion defects, tetralogy of Fallot, transposition of great vessels, anomalies of aortic arch and valve, anomalies of pulmonary valve and right ventricular outflow tract, tricuspid atresia, hypoplastic left heart syndrome, double outlet right ventricle, truncus arteriosus, anomalies of systemic and pulmonary venous return, abnormalities of atrioventricular valves, coronary artery anomalies, cardiomyopathies, pulmonary hypertension, persistent fetal circulation and Eisenmenger's syndrome, pediatric cardiac and lung transplantation, secondary vascular anomalies and cardiac tumors, anesthesia for non-cardiac surgery in children and adults with congenital heart disease.
- Postoperative care: General principles, cardiovascular dysfunctional and pharmacological support, postoperative respiratory dysfunction and its management, renal, hepatic, gastro and neurological dysfunction, postoperative pain management in pediatric cardiac patient, anesthesia for cardiac procedures in pediatric ICU.

❖ **ADULT**:

- **PREOPERATIVE ASSESSMENT AND MANAGEMENT**: Preoperative assessment of cardiac risk, The cardiac catheterization laboratory: Diagnostic and therapeutic procedures in the adult patient, Anti-ischemic drug therapy, Chronic Treatment of congestive heart failure, Antihypertensive therapy, Etiology and treatment of perioperative cardiac arrhythmias.

- **PHYSIOLOGY AND MOLECULAR BIOLOGY**: Advances in cardiovascular physiology, Coronary physiology and Atherosclerosis, Molecular cardiovascular medicine, Systemic inflammation.
- **MONITORING**: Hemodynamic Monitoring, Advances in Electrocardiographic monitoring, Intraoperative echocardiography, Central nervous system monitoring,coagulation monitoring.
- **ANESTHETIC PHARMACOLOGY**: Effects of inhalation anaesthetics on systemic hemodynamics and the coronary circulation, opioids in cardiac anesthesia, Pharmacology of intravenous anesthetic induction drugs, Muscle relaxants and cardiovascular system, Pharmacokinetics and principles of drug infusions in cardiac patients
- **ANESTHETIC TECHNIQUES FOR CARDIAC SURGICAL PROCEDURES:** Anesthesia for myocardial revascularization, Valvular heart disease, Anesthesia for patients with congenital heart disease, Thoracic aortic disease, Anesthesia for electrophysiological procedures, Uncommon diseases and cardiac anesthesia, Cardiac pacing and electro version, Anesthesia for heart, Lung, and heart- lung transplantation
- **MANAGEMENT OF CARDIOPULMONARY BYPASS AND ASSOCIATED PROBLEMS**: Extracorporeal devices and related technologies, Cardiopulmonary bypass and the anesthesiologist, Transfusion medicine and coagulation disorders, Pharmacologic management of perioperative left and right ventricular dysfunction, techniques of circulatory assistance.
- POSTOPERATIVE CARE: Postoperative respiratory management, Postoperative cardiovascular management, Central nervous system dysfunction after cardiopulmonary bypass, Critical care medicine for the cardiac patient.
- PRACTICE MANAGEMENT: The impact of managed care on cardiac anesthesia, cost containment in anesthesia and cardiac surgery, quality of life and patient satisfaction surrounding cardiovascular surgery, measuring and improving the outcomes of coronary artery bypass graft surgery.

- **THORACIC ANAESTHESIA AND ONE LUNG VENTILATION**
  - Indications for thoracic surgery
  - Preoperative assessment
  - Anesthetic management
  - Preoperative preparation
  - Investigation, premedication, intraoperative management
  - One lung ventilation: indications, contraindications, positioning of patient in thoracic surgery,
  - Physiology of one lung ventilation
  - Methods for separation of lungs
  - DLT: types, positioning, placement checking, possibilities of DLT malposition, checking with FOB
  - Management of OLV
  - Post operative management

- **CARDIOPULMONARY BYPASS**
  - Historical development
  - Blood pumps in CPB
  - Circuitry and cannulation techniques
  - Principles of oxygenator function
  - Ultrafiltration and dialysis
  - Mechanical circulatory support devices
  - Cardiopulmonary bypass for minimally invasive cardiac surgery
  - Temperature management in cardiac surgery
  - Embolic events
  - Endocrine ,metabolic and electrolyte responses
  - Cardiopulmonary bypass and lung
  - Immune system and inflammatory response to CPB
  - Kidney function and cardiopulmonary bypass
  - Neurologic effects of CPB
  - Hemodilution and priming solutions
  - The blood surface interface

- Hematologic effects and coagulopathy
- Coagulation testing
- Anticoagulation for CPB
- Heparin neutralization
- Pharmacologic prophylaxis for post CPB bleeding
- Conduct of CPB
- Patient safety in CPB
- Unusual problems in CPB
- Termination of CPB
- ECMO for respiratory support in adults
- Perfusion for thoracic aortic surgery in adults
- Noncardiac surgical application of CPB
- Pediatric cardiopulmonary bypass an overview- state of art and future
- Myocardial protection and preservation for neonates and infants
- Brain injury following infant cardiac surgery and neuroprotective strategies
- ECMO for infants and children
- Circulatory assist devices for infants and children
- Subsystem care - cerebral, Renal Hepatic protection, Cerebral protection, cerebral monitoring
- Total circulatory arrest, left heart bypass
- Anaesthesia management during CPB
- Pharmacokinetics & Pharmacodynamics of drugs during CPB

❖ **INTENSIVE CARE MANAGEMENT**

- Organizational aspects
- Shock
- Acute coronary care
- Respiratory failure
- Gastroenterological emergencies
- Acute renal failure
- Neurological disorders
- Endocrine disorders
- Obstetric emergencies

- Infection and immune disorders
- Severe and multiple trauma
- Environmental injuries
- Pharmacological considerations
- Metabolic hemostasis
- Hematological management
- Transplant
- Pediatric intensive care
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❖ **INTRAOPERATIVE TRANSESOPHAGEAL ECHOCARDIOGRAPHY**

- Principles of echocardiography: physics, digital echocardiography, imaging artifacts, and pitfalls, optimizing 2D echo
- Intraoperative examination: surgical anatomy correlated with echocardiographic imaging planes, assessment of global ventricular function, right ventricular function, regional ventricular function, mitral valve, aortic valve ,tricuspid and pulmonic valves thoracic aorta and prosthetic valves. Assessment of congenital heart disease in adults
- Decision making in critical care TEE in critical care setting, assessment of perioperative hemodynamics
- Surgical decision making in coronary artery disease: assessment of myocardial viability, assessment in higher risk myocardial revascularization, assessment of mitral valve in ischemic heart disease, assessment in off pump myocardial revascularization.
- Surgical decision making in valvular heart disease: surgical consideration in mitral and tricuspid valve surgery, assessment in mitral valve surgery, surgical consideration in aortic valve surgery, assessment in aortic valve surgery.
- Surgical decision making in major vascular surgery: Assessment of surgery of aorta.
- Surgical decision making in congestive cardiac failure: Pathophysiologic, assessment of cardiomyopathy, surgical considerations in non transplant surgery for congestive cardiac failure, assessment in surgical procedures for CHF, assessment of cardiac transplantation

- Surgical decision making in Interventional Cardiovascular Medicine and Non cardiac surgery : Assessment in cardiac intervention, assessment in noncardiac surgery.

❖ BRONCHOSCOPY

- History of rigid bronchoscopy
- History of flexible fibreoptic bronchoscopy
- Anatomy of larynx, trachea, bronchi and classification of lung segments
- Indications for FOB
- Anaesthesia for diagnostic and therapeutic bronchoscopy
- Interventional bronchoscopy
- Tracheal stents
- Percutaneous dilatational tracheostomy and bronchoscopy
- Technique and equipment care for FOB
- Virtual Bronchoscopy

❖ RECENT ADVANCES

Knowledge of recent developments in field of Cardio thoracic & Vascular surgery

- Cardiology - PTCA, Balloon embolectomy etc.
- Heart - lung transplant - physiology, pharmacology (Anaesthetic consideration) - Donor – recipient selection
- Immunosuppression etc.
- Cardiac assisting devices - Artificial heart, IABP, LHAD
- Advances Pulmonary support - ECMO, High Frequency Ventilation
- Blood substitutes
- Current advances and concepts in drugs, equipments, and monitoring methods
- Virtual bronchoscopy

PERIOD OF POSTING IN VARIOUS UNITS

The trainee will be posted in different specialties and during of this posting will be as following:

S. No.	Posting	Duration	Timing
1.	Adult Cardiac anaesthesia and ICU	16 months	All semesters
2.	Paediatric cardiac anesthesia and ICU	14 months	All semesters
3.	Cardiac Care Unit (CCU)	2 months	4th & 5th Semesters
4.	Non-operating room Anaestheisa (NORA)	3 months	4th Semester
5.	Echocardiography room	1 months	5th Semester

TEACHING PROGRAMME

The following teaching programme is prescribed for the course:

Sr No	Teaching/Learning Activity	Frequency
1.	Clinical Case presentation	Once a fortnight
2.	Clinical grand rounds	Once a fortnight
3.	Operative procedure perioperative planning and discussion	Before every case
4.	Journal Club	Once a fortnight
5.	Seminars/Webinars	Once a fortnight
6.	Cardiology / CTVS meet	Once a fortnight
7.	Dissertation review	Once every 6 months

(Teaching of MD, Anesthesia, by the DM student if available is part of the training.)

Log Book: Every candidate shall maintain a log book record (in the attached format) of his/her participation in the training programmes conducted by the department such as journal reviews, seminars and other teaching learning activities. Special mention may be made of the presentations made by the candidate as well as details of clinical or diagnostic/ therapeutic procedures,

conducted by the candidate. The work diary shall be scrutinized and certified by the Head of the Department and Head of the Institution periodically, and presented in the university practical/clinical examination.

Dissertation: Every post graduate student shall carry out work on an assigned research project under the guidance of a recognized Post Graduate Teacher, the result of which shall be written up and submitted in the form of a Thesis. Work for writing the Thesis is aimed at contributing to the development of a spirit of enquiry, besides exposing the post graduate student to the techniques of research, critical analysis, acquaintance with the latest advances in medical science and the manner of identifying and consulting available literature.

Activity	January admission	July admission
Selection of topic in consultation with PG Guide	March / April	September / October
Approval by Department PG Committee		
Institute Scientific Committee approval	May / June	November / December
Institute Ethics Committee approval		
Final approval letter by Academics Section	30th June	31st December

Thesis shall be submitted at least six months before the Theory and Clinical / Practical examination. A post graduate student shall be allowed to appear for the Theory and Practical/ Clinical examination only after the acceptance of the Thesis by the examiners

ASSESSMENT

A. FORMATIVE ASSESSMENT

i. **TOTAL 1200 MARKS – 600 FOR THEORY AND 600 FOR PRACTICALS**

ii. **THEORY INTERNAL EXAM SCHEDULE**

S. No.	SCHEDULE	MARKS	PATTERN
1.	End of First Year	100 (1 paper)	10 Questions x 10 marks each
2.	End of Second Year	100 (1 paper)	10 Questions x 10 marks each
3.	Pre-professional Exam	400 (4 x 100 mark papers)	As per the Final Professional Exam
Total		**600 marks**	

iii. **PRACTICAL INTERNAL EXAM SCHEDULE**

S. No.	SCHEDULE	MARKS	PATTERN
1.	End of First Year	100 (1 paper)	2 LONG CASES X 30 MARKS EACH 20 MARKS – EQUIPMENTS AND RADIOLOGY 20 MARKS – DRUGS
2.	End of Second Year	100 (1 paper)	
3.	Pre-professional Exam	400	As per the Final Professional Exam
Total		**600 marks**	

B. SIX MONTHLY PROGRESS REPORT

The progress of the trainees will be monitored with the help of a six-monthly structured report. The report will contain details pertaining to attendance, teaching-learning activities, clinical duties, teaching assignments, practical work, marks obtained at intermediate examinations, papers/posters presented, research publications, and progress of dissertation work. The performance of the student will be graded by the PG Guide and the Head of the Department.

C. ESSENTIAL PRE-REQUISITE TO APPEAR FOR SUMMATIVE ASSESSMENT

i. Minimum 75 % attendance

ii. Minimum of four satisfactory six-monthly progress reports

iii. Acceptance of the Dissertation is mandatory

iv. Minimum one scientific paper/poster presentation at an International/National/State Conference

v. Minimum one research paper – published/accepted for publication/sent for publication in a peer-reviewed indexed scientific journal

D. SUMMATIVE ASSESSMENT/ FINAL PROFESSIONAL EXAMINATION

At the end of the training, summative assessment will be carried out in the following pattern:

CATEGORY	COMPONENTS	MARKS
THEORY	4 PAPERS X 100 MARKS = 400 MARKS	**400**
PRACTICAL	3 CLINICAL CASES (1 LONG & 2 SHORT) + equipment + Radiology & nuclear imaging + drugs + logbook evaluation & research	**400**
TOTAL		**800**

THEORY

There shall be 4 papers; each of 3 hours duration carrying 100 marks each.

PAPER	CONTENT	MARKS
PAPER I	Basic Sciences as applied to Cardiac Anaesthesia. Monitoring in cardiac anaesthesia	100
PAPER II	Principles and practice of Adult Cardiac Anaesthesia, Anaesthetic techniques for Lung surgery, Bronchoscopy.	100
PAPER III	Paediatric Cardiac Anaesthesia, Trans-esophageal echocardiography	100
PAPER IV	Intensive care medicine as applicable to cardiac anaesthesia. Recent advances in cardiac anaesthesia and intensive care	100
Total		**400**

PRACTICAL

COMPONENT	DESCRIPTION	MARKS
CLINICAL CASE	History taking, physical examination, interpretation of clinical findings, differential diagnosis, investigations, prognosis, and management	1 LONG CASE X 100 MARKS & 2 SHORT CASES X 50 MARKS = 200 MARKS
VIVA VOCE	I. Equipments II. Radiology and Nuclear imaging III. Drugs IV. Research work, thesis, and logbook evaluation V. OSCE & CCU Round	5 STATIONS X 40 MARKS = 200 MARKS
Total		**400**

In order to be declared successful in summative assessment, the candidate must score:

1. Minimum 40% marks in each paper and aggregate of 50% marks to pass the theory exam.
2. Minimum 50% marks required in Theory & Practical separately to be declared successful in the summative exam.

TEXT BOOKS FOR REFERENCE

The following textbooks are recommended for reference:

1	**Cardiac anesthesia**	**Joel Kaplan,Reich,Konstadt**
2	**Pediatric cardiac intensive care**	**Chang, Hanley**
3	**Perioperative care in cardiac anesthesia and surgery**	**Cheng, Davy**
4	**A practical approach to cardiac anesthesia**	**Hansley, Martin**
5	**Pediatric cardiac anesthesia**	**Carol .l. Lake,Peter .D.Booker**
6	**Clinical recognition of Congenital Heart disease**	**Joseph .K.Perloff**
7	**Principle and practice of mechanical ventilation**	**Tobin**
8	**Anesthesia for cardiac surgery**	**James A. Dinardo**
9	**Principles of Crititcal Care**	**Hall,Jesse B**
10	**Blood gas analysis: A practical perspective**	**Shyam sunder T**
11	**Heart transplantation**	**Kirklin, james K**
12	**The ICU book**	**Marino, Paul L**
13	**Clinical Anesthesiology**	**Morgan, Edward G**
14	**Understanding Anesthesia Equipment (R)**	**Dorsch, Jerry A**
15	**Medicine for Anesthetists**	**Vickers, M D**
	Proceduresand techniquiesin intensive	

16	caremanagement	Irwin and Richard S
17	Essentials of Anaesthetic Equipment	Al-Shaikh, Baha
18	Anesthetic Physiology and Pharmacology	McCaughey, William
19	Paediatric Anesthesia (R)	Gregory, George A

20	Anesthesia and Co-existing Disease (R)	Stoelting, Robert K
21	Textbook of Regional Anesthesia ®	Raj, Prithvi P
22	Clinical application of mechanical ventilation	Chang, David W
23	Drugs and Equipment in Anaesthetic Practice	Paul, Arun Kumar
24	Pain Management	Main, Chris J
25	Proceduresand Techniquesin Intensive CareMedicine	Irwin, Richard S
26	Mechanical Ventilation	MacIntyre, Neil R
27	Essential Anatomy for Anesthesia	Black, Sue M
28	Miller's Anesthesia Vol.1(R)	Miller, Ronald D
29	Miller's Anesthesia Vol.2(R)	Miller, Ronald D
30	Mechanical Ventilation and Nutrition	Verma, P K
31	Pediatric Cardiac Anesthesia	Lake, Carol L
32	Laryngeal Mask Anesthesia	Brimacombe, Joseph R
33	Comprehensive Textbook of Intraoperatively Tran esophageal Echocardiography	Savage, Robert M
34	A practical approach to transesophagealechocardiography	Albert Perrino

35	Oh's Intensive Care Manual	Bernsten, Andrew
36	Cardiovascular Physiology for Anesthesiologists	Gordon
37	Nunn's Applied Respiratory Physiology	Lump
38	Principles of Critical Care	Hall,Jesse B
39	ECG Complete	Bowbrick,Steven
40	ECG in Emergency Decision Making	Wellens
41	Electrocardiography in Clinical Practice	Chou, Te-Chuan
42	Lung function tests	Hughes,J M B
43	Chou's Electrocardiography in Clinical Practice	Surawicz, Borys

44	Marriott's Practical Electrocardiography	Wagner, Galen S
45	Handbook of Clinical Electrocardiography	Koley, Kumar Tapas
46	Twelve-Lead Electrocardiography	Foster,Bruce D
47	An Introduction to Electrocardiography	Colin, Schamroth
48	Advanced Therapy in Cardiac Surgery	Franco, Kenneth L
49	Glenns Thoracic and cardiovascular surgery Vol 1&2	Baue,Arther E
50	Clinical cardiovascular and pulmonary physiology	Rosedorff,clive
51	Blood Conservation in Cardiac Surgery	Krieger, Karl H
52	Cardiac Surgery	Doty, Donald B
53	Nadas' Pediatric Cardiology	Fyler, Donald C
54	Pediatric Cardiology - Vol. 1 (R)	Anderson, Robert H
55	Pediatric Cardiac Surgery	Mavroudis, Constantine

56	**Bronchoscopy**	**Udaya B S Prakash**
57	**Interventional bronchoscopy**	**Bolliger, C T**

LIST OF RECOMMENDED JOURNALS

- **Anesthesia analgesia**
- **Anesthesiology clinics**
- **British journal of anesthesia**
- **Critical care clinics**
- **Critical care medicine**
- **Current opinion in critical care**
- **Indian journal of anaesthesia**
- **Journal of cardio thoracic and vascular anaesthesia**
- **Advances in anaesthesia**
- **Annals of cardiac anaesthesia**
- **Canadian journal of anaesthesia**