



**AMRITA**  
VISHWA VIDYAPEETHAM

**Program**  
**DM Cardiac Anaesthesia**  
(Revised with effect from 2016-2017 onwards)

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# Program Outcomes

PO1: An understanding of the pathophysiology of acquired and congenital heart diseases

PO2: The expertise for the anaesthetic management of acquired and congenital heart diseases.

PO3: The knowledge and skill for the postoperative intensive care management of both adult and pediatric cardiac surgical patients.

## Program Specific Outcomes

PSO1: The skill of undertaking procedures like percutaneous tracheostomy and bronchoscopy.

PSO2: Possession of the skill in the anaesthetic management of patients undergoing various procedures in the cardiac catheterization labs.

PSO3: The competency to do transesophageal echocardiography in adult and pediatric cardiac surgical patients.

PSO4: The knowledge and skill required in the anaesthetic and postoperative management of patients undergoing major vascular surgical procedures.

PSO5: The skill and spirit of scientific inquiry and orientation to the principles of research methodology and epidemiology.

PSO6: The competency to plan and set up independent cardiac anaesthesia units catering to cardiothoracic and vascular surgery and intensive care units and cath labs

PSO7: The basic skills of teaching students at various levels of medicine.

PSO8: Possession of inter-communication skills with surgeons and other members of cardiac surgical team.

PSO9: Communication skills with patients and relatives.

## GOALS AND OBJECTIVES

1. Understand the pathophysiology of acquired and congenital heart diseases
2. Develop the expertise for the anaesthetic management of acquired and congenital heart diseases.
3. Develop the knowledge and skill for the postoperative intensive care management of both adult and pediatric cardiac surgical patients.
4. Develop the skill of undertaking procedures like percutaneous tracheostomy and bronchoscopy.
5. Understand the needs and develop the skill in the anaesthetic management of patients undergoing various procedures in the cardiac catheterization labs.

6. Understand, develop and utilize the skill of doing transesophageal echocardiography in adult and pediatric cardiac surgical patients.
7. To develop the knowledge and skill in the anaesthetic and postoperative management of patients undergoing major vascular surgical procedures.
8. Develop the skill and spirit of scientific inquiry and orientation to the principles of research methodology and epidemiology.
9. To plan and set up independent cardiac anaesthesia units catering to cardiothoracic and vascular surgery and intensive care units and cath labs
10. Develop the basic skills of teaching students at various levels of medicine.
11. Develop inter-communication skills with surgeons and other members of cardiac surgical team.
12. Develop communication skills with patient relatives.

### **COMPONENTS OF THE CURRICULUM FOR DM COURSE IN CARDIAC ANAESTHESIA**

The major components of the curriculum shall be:

- Theoretical Knowledge
- Practical/ clinical skills
- Attitudes, including communication
- Training in research methodology

Source: Medical Council of India, Regulations on Postgraduate Medical Education, 2000.

## **SELECTION OF CANDIDATES**

### **Eligibility**

Candidate seeking admission for D.M course in Cardiac Anaesthesia must possess a recognized postgraduate degree of MD in the subject specified in the regulations of the Medical Council in India from time to time. (or its equivalent recognized degree). Candidates who have completed 35 years of age cannot apply.

### **Intake of Students**

The intake of students to the course shall be in accordance with the permission from the University and MCI.

### **Duration of the study**

The course of study shall be for a period of 3 years.

### **Mode of selection**

Written test and Interview

## **METHOD OF TRAINING**

During the period of training candidates follow an in-service residency programme. He/she works as a senior resident and is given gradually increasing responsibility – from complete supervision of all activities initially to semi-independently managing the sample cardiac operations and decision making in intensive care management. Candidates are also allowed to manage procedures in the cardiac catheterization laboratory. During their training they will be doing invasive procedures including percutaneous tracheostomy under supervision as well as undergo training in the art of bronchoscopy and trans-esophageal echocardiography (TEE). The day-to-day work of the trainees will be supervised by the consultant of the department of cardiac anesthesiology. The posting is so designed that the trainee get posted in various areas of the department like operation theatre, postoperative ICU, intensive coronary care unit, cath. lab, ECHO room. In addition to these general activities, didactic classes will be taken at least 4 times a week, with additional sessions on journal clubs, case presentations etc.

### **Attendance, Progress and Conduct**

- A candidate pursuing the course should work in the concerned department of the institution for the full period as a full time student. No candidate is permitted to run a clinic/laboratory/nursing home while doing the postgraduate course.
- Each year shall be taken as a unit for the purpose of calculating attendance.
- Every DM student shall attend symposia, seminars, conferences, journal review meetings, grand rounds, CPC, case presentations, clinics and lectures during each year. Candidates should have a minimum attendance of 90% each year before they can appear for their final examinations.
- Any student who fails to complete the course in the manner stated above shall not be permitted to appear for the University Examinations.

### **MONITORING PROGRESS OF STUDIES**

1. **Work diary/ Log Book:** Every candidate shall maintain a work diary 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.

2. **Periodic tests:-** The concerned department would conduct tests every six months; annual tests would be conducted at the end of first year and the other at the end of second year. The final test may be held three months before the final examination. The tests would include written papers, practicals/ clinicals and for viva voce. Records and marks obtained in such tests will be maintained by the head of the department and sent to the university, when called for.

### 3. **Dissertation**

- The dissertation is aimed to train a postgraduate student in research methods and techniques. It includes identification of a problem, formulation of a hypothesis, search and review of literature, getting acquainted with recent advances, designing of a research study, collection of data, critical analysis, comparison of results and drawing conclusions.
- Every candidate shall submit to the Registrar (Academic) of the University in the prescribed proforma, a synopsis containing particulars of proposed dissertation work within three months from the date of commencement of the course on or before the dates notified by the University. The synopsis shall be sent through the proper channel.
- Such synopsis will be reviewed and the dissertation topic will be registered by the University. No change in the dissertation topic or guide shall be made without prior approval of the University.
- The dissertation should be written under the following headings:

1. Introduction	7. Conclusions
2. Aims or Objectives of study	8. Summary
3. Review of Literature	9. References
4. Material and Methods	10. Tables
5. Results	11. Annexures
6. Discussion	

The written text of dissertation shall be not less than 50 pages and shall not exceed 150 pages excluding references, tables, questionnaires and other annexure. It should be neatly typed in double line spacing on one side of paper (A4 size,) and bound properly. Spiral binding should be avoided. The dissertation shall be certified by the guide, head of the department and head of the Institution.

Four copies of dissertation thus prepared shall be submitted to the Registrar (Evaluation), six months before final examination or before the dates notified by the University.

The dissertation shall be valued by examiners appointed by the University. Approval of dissertation work is an essential precondition for a candidate to appear in the University examination.

**Guide:** The academic qualification and teaching experience required for recognition by this University as a guide for dissertation work is as per Medical Council of India Minimum Qualifications for Teachers in Medical Institutions Regulations. Teachers in a medical college / institution having a total of eight years teaching experience, of which at least five years is as Lecturer or Assistant Professor are recognized post graduate teachers.

## **COURSES**

### **Course - I Basic Sciences as Applied to Cardiac Anaesthesia. Monitoring in Cardiac anaesthesia (Code: DMCA1)**

CO1: Knowledge of cardiac embryology, development of heart, pulmonary and vascular anatomy, coronary artery anatomy

CO2: Knowledge of cardiac cellular physiology, hemodynamic, autonomic nervous system, cardiac functions, blood physiology, coagulation cascade and cardiac action potential. Knowledge of cardiac arrhythmias, pulmonary physiology.

CO3: Knowledge of pathophysiology of heart failure, congenital defects, COAD, cardiopulmonary reserves, acquired cardiac & pulmonary diseases. Vascular pathology.

CO4: Knowledge of relevant immunology and pharmacology.

CO5: Knowledge of basic concepts of physics, and competency to handle the equipment.

CO6: Competency in monitoring in Cardiac Anaesthesia.

### **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 for Pre-peri & Post-operative periods in cardio thoracic 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, Vent. Pressures, Calculation of cardiac output, resistance, Flow, Echo, Doppler's & (CAT, PET, NMR)**
- Pulmonary functions : PFT, Blood gases, Acid-base Pulm. Airway mechanics.
- Coagulation Profile : Temp. renal, B. Sugar, Enzymes. ACT Heparin & Protomine regulation, thromboelastography.
- **Neuromuscular blockade : And other Recent advances in monitoring. BIS cerebral oximetry, evoked potential monitoring, CNS monitoring during CPB.**

### **Course - II Principles and Practice of Adult Cardiac Anaesthesia. Anaesthetic techniques for Lung Surgery Bronchoscopy (DMCA2)**

CO1: Skill in preoperative assessment and management.

CO2: Competency in hemodynamic monitoring.

CO3: Knowledge of anaesthetic pharmacology and skill in techniques for cardiac surgical procedures.

CO4: Skill in managment of cardiopulmonary bypass and skill in postoperative care.

CO5: Skill in thoracic anaesthesia and one lung ventillation.



CO6: Skill in cardio-pulmonary bypass.

- **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.
- Knowledge of rate controlling drugs and their adverse effects
- 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.
- Competency in performing Cardiopulmonary resuscitation
- ANAESTHETIC 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 hypothermia and hypotension peri operatively
- 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

**Course - III Paediatric Cardiac Anaesthesia Trans-esophageal Echo Cardiography (DMCA3)**

CO1: Knowledge of intrauterine development of cardiovascular system, extrauterine development of cardiovascular system, pediatric anesthesia pharmacology.

CO2: Competency in preoperative evaluation and preparation of pediatric patient with cardiac disease, cardiac catheterization and other radiographic examinations, pediatric electrocardiography and cardiac electrophysiology, pediatric echocardiography.

CO3: Competency in 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.

CO4: Competency in anaesthesia for cardiac surgical procedures.

CO5: Skill in post-operative care.

- **PAEDIATRIC** : history of pediatric cardiac anesthesia, pediatric heart disease in developing world
- **DEVELOPMENT ISSUES:** intrauterine development of cardiovascular system, extrauterine 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, hypo plastic 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 Eisenmengers 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.
- Use of muscle relaxants and their adverse effects in pediatric age group
- 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.
- Total Parenteral Nutrition in pediatric age group

**Course - IV Intensive Care Medicine as Applicable to Cardiac Anaesthesia, Recent Advances in Cardiac Anaesthesia and intensive care (Code DMCA4)**

CO1: Competency in intensive care management.

CO2: Competency in pediatric intensive care management.

CO3: Skill in procedures such as femoral catheterization, Subclavian and Internal Jugular Catheterization, TOE, PA Catheter insertion, Bronchoscopy, Percutaneous Tracheostomy & IABP Insertion.

CO4: Familiarity with recent publications in the field of cardiac anaesthesia.

CO5: Knowledge of recent developments in field of Cardio thoracic & Vascular surgery

**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 Pulm. support - ECMO, H.F. Ventilation
- ❑ Blood substitutes
- ❑ Current advances and concepts in drugs, equipments, and monitoring methods
- ❑ Virtual bronchoscopy

**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

**Soft Skills (Code DMCA5) – Elective Course**

CO1: Skill in conducting clinical research.

CO2: Attitude to be a lifelong learner.

CO3: Communication skills necessary in interacting with the patients, caregivers and colleagues.

CO4: Attitude to be a member of a healthcare team.

CO5: Skill necessary to be a good communicator and teacher

## SCHEME OF EXAMINATION

The examination shall consist of the following parts:

- A. Theory
- B. Clinical examination & Viva voce

**A) Theory:**

**Marks: 100 X 4 papers=400 marks**

The theory examination shall consist of 4 papers of 100 marks each. Each paper in turn shall consist of 10 questions each carrying 10 marks. All questions shall be compulsory. Each theory paper shall be for 3 hours.

- Paper I : Basic Sciences as applied to Cardiac Anaesthesia. Monitoring in cardiac anaesthesia**
- Paper II : Principles and practice of Adult Cardiac Anaesthesia, Anaesthetic techniques for Lung surgery, Bronchoscopy.**
- Paper III: Paediatric Cardiac Anaesthesia, Trans-esophageal echo cardiography.**
- Paper IV: Intensive care medicine as applicable to cardiac anaesthesia. Recent advances in cardiac anaesthesia and intensive care**

**B) Clinical examination:**

**Total=300 marks**

- Part I : Clinical Cases ( 300 marks)**
- One long case : 100 marks
- Two short cases : 25 mark each (25x2=50 marks)
- Equipments : 25 marks
- Drugs : 25 marks

- TEE : 50 marks
- Internal assessment : 50 marks

## **CLINICAL PRACTICAL AND VIVA VOCE**

Students will be taken into the operating rooms where live demonstration and evaluation of TOE views and their interpretation will be evaluated. The long case will be for 45 minutes and each short case about 20 minutes. Viva Voce for drugs and equipments will be for a period of 20 minutes each. The candidates are also given ECG, X-rays to be interpreted. Various equipment, used in OT, intensive care, drugs, fluids, catheter for invasive monitoring are also required to be interpreted and discussed.

## **TEACHING PROGRAMME**

The following teaching programme is prescribed for the course:

Operation theatre	: 20 days per month
Intensive care unit duties	: 10 days per month
Didactic lectures	: 4 days/week
Seminars	: Once every alternate week
Journal Club	: Once every alternate week
Pediatric Cardiology Cath Meeting	: Once every week
Cath Lab	: Once a week
Bed side case discussion	: Once a week

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

## **PERIOD OF POSTING IN VARIOUS UNITS**

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

1. Adult Cardiac anaesthesia and ICU : 16 months
2. Paediatric cardiac anesthesia and ICU : 14 months
3. Medical ICU : 1 month
4. Cath Lab : 1 month
5. Echo room : 1 month
6. ICCU : 1 month
7. Research experience : 1 month (optional)
8. Outside posting : 1 month

## **ASSESSMENT**

Regular 5 internal assessment both in theory and clinical should be made for every candidate (at 6 monthly intervals). Internal assessment will also be made in day-to-day work of the trainee, which involve patient care, teaching, anesthesia management in the operation room, emergency service, bed side presentation and research.

## **RESEARCH**

The trainee shall be required to undertake research and write papers under the guidance of consultant. The candidate will have to submit a proposal/topic for the project work within three months of the joining of the course. The work period for the project will be 1½ year to 2 years. Papers from the project should be accepted for publication in an indexed journal. Another article as first author should also be submitted for publication in an indexed journal before the candidate appears in the final DM. Cardiac Anesthesiology examination.

- ❑ Visits to other Institution of excellence as and when needed
- ❑ Attending Continuing Education Programmes, Seminars, Conferences, and Workshop in furtherance of course objectives.
- ❑ Presenting papers, Topics, Lectures, Posters and similar activities to peer groups in furtherance of the learning and objectives of the course.

## **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 for Pre-peri & Post-operative periods in cardio thoracic 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, Vent. Pressures, Calculation of cardiac output, resistance, Flow, Echo, Doppler's & (CAT, PET, NMR)
- Pulmonary functions : PFT, Blood gases, Acid-base Pulm. Airway mechanics.
- Coagulation Profile : Temp. renal, B. Sugar, Enzymes. ACT Heparin & Protomine 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, extrauterine 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, hypo plastic 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 Eisenmengers 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.
- **ANAESTHETIC 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:** Extrcorporeal 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

### **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 nontransplant 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 Pulm. support - ECMO, H.F. Ventilation
- ❑ Blood substitutes
- ❑ Current advances and concepts in drugs, equipments, and monitoring methods
- ❑ Virtual bronchoscopy

### LIST OF PROCEDURES TO BE PERFORMED

Procedure	Under Supervision	Independently
<b>Femoral catheterization</b>	10	100
Subclavian and Internal jugular Catheterization	10	100
<b>TOE</b>	50	100
PA Catheter insertion	5	50
Bronchoscopy	15	15
Percutaneous Tracheostomy	5	15
IABP Insertion	5	10

### ORIENTATION TO INFORMATION

#### 1. Library

The postgraduate students need to become familiar with the books, periodicals, and other publications pertaining to Cardiac Anaesthesia that are available in the Institution. A list of such books will be on record in the department. In addition to this, department will develop and maintain *Departmental Library*, which will contain highly specialized books and publications from which the postgraduate can benefit.

#### 2. Research

The component of research shall be promoted by encouraging candidates to undertake projects during the first two years of their course.

This objective may be achieved either through an intramural programme or by enrolling postgraduates in an extramural programme providing the necessary training.

#### 3. Monitoring of Teaching/ Learning Activities

<i>Activity</i>	<i>Periodicity of Assessment</i>	<i>Method</i>
Journal clubs	Monthly	Faculty and Peer review
Seminars	Monthly	Faculty and Peer review
Theory Knowledge	Six monthly	Written tests
Clinical performance	Six monthly	Clinical exam

Procedures	Monthly	Log book
Research & Presentation	Three monthly	Logbook & Faculty peer view

## 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 .I. 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
16	Procedures and techniques in intensive care management	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	Procedures and Techniques in Intensive Care Medicine	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 transesophageal echocardiography	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 anaesthesia
- ❖ 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

# **LOG BOOK FOR DM CARDIAC ANAESTHESIA**

Name of candidate :

Date of joining :

Period of the course :

Name of the Institution :

Name of the Department :

I hereby state that this is a true record of the teaching-learning activities and procedures done by me (under supervision and independently) during my DM course.

Date:

Signature of the candidate

May be accepted by the University.

Signature of the Head of Dept.

Seal:

Date :

## ***ACADEMIC ACTIVITIES ATTENDED***

<b><i>Date</i></b>	<b><i>Topics</i></b>	<b><i>Speaker</i></b>


Signature of the student

Signature of the HOD

**ACADEMIC PRESENTATIONS MADE BY THE CANDIDATE**

Date	Topic	Type of presentation Journal club/Seminar/ Topic presentation/ case Presentation/ UG teaching	Assessment

Signature of the student

Signature of the HOD

**LIST OF PROCEDURES DONE BY CANDIDATE**

**1.Femoral Catheterization**

*Done under supervision*

Date	Name of the patient	Hospital No:


***Done Independently***

Date	Name of the patient	Hospital No:

**2. Transesophageal Echocardiography**

***Done under supervision***

Date	Name of the patient	Hospital No:

***Done Independently***

Date	Name of the patient	Hospital No:

**3. Percutaneous Tracheostomy**

***Done under supervision***

Date	Name of the patient	Hospital No:

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***Done Independently***

Date	Name of the patient	Hospital No:

**4. PA Catheter Insertion**

***Done under supervision***

Date	Name of the patient	Hospital No:

***Done Independently***

Date	Name of the patient	Hospital No:

**5. IABP Insertion**

***Done under supervision***

Date	Name of the patient	Hospital No:

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***Done Independently***

Date	Name of the patient	Hospital No:

**6. Bronchoscopy**

***Done under supervision***

Date	Name of the patient	Hospital No:

***Done Independently***

Date	Name of the patient	Hospital No:

**7. ICD Insertion**

***Done under supervision***

Date	Name of the patient	Hospital No:


***Done Independently***

Date	Name of the patient	Hospital No:

Signature of the student

Signature of the HOD