



MALLA REDDY VISHWAVIDYAPEETH

SCHOOL OF ALLIED AND HEALTHCARE SCIENCES AND TECHNOLOGY

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Program

Masters of Science (M.Sc.)

2026

MALLA REDDY VISHWAVIDYAPEETH
SCHOOL OF ALLIED HEALTH CARE SCIENCES AND TECHNOLOGY
MASTER OF CARDIO PERFUSION TECHNOLOGY

VISION

To become a globally recognized center of excellence in Perfusion Technology education, clinical training, research, and innovation by producing highly competent, ethical, and research-oriented perfusion professionals. The institution aims to develop technologically skilled experts who are capable of delivering advanced cardiovascular care and extracorporeal life support services, including cardiopulmonary bypass, ECMO, and related critical care technologies, while contributing to continuous improvement in patient outcomes, healthcare standards, and scientific advancement in the field of perfusion sciences.

Cardio Perfusion Technology

MISSION

1. To provide comprehensive theoretical and clinical training in perfusion technology and cardiovascular sciences.
2. To promote evidence-based clinical practice, patient safety, and ethical healthcare delivery.
3. To develop research aptitude, leadership qualities, and interdisciplinary collaboration among students.
4. To train students in modern extracorporeal technologies including ECMO, VAD, minimally invasive cardiac surgery, and organ transplantation.
5. To encourage lifelong learning and professional excellence in cardiac healthcare.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

1. After completion of the M.Sc. Perfusion Technology program, graduates will be able to:
2. Apply advanced knowledge of cardiology, cardiac surgery, extracorporeal circulation, and critical care during clinical practice.
3. Perform and manage cardiopulmonary bypass, ECMO, ventricular assist devices, and other circulatory support systems safely and effectively.
4. Demonstrate professionalism, ethical responsibility, communication skills, and teamwork in multidisciplinary healthcare environments.
5. Engage in research, innovation, and evidence-based clinical decision making for advancement in perfusion sciences.
6. Adapt to emerging technologies and contribute to quality improvement in cardiac healthcare system

PROGRAM OUTCOMES (POs)

At the end of the program, students will be able to:

1. Demonstrate advanced knowledge in cardiovascular anatomy, physiology, pathology, and perfusion sciences.
2. Operate and troubleshoot heart-lung machines, ECMO systems, and perfusion-related equipment.
3. Conduct cardiopulmonary bypass procedures independently under clinical supervision.
4. Apply pharmacological principles during cardiac surgical procedures.
5. Manage perfusion strategies in adult, pediatric, and minimally invasive cardiac surgeries.
6. Interpret hemodynamic, hematological, and biochemical monitoring data accurately.
7. Demonstrate competency in emergency circulatory support including ECLS and ECMO.
8. Apply principles of blood conservation, anticoagulation, and transfusion management.
9. Participate effectively in organ transplantation and mechanical circulatory support programs.
10. Practice ethical principles, patient safety, infection control, and biomedical waste management.
11. Conduct research activities, dissertation work, and scientific presentations.
12. Communicate effectively with healthcare professionals, patients, and caregivers.

PROGRAM SPECIFIC OUTCOMES (PSOs)

1. Perform safe and effective extracorporeal circulation procedures during cardiac and thoracic surgeries.
2. Manage ECMO, ventricular assist devices, and advanced perfusion technologies in critical care settings.
3. Apply advanced perfusion strategies in pediatric, minimally invasive, transplant, and robotic cardiac surgeries.
4. Integrate research methodology, quality assurance, and evidence-based practices into perfusion technology.

MALLA REDDY VISHWAVIDYAPEETH
SCHOOL OF ALLIED AND PUBLIC HEALTH SCIENCES AND TECHNOLOGY
MASTERS OF CARDIO PERFUSION TECHNOLOGY

COURSE STRUCTURE

I year I semester

S.NO	SUBJECT CODE	SUBJECT	L	T	P	C	Max. Marks		
							INT	EXT	TOTAL
1		Cardiology	4	-	2	3	40	60	100
2		Principles of Cardiac Surgery – Part I	4	-	-	4	40	60	100
3		OT Techniques & Perfusion Technology	4	-	4	6	40	60	100
4		Pharmacology of Cardiovascular Drugs	2	-	-	2	40	60	100
5		Clinical postings	-	-	14	7	40	60	100
TOTAL			14	-	20	22	200	300	500

I year II semester

S.NO	SUBJECT CODE	SUBJECT	L	T	P	C	Max. Marks		
							INT	EXT	TOTAL
1		Cardiac Surgery – II	3	-	-	3	40	60	100
2		Advanced ECMO and Extracorporeal Life Support	3	-	2	4	40	60	100
3		Equipments in Perfusion Technology	3	-	2	4	40	60	100
4		Physiology and Pathology of Perfusion	3	-	-	3	40	60	100
5		Clinical postings	-	-	12	6	40	60	100
TOTAL			12	-	16	20	200	300	500

II year III semester

S.NO	SUBJECT CODE	SUBJECT	L	T	P	C	Max. Marks		
							INT	EXT	TOTAL
1		Clinical Applications of Perfusion Technology	3	-	2	4	40	60	100
2		Cardiac Surgery without CPB, Mechanical Circulatory Support and Robotic Cardiac Surgery	3	-	2	4	40	60	100
4		Dissertation Work – I and Viva Voce	0	0	24	12	40	60	100
TOTAL			6	-	28	20	180	180	300

II year IV semester

S.NO	SUBJECT CODE	SUBJECT	L	T	P	C	Max. Marks		
							INT	EXT	TOTAL
1		Organ Transplantation	3	-	-	3	40	60	100
2		Hematology Relevant to Perfusion, Blood Transfusion and Blood Conservation	2	-	2	3	40	60	100
3		Dissertation Work – II and Viva Voce	0	-	32	16	40	60	100
TOTAL			5	-	34	22	120	180	300

M.Sc. PERFUSION TECHNOLOGY – REGULATIONS**1.1 Post Graduate Programme**

Sl. No.	Course	Duration	Eligibility for Admission
1	M.Sc. Perfusion Technology	2 Years (4 Semesters)	B.Sc. Cardio Perfusion Technology / B.Sc. Perfusion Technology or equivalent degree from a recognized University

1.2 Medium of Instruction

English shall be the medium of instruction for all subjects of study and for examinations.

1.3 Duration of the Course

The duration of the M.Sc. Perfusion Technology course shall be 2 academic years consisting of 4 semesters.

1.4 Examination Regulations**1.4.1 Attendance**

75% attendance (physical presence) is mandatory.

Medical leave or other sanctioned leave shall not be counted as physical presence. Attendance shall be calculated from the date of commencement of the session to the last working day before commencement of the University examination.

1.4.2 Internal Assessment

a) Regular periodic assessment shall be conducted throughout the course.

In each semester there shall be:

- Two internal assessment examinations carrying 10 marks each.
- Continuous assessment carrying 10 marks.

Thus, the total internal assessment marks shall be 30 marks.

The weightage for internal assessment shall be 30% of the total marks in each subject.

Pattern of Internal Assessment

Theory Internal Examination

- Three short questions shall be asked.
- Student shall answer any two questions.
- Each question carries 5 marks.
- Total = 10 marks.

Two such examinations shall be conducted during each semester.

Continuous Assessment

Continuous assessment shall be based on:

- Attendance
- Seminar presentations
- Journal clubs
- Case presentations
- Clinical performance
- Dissertation progress
- Professional behaviour
- Academic activities

Continuous assessment carries 10 marks.

Thus, total internal marks = 10 + 10 + 10 = 30 marks.

A candidate shall secure a minimum of 40% marks in internal assessment in each subject to become eligible for appearing in the University examination.

1.4.3 University Examination (External)

a) University examinations shall be conducted at the end of every semester.

b) A candidate who satisfies the requirements of attendance and internal assessment shall be eligible to appear for the University examination.

c) Theory examination shall be of 3 hours duration.

Theory Examination Pattern (70 Marks)

Long Essay Questions

- Three questions shall be asked.
- Student shall answer any two questions.
- Each question carries 10 marks.
- Total = 20 marks.

Short Notes

- Eight questions shall be asked.
- Student shall answer any six questions.
- Each question carries 5 marks.
- Total = 30 marks.

Very Short Answer Questions

- Ten questions shall be asked.
- Each question carries 2 marks.
- Total = 20 marks.

Thus, total marks = 70 marks.

1.4.4 Practical Examination

Practical examination may include:

- Major practical
- Minor practical
- Spotters
- Viva voce
- Logbook evaluation
- Clinical performance assessment
- Case discussion

1.4.5 Dissertation Evaluation

The dissertation work shall be evaluated by:

- Internal examiner
- External examiner
- Viva voce examination

Students shall submit the dissertation work before the final semester University examination as per University regulations.

1.4.6 Minimum Pass Criteria

- Minimum pass marks for Internal Assessment: 40%
- Minimum pass marks for University Examination: 50%

A student shall secure an aggregate of 50% marks (internal + external examination) separately in theory and practical examinations to pass in each subject.

COURSE STRUCTURE**I year I semester**

S.NO	SUBJECT CODE	SUBJECT	L	T	P	C	Max. Marks		
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TOTAL			14	-	20	22	200	300	500

CARDIOLOGY**L/P/T/C**
3/-/2/4**Learning Objectives**

1. To explain the anatomy, physiology, and electrical activity of the cardiovascular system.
2. To describe coronary artery diseases, myocardial infarction, heart failure, and shock.
3. To understand cardiac arrhythmias, conduction abnormalities, and electrophysiological studies.
4. To explain valvular heart diseases, congenital heart diseases, and structural heart interventions.
5. To describe diagnostic and therapeutic cardiac procedures including PCI, pacemakers, TAVI, TAVR, and MitraClip.
6. To understand the role of TEE, ECPR, VAD, and advanced cardiac support systems in modern cardiac care.
7. To correlate cardiology concepts with perfusion technology and cardiac surgical practice.

Learning Outcomes:

1. Explain cardiovascular anatomy, physiology, and cardiac electrophysiology relevant to perfusion practice.
2. Interpret ECG findings and identify common arrhythmias and conduction disorders.
3. Understand the pathology, diagnosis, and management of coronary artery disease and myocardial infarction.
4. Describe the clinical features and management of heart failure, shock, and mechanical circulatory support systems.
5. Differentiate congenital and acquired valvular heart diseases and their interventional management.

6. Understand electrophysiological procedures, pacemaker therapy, and structural heart interventions.
7. Identify basic TEE views and explain the role of TEE during cardiopulmonary bypass and cardiac surgery.
8. Apply cardiology knowledge effectively during perfusion procedures and perioperative cardiac care.

UNIT I (8 Hours)

The Electrical Activity of the Heart

Cardiac Action Potential

Electrical Conduction System

Electrocardiogram

UNIT II(10 Hours)

Diseases of the Coronary Arteries

a)Coronary Artery Disease

- Causes and risk factors
- Pathology and prevention

b)Angina

- Stable angina
- Unstable angina

c)Myocardial Infarction

- Acute myocardial infarction
- Treatment of acute infarction
- Complications and management
- Late complications of infarction

d)Emergency Cardiac Support

- Emergency PCI
- Role of ECPR during emergency PCI

UNIT III (8 Hours)

Heart Failure and Mechanical Circulatory Support

Heart Failure

- Pathophysiology of heart failure
- Clinical syndromes of heart failure

Management of Heart Failure

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- Medical management
- Acute circulatory failure (shock)

Advanced Cardiac Support

- Cardiac transplantation
- Role of VAD in heart failure patients

UNIT IV (10 Hours)

Disorders of Rate, Rhythm and Conduction

Arrhythmias

- Mechanisms of arrhythmias
- Disturbances of rate and rhythm

Conduction Disorders

- Heart blocks
- Bundle branch blocks

Investigation and Management

- Investigation of arrhythmias
- Management of arrhythmias

Electrophysiology and Cardiac Devices

- Electrophysiological study
- Radiofrequency ablation
- Holter ECG monitoring
- Temporary pacemaker

UNIT V (10 Hours)

Rheumatic Fever and Disorders of Cardiac Valves

Rheumatic Fever

- Etiology and pathology
- Sequelae of rheumatic fever

Valvular Heart Diseases

- Mitral valve disease
- Aortic valve disease
- Tricuspid valve disease
- Pulmonary valve disease

Infective Endocarditis

- Causes and pathology
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- Clinical features and complications

Structural Heart Interventions

- TAVI
- TAVR
- MitraClip
- Cardiobanding

UNIT VI(6 Hours)

Congenital Heart Disease

Classification

- Cyanotic congenital heart disease
- Acyanotic congenital heart disease

Common Congenital Cardiac Defects

- ASD
- VSD
- PDA
- TOF
- Coarctation of aorta

UNIT VII(8 Hours)

TEE Basics for Perfusionists

Introduction to TEE

- Principles of transesophageal echocardiography
- Indications of TEE

TEE Views

- Basic TEE views
- Cardiac structures visualized in TEE

Role of TEE During Cardiac Surgery

- Role during CPB
- Role during de-airing of the heart
- Assessment of cardiac function during surgery

Textbook:

- Cardiology, 7th Edition, Desmond G. Julian, J. Campbell Cowan, James M. McLenachan

PRACTICALS CARDIOLOGY

Total Hours 30 HOURS

Clinical scenario given to the candidate for diagnosis and treatment of following disorders:

- a. Unstable angina
- b. Myocardial infarction
- c. Left ventricular aneurysm
- d. Congestive heart failure 20
- e. Cardiac arrhythmia
- f. Atrial septal defect
- g. Ventricular septal defect
- h. Tetralogy of Fallot
- i. Hypertension

CARDIAC SURGERY – I

L/P/T/C
3/-/-/3

Learning Objectives

- To explain the pathophysiology and surgical management of ischemic heart disease.
- To describe indications, contraindications, and planning of coronary artery bypass graft surgery (CABG).
- To understand conduit selection, harvesting techniques, and coronary artery bypass procedures.
- To explain off-pump and redo coronary artery bypass surgeries and their complications.
- To describe pathophysiology and surgical management of aortic valve diseases.
- To understand principles of valve replacement, valve repair, and aortic root procedures.
- To explain advanced surgical techniques including Ross procedure, homograft replacement, and valve sparing procedures.
- To correlate cardiac surgical procedures with perfusion techniques and perioperative management.

Learning Outcomes

- After completion of the subject, the student will be able to:
- Explain the pathology and surgical indications of ischemic heart disease.
- Describe various CABG techniques and conduit harvesting procedures.
- Understand coronary artery bypass planning and management of complex coronary surgeries.
- Identify complications associated with ischemic heart disease and coronary surgery.
- Explain surgical management of aortic stenosis and aortic regurgitation.
- Differentiate various valve replacement and valve repair procedures.
- Understand aortic root surgeries and valve sparing techniques.
- Apply cardiac surgical knowledge effectively during cardiopulmonary bypass procedures.

Assist in perioperative planning and management during cardiac surgical procedures.

UNIT I(20 Hours)

Ischaemic Heart Disease and CABG

Pathophysiology of Ischaemic Heart Disease

- Coronary artery disease
- Myocardial ischemia
- Coronary circulation

Indications and Contraindications for CABG

- Patient selection
- Risk assessment

Planning Coronary Artery Surgery

- Surgical planning
- Preoperative assessment

Conduits for CABG

- Saphenous vein graft
- LIMA
- RIMA
- Alternative conduits

Vein and Artery Harvesting

- Principles of saphenous vein harvest
- LIMA harvest
- RIMA harvest

UNIT II (20 Hours)

Coronary Artery Bypass Techniques

Anastomotic Techniques

- Distal anastomosis
- Proximal anastomosis
- Sequential grafts
- Jump grafts

Off-Pump CABG

- Positioning of heart in OPCAB
- Stabilization techniques

Advanced CABG Procedures

- Endarterectomy
- Redo CABG surgery
- Problem scenarios in redo surgery

Complications of Ischaemic Heart Disease

- Left ventricular aneurysm
- LV aneurysmectomy
- Ischaemic VSD
- Ischaemic mitral regurgitation

Outcomes

- Results of coronary artery bypass surgery

UNIT III (20 Hours)

Valvular Heart Disease – Aortic Valve Surgery

Aortic Valve Disease

- Pathophysiology of aortic stenosis
- Pathophysiology of aortic regurgitation

Timing and Principles of Surgery

- Timing of surgery
- Principles of aortic valve replacement

Aortic Valve Procedures

- Aortic valve implantation
- Stentless aortic valve replacement
- Homograft aortic valve replacement
- Ross procedure

Aortic Root Procedures

- Aortic root replacement
- Aortic root enlargement
- Valve sparing procedures

Surgical Outcomes

- Results of aortic valve surgery

Textbook:

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Oxford specialist handbook in surgery (Cardio thoracic surgery), Indian Edition, Joanna Chikwe, Emma Beddow, Brain Glenville.

INTRODUCTION TO OT & PERFUSION TECHNOLOGY

L/P/T/C
3/-/4/6

Learning Objectives

1. To explain the operating room environment, protocols, and sterile techniques followed in cardiac surgery.
2. To describe the components and basic functioning of the cardiopulmonary bypass system.
3. To understand the principles and procedures of cardiopulmonary bypass.
4. To explain the basics of electricity, electro-medical equipment, and electrical safety measures.
5. To describe sterilization methods and handling of surgical and perfusion equipment.
6. To understand basic and advanced cardiopulmonary resuscitation techniques.
7. To explain concepts of intensive coronary care units and postoperative recovery rooms.
8. To understand biomedical waste management and infection control practices in healthcare settings.

Learning Outcomes

After completion of the subject, the student will be able to:

1. Demonstrate knowledge of operating room protocols and sterile techniques.
2. Identify components of the cardiopulmonary bypass machine and related equipment.
3. Explain the basics of CPB procedures and perfusion technology.
4. Apply principles of electrical safety and safe handling of electro-medical equipment.
5. Perform proper sterilization and disinfection practices in the OT environment.
6. Demonstrate basic knowledge of BCLS and ACLS protocols.
7. Understand ICU and recovery room management concepts in cardiac care.
8. Implement biomedical waste management protocols and infection control measures.

UNIT I (12 Hours)

Operating Room Environment and Protocols

Operating Room Environment

- General protocols followed in the operating room
- Operating room setup

Sterile Techniques

- Hand washing techniques
- Unsterile, substerile, and sterile methods

Handling of OT Materials

- Handling of disposables in the OT
- Handling and maintenance of equipment in the OT

CCU Protocols

- Protocols followed in CCU

UNIT II (10 Hours)

Components of Cardiopulmonary Bypass System

CPB Machine Components

- Venous reservoir
- Oxygenator
- Heat exchanger
- Roller pump and centrifugal pump

Tubing and Cannulae

- Arterial and venous cannulae
- Tubing systems

Monitoring Devices

- Pressure monitoring
- Temperature monitoring
- Bubble detector and level sensor

UNIT III (10 Hours)

Basics of Cardiopulmonary Bypass Procedures

Introduction to CPB

- Principles of CPB
- Indications for CPB

Conduct of CPB

- Priming of circuit
- Initiation and termination of bypass

Monitoring During CPB

- Flow monitoring
- Pressure monitoring
- Anticoagulation monitoring

UNIT IV (10 Hours)

Basics of Electricity and Electro-Medical Equipments

Basics of Electricity

- Basic electrical concepts
- Current, voltage, and resistance

Electro-Medical Equipments

- Functioning of electro-medical equipment
- Care and maintenance of apparatus

Electrical Safety

- Earthing
- Electrical hazards and safeguards
- Static electricity

UNIT V (6 Hours)

Sterilization Methods and Infection Control

Sterilization

- Principles of sterilization
- Sterilization materials and methods

Infection Control

- Disinfection techniques
- OT infection control practices

UNIT VII (4 Hours)

Intensive Coronary Care Unit and Recovery Room Concepts

Intensive Coronary Care Unit

- ICU setup and monitoring
- Hemodynamic monitoring basics

Recovery Room Concepts

- Postoperative care
- Recovery room protocols

UNIT VIII (4 Hours)

Biomedical Waste Management

Biomedical Waste

- Categories of biomedical waste
- Segregation and disposal methods

Waste Management Protocols

- Biomedical waste management rules
- Infection prevention and safety measures

Textbook:

1. Cardiopulmonary bypass; Principles and practice, Glenn P. Gravelee, Richard F. Davis , Mark Kurusz & Joe R. Utley; 2nd edition; Lippincott Williams & Wilkins 2000.
2. Techniques in Extracorporeal circulation, Philip H. Kay & Christopher M. Munsch

PRACTICALS

INTRODUCTION TO OT & PERFUSION TECHNOLOGY

- Orientation to operation theatre environment and protocols
- Demonstration of hand washing and sterile techniques
- Identification and handling of OT disposables
- Handling and maintenance of OT and perfusion equipment
- Identification of components of cardiopulmonary bypass machine
- Assembly and priming of CPB circuit
- Observation of basic CPB procedures
- Demonstration of electrical safety and earthing
- Identification and handling of electro-medical equipment
- Sterilization and disinfection techniques
- ICU and recovery room monitoring techniques
- Biomedical waste segregation and disposal methods

PHARMACOLOGY OF CARDIOVASCULAR DRUGS

L/P/T/C
3/-/-3

Learning Objectives

1. Explain cardiovascular pharmacology.
2. Understand drugs used during CPB.
3. Describe anticoagulation management.
4. Discuss recent advances in cardiac pharmacology.

Learning Outcomes

1. Identify indications and side effects of cardiac drugs.
2. Apply pharmacological principles during CPB.
3. Monitor anticoagulation safely.
4. Assist in drug preparation during cardiac surgery.

Unit I – (5 Hours)

Anti-anginal Agents

Beta-blocking agents, nitrates, calcium channel blockers

Unit II (5 Hours)

Anti-failure Agents

Diuretics

Unit III – (5 Hours)

ACE Inhibitors, ARBs and Aldosterone Antagonists

Angiotensin-converting enzyme (ACE) inhibitors

angiotensin-II receptor blockers (ARBs)

aldosterone antagonism

Unit IV (5 Hours)

Digitalis and Inotropic Drugs –

Digitalis

acute inotrope

inotropic dilators

Unit V (5 Hours)

Antiarrhythmic Drugs

Unit VII (5 Hours)

Antithrombotic and Lipid-Lowering Drugs

Platelet inhibitors

Anticoagulants

Fibrinolytics

lipid-lowering

antiatherosclerotic drugs

Unit VIII (5 Hours)

Drugs Used During Cardiopulmonary Bypass (CPB)

Dosage for adult and pediatric CPB, alterations of drug dosage during CPB

Unit IX (5 Hours)

Recent Developments in Cardiovascular Pharmacology

Milrinone, levosimendan, argatroban, bivalirudin, bio-glues, Factor VIII, and fibrinogen

I year II semester

S.NO	SUBJECT CODE	SUBJECT	L	T	P	C	Max. Marks		
							INT	EXT	TOTAL
1		Cardiac Surgery – II	3	-	-	3	40	60	100
2		Advanced ECMO and Extracorporeal Life Support	3	-	2	4	40	60	100
3		Equipments in Perfusion Technology	3	-	2	4	40	60	100
4		Physiology and Pathology of Perfusion	3	-	-	3	40	60	100
5		Clinical postings	-	-	12	6	40	60	100
TOTAL			12	-	16	20	200	300	500

Cardiac Surgery – II

L/P/T/C
3/-/3/4

UNIT I(10 Hours)**Mitral and Tricuspid Valve Surgery****Mitral Valve Disease**

- Pathophysiology of mitral stenosis
- Pathophysiology of mitral regurgitation
- Timing of surgery

Mitral Valve Procedures

- Mitral valvotomy
- Mitral valve repair
- Mitral valve replacement

Tricuspid Valve Disease

- Tricuspid valve surgery
- Combined valvular procedures

Infective Endocarditis

- Surgery for infective endocarditis

UNIT II (15 Hours)

Congenital Heart Disease and Surgical Procedures

Embryology and Overview

- Embryology of heart
- Overview of congenital heart surgery

Congenital Cardiac Defects

- PDA
- TAPVC
- Coarctation of aorta
- ASD
- VSD
- AVSD
- Truncus arteriosus
- Transposition of great arteries
- Ebstein anomaly
- Tetralogy of Fallot
- Hypoplastic left heart syndrome

Surgical Procedures

- Arterial switch operation
- Rastelli operation
- Damus-Kaye-Stansel operation
- Norwood operation
- Glenn shunt
- Fontan operation
- Pulmonary artery banding
- Aortopulmonary shunts

Hybrid Procedures

- Role of perfusionist during percutaneous device closure
- Hybrid cardiac procedures

UNIT III(10 Hours)

Diseases of Thoracic Aorta

Aortic Dissection

- Pathology of aortic dissection
- Diagnosis of type A dissection
- Management of type A and B dissections

Surgical Repair

- Repair of DeBakey type I and II dissections
- Surgical setup and perfusion considerations

Aortic Aneurysms

- Pathology and diagnosis
- Management of aneurysms

Aortic Surgery

- Ascending aneurysm surgery
- Arch aneurysm surgery
- Descending thoracic aneurysm repair
- Bypass techniques for descending aortic surgery
- Traumatic aortic transection
- Hybrid TEVAR

UNIT IV(10 Hours)

Minimal Access and Hybrid Cardiac Surgery

Minimal Access Surgery

- Surgical incisions
- Basic surgical instruments

Perfusion Disposables

- Cannulas
- VAVD systems

Cardiopulmonary Bypass Options

- CPB strategies in minimally invasive surgery

Minimally Invasive Procedures

- LIMA harvest
- Minimal access CABG

- Minimal access valve surgery

Mechanical Ventilation

- Basics of mechanical ventilation
- Modes of ventilation

Advanced ECMO and Extracorporeal Life Support

L/P/T/C
3/-/2/4

1. To explain the principles and physiology of extracorporeal membrane oxygenation (ECMO) and extracorporeal life support (ECLS).
2. To describe various ECMO circuits, components, and cannulation techniques.
3. To understand indications, contraindications, and management of ECMO support in adult, pediatric, and neonatal patients.
4. To explain monitoring, anticoagulation, and troubleshooting during ECMO support.
5. To describe complications associated with ECMO and methods for prevention and management.
6. To understand advanced extracorporeal support systems including ECPR, ventricular assist devices, and extracorporeal CO₂ removal.
7. To correlate ECMO management with perfusion technology and critical care practices.

Learning Outcomes

After completion of the subject, the student will be able to:

1. Explain the principles and physiology of ECMO and ECLS.
2. Identify components of ECMO circuits and extracorporeal support systems.
3. Describe VV ECMO and VA ECMO configurations and cannulation strategies.
4. Perform monitoring and troubleshooting during ECMO support.
5. Understand anticoagulation management and ECMO-related complications.
6. Explain ECPR and advanced extracorporeal support techniques.
7. Apply ECMO knowledge effectively in critical care and perfusion practice.

UNIT I (8 Hours)

Introduction to ECMO and ECLS

Principles of ECMO

- History and evolution of ECMO
- Principles of extracorporeal support

Types of ECMO

- VV ECMO
- VA ECMO
- Hybrid ECMO configurations

Indications and Contraindications

- Respiratory failure
- Cardiac failure
- Contraindications for ECMO

Patient Management

- Ventilator management during ECMO
- Fluid and electrolyte management
- Renal support during ECMO

UNIT II (10 Hours)

ECMO Circuit and Components

ECMO Circuit

- Tubing systems
- Venous reservoir

Oxygenators and Pumps

- Membrane oxygenators
- Centrifugal pumps

Heat Exchanger and Monitoring Devices

- Heat exchanger
- Pressure monitoring
- Bubble detector
- Flow sensors

UNIT III (10 Hours)

Cannulation Techniques and ECMO Configurations

Cannulation Techniques

- Peripheral cannulation
- Central cannulation

Cannulation Sites

- Femoral cannulation
- Jugular cannulation

ECMO Configurations

- VV ECMO configuration
- VA ECMO configuration
- Hybrid ECMO support

UNIT IV (10 Hours)

Repairs

- TOF repair
- Pulmonary valvotomy
- Coarctation repair
- Interrupted aortic arch repair
- LVOT obstruction repair

Physiology and Management During ECMO

Gas Exchange and Hemodynamics

- Oxygen delivery and consumption
- Carbon dioxide removal
- Hemodynamic support

Weaning from ECMO

- Weaning protocols
- Decannulation procedures

UNIT V (8 Hours)

Monitoring and Anticoagulation in ECMO

Monitoring During ECMO

- Hemodynamic monitoring
- Blood gas analysis
- Flow and pressure monitoring

Anticoagulation

- Heparin management
- ACT and anti-Xa monitoring

Laboratory Monitoring

- Coagulation profile
- Hematological monitoring

UNIT VI (6 Hours)

Complications and Troubleshooting in ECMO

Mechanical Complications

- Pump failure
- Oxygenator failure
- Air embolism

Patient-Related Complications

- Bleeding
- Thrombosis
- Infection

Troubleshooting

- Circuit troubleshooting
- Emergency management during ECMO

UNIT VII (4 Hours)

ECPR and Advanced Extracorporeal Support Systems

Extracorporeal Cardiopulmonary Resuscitation

- Principles of ECPR
- Indications and outcomes

Advanced Support Systems

- Extracorporeal CO₂ removal (ECCO₂R)
- Ventricular assist devices (VAD)

UNIT VIII(4 Hours)

Pediatric and Neonatal ECMO

Pediatric ECMO

- Indications in pediatric patients
- Pediatric ECMO management

Neonatal ECMO

- Neonatal respiratory failure
- Neonatal ECMO considerations

PRACTICALS

ADVANCED ECMO AND EXTRACORPOREAL LIFE SUPPORT

Total Practical Hours: 60 Hours

1. Identification of ECMO circuit components
2. Assembly and priming of ECMO circuit
3. Demonstration of VV ECMO and VA ECMO configurations
4. Observation of ECMO cannulation techniques
5. Monitoring of ECMO parameters and blood gases
6. Anticoagulation monitoring during ECMO
7. Troubleshooting of ECMO circuit problems
8. Ventilator management during ECMO
9. Weaning and decannulation procedures
10. Case discussion and logbook maintenance

EQUIPMENTS IN PERFUSION TECHNOLOGY

L/P/T/C
3/-/2/4

Learning Objectives

1. To explain the principles and functioning of blood pumps and oxygenators used in extracorporeal circulation.
2. To describe gas exchange, heat transfer, and operation of oxygenators.
3. To understand perfusion circuitry and cannulation techniques used during cardiopulmonary bypass and extracorporeal life support.
4. To explain cardiotomy suction, venting systems, and related complications.
5. To understand cannulation strategies during conversion between CPB and ECLS.

Learning Outcomes

After completion of the subject, the student will be able to:

1. Explain the functioning of blood pumps and oxygenators.
2. Describe gas exchange and heat transfer principles in extracorporeal circulation.
3. Identify components of perfusion circuitry and cannulation systems.
4. Understand cardiotomy suction and venting techniques during CPB.
5. Recognize complications related to cannulation and extracorporeal circulation.
6. Apply cannulation strategies during transition from CPB to ECLS and vice versa.

UNIT I (10Hours)

Blood Pumps

Roller Pumps

- Construction and working principles
- Advantages and disadvantages

Centrifugal Pumps

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- Components and functioning
- Clinical applications

Comparison of Blood Pumps

- Roller pump versus centrifugal pump

UNIT II(10 Hours)

Principles of Oxygenator Function

Oxygenators

- Bubble oxygenators
- Membrane oxygenators
- Hollow fiber oxygenators

Oxygenator Physiology

- Principles of gas exchange
- Oxygen transfer mechanisms
- Carbon dioxide removal

UNIT III (8 Hours)

Gas Exchange, Heat Transfer and Oxygenator Operation

Gas Exchange

- Factors affecting gas exchange
- Blood flow and gas flow relationship

Heat Transfer

- Heat exchangers
- Temperature regulation during CPB

Oxygenator Operation

- Priming procedures
- Monitoring oxygenator performance

UNIT IV (5 Hours)

Perfusion Circuit

Components of Circuit

- Tubing systems
- Arterial and venous lines

- Reservoirs and filters

Circuit Assembly

- Circuit setup
- Safety checks before CPB

UNIT V (6 Hours)

Cannulation Techniques

Arterial Cannulation

- Aortic cannulation
- Femoral cannulation

Venous Cannulation

- Single-stage cannulation
- Two-stage cannulation
- Bicaval cannulation

Special Cannulation Techniques

- Peripheral cannulation
- Central cannulation

UNIT VI (4 Hours)

Cardiotomy Suction and Venting

Cardiotomy Suction

- Principles and techniques
- Blood conservation

Venting Techniques

- Left ventricular vent
- Aortic root vent
- Pulmonary artery vent

UNIT VII (2 Hours)

Complications of Cannulation

Cannulation Complications

- Air embolism

- Vascular injury
- Bleeding
- Malperfusion

UNIT VIII (2 Hours)

Cannulation Strategy During CPB and ECLS Transition

Transition from CPB to ECLS

- Cannulation strategy during conversion
- Emergency ECLS initiation

Transition from ECLS to CPB

- Perfusion considerations
- Circuit modifications

PRACTICALS EQUIPMENTS IN PERFUSION TECHNOLOGY

Total Practical Hours: 30 Hours

1. Identification of roller and centrifugal pumps
2. Demonstration of oxygenator components and setup
3. Observation of gas exchange and heat exchanger systems
4. Assembly of perfusion circuitry
5. Identification of arterial and venous cannulae
6. Demonstration of cannulation techniques
7. Observation of cardiotomy suction and venting systems
8. Troubleshooting of perfusion circuitry and equipment

PHYSIOLOGY & PATHOLOGY OF PERFUSION

L/P/T/C
3/-/-3

Learning Objectives

1. To explain physiological and pathological changes occurring during cardiopulmonary bypass.
2. To describe blood-surface interactions, pulsatile perfusion, and hemodilution during CPB.
3. To understand hypothermia, myocardial protection, and pharmacokinetic alterations during perfusion.
4. To explain methods for assessing adequacy of perfusion and principles of goal-directed perfusion.
5. To understand inflammatory, metabolic, neurologic, renal, pulmonary, and visceral effects of CPB.
6. To describe recent developments and online monitoring systems used in perfusion technology.
7. To explain the significance of NIRS and advanced monitoring during CPB.

Learning Outcomes

After completion of the subject, the student will be able to:

1. Explain physiologic and pathologic responses associated with cardiopulmonary bypass.
2. Describe hemodilution, hypothermia, and myocardial protection techniques during CPB.
3. Understand pharmacologic and metabolic changes during extracorporeal circulation.
4. Assess adequacy of perfusion using monitoring techniques and goal-directed perfusion principles.
5. Recognize inflammatory and organ-specific complications associated with CPB.
6. Understand recent advances and online monitoring systems in perfusion technology.
7. Apply NIRS and perfusion monitoring concepts during clinical perfusion practice

UNIT I (6 Hours)

Blood-Surface Interface and Pulsatile Cardiopulmonary Bypass

Blood-Surface Interface

- Blood contact with artificial surfaces
- Hematological changes during CPB

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- Coagulation and platelet activation

Pulsatile Cardiopulmonary Bypass

- Principles of pulsatile flow
- Advantages and disadvantages
- Physiological effects of pulsatile perfusion

UNIT II (8 Hours)

Hemodilution, Priming Solutions and Hypothermia

Hemodilution

- Principles of hemodilution
- Advantages and complications

Priming Solutions

- Crystalloid solutions
- Colloid solutions
- Blood priming

Hypothermia

- Physiology of hypothermia
- Clinical applications during CPB
- Rewarming techniques

UNIT III (6 Hours)

Surgical Myocardial Protection and Pharmacokinetics During CPB

Myocardial Protection

- Principles of myocardial protection
- Cardioplegia solutions
- Delivery techniques of cardioplegia

Pharmacokinetics During CPB

- Drug dilution during CPB
- Altered drug metabolism
- Effects of hypothermia on pharmacokinetics

UNIT IV(5 Hours)

Assessment of Perfusion Adequacy and Goal Directed Perfusion

Perfusion Adequacy

- Oxygen delivery and consumption
- Mixed venous oxygen saturation
- Lactate monitoring

Goal Directed Perfusion

- Principles of goal directed perfusion
- Perfusion pressure management
- Hematocrit management during CPB

UNIT V (6 Hours)

Immune, Inflammatory, Endocrine and Metabolic Response

Immune and Inflammatory Responses

- Systemic inflammatory response syndrome
- Cytokine activation during CPB

Embolic Events

- Air embolism
- Particulate embolism

Endocrine and Metabolic Responses

- Stress response during CPB
- Electrolyte imbalance
- Acid-base disturbances

UNIT VI (7 Hours)

Cardiopulmonary Bypass and Organ System Effects

Pulmonary Effects

- CPB and lung injury
- Pulmonary dysfunction after CPB

Renal Effects

- Acute kidney injury during CPB
- Renal protection strategies

Splanchnic and Hepatic Effects

- Hepatic dysfunction
- Gastrointestinal complications

Neurologic Effects

- Neurologic complications during CPB
- Cognitive dysfunction after CPB

UNIT VII(3 Hours)

Recent Developments in Perfusion Technology

Advances in Perfusion Equipment

- Miniaturized CPB circuits
- Biocompatible circuits

Advanced Perfusion Techniques

- Modified ultrafiltration
- Autotransfusion systems

Modern Perfusion Strategies

- Evidence-based perfusion practices
- Enhanced perfusion safety systems

UNIT VIII(4 Hours)

Online Monitoring Systems and NIRS During CPB

Online Monitoring Systems

- Continuous blood gas monitoring
- Hematocrit and oxygen saturation monitoring
- Perfusion adequacy monitoring systems

Near Infrared Spectroscopy (NIRS)

- Principles of NIRS
- Cerebral oximetry
- Significance and importance during CPB

Textbook:

1. Cardiopulmonary bypass; Principles and practice, Glenn P. Gravelee, Richard F. Davis , Mark Kurusz & Joe R. Utley; 2nd edition; Lippincott Williams & Wilkins 2000.
2. Techniques in Extracorporeal circulation, Philip H. Kay & Christopher M. Munsch
3. Warm heart surgery , Tomas Antonio Salerno

Ilyear III semester

S.NO	SUBJECT CODE	SUBJECT	L	T	P	C	Max. Marks		
							INT	EXT	TOTAL
1		Clinical Applications of Perfusion Technology	3	-	2	4	40	60	100
2		Cardiac Surgery without CPB, Mechanical Circulatory Support and Robotic Cardiac Surgery	3	-	2	4	40	60	100
4		Dissertation Work – I and Viva Voce	0	0	24	12	40	60	100
TOTAL			6	-	28	20	180	180	300

Clinical Applications of Perfusion Technology

L/P/T/C
3/-/2/4

Learning Objectives

1. To explain the clinical conduct and termination of cardiopulmonary bypass.
2. To understand management of complications and unusual situations during CPB.
3. To describe pediatric and neonatal perfusion techniques.
4. To explain ECMO management, cannulation strategies, and retrieval logistics.
5. To understand extracorporeal cardiopulmonary support outside the operating room.
6. To explain non-cardiac applications of perfusion technology including HIPEC.
7. To understand perfusion strategies for thoracic aortic and minimally invasive cardiac surgery.

Learning Outcomes

After completion of the subject, the student will be able to:

1. Conduct and terminate cardiopulmonary bypass safely.
2. Manage complications encountered during extracorporeal circulation.
3. Apply perfusion techniques in pediatric and neonatal cardiac surgery.
4. Understand ECMO management and patient retrieval logistics.
5. Explain extracorporeal support applications outside the cardiac operating room.
6. Assist in oncology and thoracic aortic perfusion procedures.
7. Apply perfusion principles in minimally invasive cardiac surgery.

UNIT I (10 Hours)

Conduct and Termination of Cardiopulmonary Bypass

Conduct of CPB

- Initiation of cardiopulmonary bypass
- Monitoring during CPB
- Maintenance of perfusion parameters

Termination of CPB

- Weaning from bypass
- Decannulation procedures
- Post-bypass management

UNIT II (8 Hours)

Management of Problems During Cardiopulmonary Bypass

UNIT III(8 Hours)

Cardiopulmonary Bypass in Infants and Children

Pediatric Perfusion Principles

- Pediatric physiology
- Neonatal circulation

Pediatric CPB Techniques

- Priming strategies
- Temperature management
- Flow management

Pediatric Complications

- Hemodilution
- Coagulopathy
- Organ protection

UNIT IV (12 Hours)

ECMO for Respiratory and Cardiac Support

ECMO Principles

- Respiratory ECMO
- Cardiac ECMO

Cannulation Strategies

- Peripheral cannulation
- Central cannulation

ECMO Management

- Technical management
- Medical management
- Hematological management

ECMO Complications

- Bleeding
- Thrombosis
- Infection

ECMO Retrieval and Logistics

- Road and air patient retrieval
- Interhospital and intrahospital transfer
- ECMO logistics management

ECMO Classifications

- ECMO as RVAD
- ECMO as LVAD
- ECMO as ECCO₂R

UNIT V (6 Hours)

Extracorporeal Cardiopulmonary Support Outside the Operating Room

ECPR

- Extracorporeal cardiopulmonary resuscitation
- Indications and management

Support During Invasive Cardiology Procedures

- Support during high-risk PCI
- Support during catheterization procedures

Perfusion Outside OT

- Mobile perfusion services
- Emergency extracorporeal support

UNIT VI(4 Hours)

Non-Cardiovascular Applications of Cardiopulmonary Bypass

UNIT VII(4 Hours)

Role of Perfusionist in Oncology Treatment – HIPEC

HIPEC Principles

- Hyperthermic intraperitoneal chemotherapy
- Temperature regulation during HIPEC

Role of Perfusionist

- Circuit setup and monitoring
- Safety precautions during HIPEC

UNIT VIII (8 Hours)

Perfusion for Thoracic Aortic and Minimally Invasive Cardiac Surgery

Thoracic Aortic Surgery

- Perfusion strategies during aortic surgery
- Deep hypothermic circulatory arrest

Minimally Invasive Cardiac Surgery

- Minimal access perfusion techniques
- Peripheral cannulation strategies

Perfusion Modifications

- Vacuum assisted venous drainage
- Miniaturized CPB circuits

PRACTICALS

CLINICAL APPLICATIONS OF PERFUSION TECHNOLOGY

Total Practical Hours: 60 Hours

1. Observation of conduct and termination of cardiopulmonary bypass –
2. Troubleshooting during cardiopulmonary bypass
3. Observation of pediatric and neonatal perfusion procedures
4. Demonstration of ECMO circuit setup and priming
5. Observation of ECMO cannulation and management
6. Observation of extracorporeal support during invasive cardiology procedures
7. Observation of perfusion support during thoracic aortic surgery
8. Observation of minimally invasive cardiac surgery perfusion
9. Observation of HIPEC procedures
10. Case discussion and logbook maintenance

Textbook:

1. Cardiopulmonary bypass; Principles and practice, Glenn P. Gravelee, Richard F. Davis , Mark Kurusz & Joe R. Utley; 2nd edition; Lippincott Williams & Wilkins 2000.
2. Techniques in Extracorporeal circulation, Philip H. Kay & Christopher M. Munsch
3. Warm heart surgery , Tomas Antonio Salerno

CARDIAC SURGERY WITHOUT CPB, MECHANICAL CIRCULATORY SUPPORT & ROBOTIC CARDIAC SURGERY

L/P/T/C

3/-/2/4

Learning Objectives

1. To explain principles and techniques of cardiac surgery without cardiopulmonary bypass.
2. To understand patient selection and perfusion considerations in minimally invasive and off-pump cardiac surgery.
3. To describe mechanical circulatory support devices and their clinical applications.
4. To understand INTERMACS classification and assist device implantation strategies.
5. To explain bridge-to-transplant devices and long-term outcomes of mechanical support systems.
6. To describe robotic cardiac surgery and perfusion management during robotic and port-access procedures.

Learning Outcomes

After completion of the subject, the student will be able to:

1. Explain techniques and patient selection criteria for off-pump cardiac surgery.
2. Understand stabilizing devices and alternative surgical approaches for coronary artery disease.
3. Describe various mechanical circulatory support systems and assist devices.
4. Apply perfusion strategies during transition from ECLS to CPB and assist devices.
5. Understand indications and outcomes of bridge-to-transplant devices.
6. Explain perfusion management during robotic and minimally invasive cardiac surgery.

UNIT I (10 Hours)

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Cardiac Surgery Without CPB

Patient Selection

- Selection criteria for MIDCAB
- Selection criteria for OPCAB

Off-Pump Surgical Techniques

- Technical considerations in off-pump surgery
- Stabilizing devices
- Intracoronary shunts

Beating Heart Surgery

- Primary off-pump CABG in impaired LV function
- Beating heart surgery supported by assist devices

Alternative Surgical Approaches

- Alternative approaches to coronary artery disease

UNIT II (8 Hours)

Introduction to Mechanical Circulatory Support

Mechanical Circulatory Support

- Principles of circulatory support
- Indications and contraindications

INTERMACS Classification

- INTERMACS profiles
- Clinical significance

Intra-Aortic Balloon Pump

- Principles of IABP
- Components and functioning
- Clinical applications

UNIT III (12 Hours)

Cardiac Assist Devices

General Aspects of Mechanical Support

- Hemodynamic support principles
- Device classifications

Extracorporeal Devices

- ECMO support systems
- Extracorporeal ventricular assist devices

Intracorporeal Devices

- LVAD
- RVAD
- BiVAD

Future Devices

- Total artificial heart
- Emerging technologies in circulatory support

UNIT IV (10 Hours)

Devices Used to Bridge to Transplantation

Thoratec VAD

- Components and functioning
- Clinical applications

Novacor LVAD

- Device principles
- Management strategies

HeartMate Devices

- Types and indications
- Long-term support

Totally Artificial Heart

- Principles and applications
- Limitations and complications

UNIT V (8 Hours)

Assist Devices and Perfusion Strategies

Patient Selection

- Criteria for assist device implantation
- Risk assessment

Patient Preparation

- Medical preparation
- Psychological preparation
- Economical considerations

Perfusion Strategies

- Switching from ECLS to CPB
- Switching from CPB to assist devices
- Perfusion management during implantation

UNIT VI (4 Hours)

Outcomes and Complications of Mechanical Support Devices

Survival Outcomes

- Long-term survival results
- Device performance evaluation

Mortality and Morbidity

- Complications associated with assist devices
- Infection, thrombosis, and bleeding complications

UNIT VII (8 Hours)

Robotic Cardiac Surgery

Robotic Surgery Principles

- Introduction to robotic cardiac surgery
- Robotic surgical systems

Minimally Invasive Cardiac Surgery

- Port-access surgery
- Direct vision surgery
- Micro-incision surgery
- Video-assisted cardiac surgery

Endovascular Catheter Systems

- Components and applications
- Perfusion considerations

UNIT VIII (10 Hours)

Cardiopulmonary Bypass During Robotic and Port-Access Surgery

CPB in Minimally Invasive Surgery

- Peripheral cannulation techniques
- Vacuum assisted venous drainage

Perfusion Management

- CPB setup during robotic surgery
- Monitoring during robotic procedures

Special Considerations

- Perfusion challenges during robotic surgery
- Safety protocols and troubleshooting

PRACTICALS

CARDIAC SURGERY WITHOUT CPB, MECHANICAL CIRCULATORY SUPPORT & ROBOTIC CARDIAC SURGERY

Total Practical Hours: 60 Hours

Designing a LVAD / RVAD circuit and describe the components

2. Assembling the LVAD/RVAD circuit and prime.

3. Set up of an IABP; indentation the diastolic point, unassisted systole, and assisted systole.

4. Description of proper timing, timing errors, complications and contra indications of IABP therapy.

Diagrammatic representation of picture of pressure wave of 1:2 assist.

5. Identification & use of octopus in off-pump CABG

6. Identification & use of star fish in off-pump CABG

7. Indications for use of IABP for off-pump procedures

8. Shunts used for systemic –pulmonary shunts in pediatric cardiac surgery and for aortic surgery.

9. Intra coronary shunts in off-pump CABG.

Textbook:

1. Cardiac assist devices, Daniel J. Goldstein & Mehmet C.Oz, Futura Publishing Company, 2000

2. Cardiopulmonary bypass; Principles and practice, Glenn P. Gravelee, Richard F. Davis, Mark Kurusz & Joe R. Utley; 2nd edition; Lippincott Williams & Wilkins 2000.

3. Techniques in Extracorporeal circulation, Philip H. Kay & Christopher M. Munsch

DISSERTATION – I

Learning Objectives

- Develop understanding of research methodology and data collection techniques in perfusion technology.
- Learn to investigate clinical and technical problems related to cardiopulmonary bypass, ECMO, and extracorporeal circulation using scientific methods.
- Enhance skills in scientific writing, statistical analysis, and presentation of research findings.

Learning Outcomes

- Conduct a basic research study in perfusion technology and clinical perfusion practice.
- Analyze and interpret research data to derive meaningful clinical conclusions.
- Present research findings in a structured scientific dissertation and viva voce presentation

Dissertation Activities

- Selection of research topic
- Review of literature
- Preparation of research proposal
- Ethical committee approval
- Data collection and documentation
- Statistical analysis and interpretation
- Dissertation writing and formatting
- Preparation of presentation and viva voce

Evaluation Methods

- Internal assessment by research supervisor
- Dissertation submission and evaluation
- External examiner assessment
- Viva voce examination
- Research presentation and defense

II year IV semester

S.NO	SUBJECT CODE	SUBJECT	L	T	P	C	Max. Marks		
							INT	EXT	TOTAL
1		Organ Transplantation	3	-	-	3	40	60	100
2		Hematology As Relevant To Perfusion, Blood Transfusion And Blood Conservation	2	-	2	4	40	60	100
3		Dissertation Work – II and Viva Voce	0	-	32	16	40	60	100
TOTAL			5	-	34	22	120	180	300

ORGAN TRANSPLANTATION

L/P/T/C
3/-/3/4

Learning Objectives

1. To explain principles of organ transplantation and transplant immunology.
2. To understand donor and recipient selection criteria in cardiac and thoracic transplantation.
3. To describe surgical procedures and perioperative management in heart, lung, and heart-lung transplantation.
4. To explain the role of perfusionist during organ transplantation procedures.
5. To understand preservation solutions, grafts, prosthetic valves, and organ retrieval systems.
6. To describe postoperative management, immunosuppression, and transplant-related complications.

Learning Outcomes

After completion of the subject, the student will be able to:

1. Explain immunological principles and surgical techniques involved in organ transplantation.
2. Understand donor-recipient matching and organ preservation strategies.
3. Describe the role of perfusionist in cardiac, thoracic, liver, and renal transplantation.
4. Identify transplant-related grafts, prosthetic valves, and organ retrieval systems.
5. Understand postoperative management and complications following transplantation.
6. Apply transplantation concepts in perfusion and extracorporeal circulation practice

UNIT (8 Hours)

Heart Transplantation

Basic Transplant Immunology

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- Immunological principles of transplantation
- Rejection mechanisms

Donor and Recipient Selection

- Patient selection criteria
- Donor selection criteria
- Matching donor to recipient

Donor Preparation

- Organ preservation techniques
- Donor management protocols

Surgical Procedures

- Orthotopic cardiac transplantation
- Heterotopic cardiac transplantation

Postoperative Management

- Intensive care management
- Immunosuppression therapy
- Rejection and complications

Transplant Equipment

- Contents of transplant kit
- Dimensions of transplant box for heart, lung, and heart-lung transplantation

UNIT II (8 Hours)

Heart-Lung Transplantation

Recipient and Donor Selection

- Recipient evaluation
- Donor selection and graft harvest

Surgical Procedures

- Heart-lung transplantation techniques
- Perfusion considerations during transplantation

Pathophysiology and Management

- Pathophysiology before transplantation
- Pathophysiology after transplantation
- Preoperative management

UNIT III (10 Hours)

Lung Transplantation

Recipient and Donor Selection

- Indications for lung transplantation
- Donor selection criteria

Surgical Procedures

- Single lung transplantation
- Double lung transplantation

Pathophysiology and Management

- Pathophysiology before and after transplantation
- Postoperative management

Lung Preservation

- Perfadex solution
- Perfadex Plus solution for lung protection

UNIT IV (8 Hours)

Liver and Renal Transplantation – Role of Perfusionist

Liver Transplantation

- Overview of liver transplantation
- Role of perfusionist during liver transplantation

Renal Transplantation

- Overview of renal transplantation
- Role of perfusionist during renal transplantation

UNIT V (6 Hours)

Transplant Immunology and Postoperative Management

Immunosuppression

- Immunosuppressive drugs
- Monitoring during immunosuppressive therapy

Rejection

- Acute rejection
- Chronic rejection

Postoperative Complications

- Infection
- Organ dysfunction
- Hemodynamic management

UNIT VI (6 Hours)

Prosthetic Heart Valves and Homografts

Prosthetic Heart Valves

- Mechanical heart valves
- Bioprosthetic heart valves

Homografts

- Types of homografts
- Clinical applications

UNIT VII (4 Hours)

Vascular and Composite Grafts

Vascular Grafts

- Collagen impregnated grafts
- Trifurcated grafts
- Arch vessel grafts

Composite Valved Grafts

- Structure and applications
- Surgical indications

UNIT VIII (4 Hours)

Organ Retrieval Systems and Preservation Solutions

Organ Retrieval Systems

- TRANSMEDICS organ retrieval system
- Organ transport and preservation techniques

Preservation Solutions

- Organ preservation methods
- Cold storage techniques

Books for organ transplantation

1. Heart, lung and heart lung transplantation: In Kaplan's Cardiac Anaesthesia, 5th Edition, Joel A Kaplan (Editor) Elsevier Saunders, Philadelphia 2006.
2. Oxford specialist handbook in surgery (Cardio thoracic surgery), Indian Edition, Joanna Chikwe, Emma Beddow, Brain Glenville.

HEMATOLOGY AS RELEVANT TO PERFUSION, BLOOD TRANSFUSION AND BLOOD CONSERVATION

L/P/T/C

3/-/2/4

Learning Objectives

1. To explain hematological principles relevant to cardiopulmonary bypass and extracorporeal circulation.
2. To understand anticoagulation management and heparin neutralization during CPB.
3. To describe hematologic complications and coagulopathies associated with perfusion.
4. To explain blood transfusion practices and transfusion algorithms.
5. To understand blood conservation techniques and autotransfusion methods.
6. To describe thromboelastography, antifibrinolytics, and cell saver systems used in perfusion practice.

Learning Outcomes

After completion of the subject, the student will be able to:

1. Explain anticoagulation and coagulation management during cardiopulmonary bypass.
2. Understand hematologic changes and coagulopathies associated with CPB.
3. Apply transfusion practices and blood conservation strategies during cardiac surgery.
4. Interpret thromboelastogram findings during ECMO and bleeding conditions.
5. Understand principles and applications of cell saver systems and antifibrinolytic therapy.
6. Apply blood conservation techniques in perfusion and extracorporeal circulation practice.

UNIT I (10 Hours)

Hematology Relevant to Perfusion

Hemostasis and Coagulation

- Physiology of coagulation
- Platelet function during CPB

Anticoagulation for Cardiopulmonary Bypass

- Heparin administration
- ACT monitoring
- Anticoagulation protocols

Heparin Neutralization

- Protamine administration
- Complications of protamine therapy

UNIT II (10 Hours)

Hematologic Effects and Coagulopathies During CPB

Hematologic Effects of CPB

- Hemodilution
- Platelet dysfunction
- Hemolysis during CPB

Coagulopathies Associated with CPB

- Consumptive coagulopathy
- Dilutional coagulopathy
- Management of bleeding disorders during CPB

UNIT III (8 Hours)

Hemodilution and Priming Solutions

Hemodilution

- Advantages of hemodilution
- Disadvantages of hemodilution

Priming Fluids

- Crystalloid solutions
- Colloid solutions
- Blood priming techniques

UNIT IV (10 Hours)

Blood Transfusion Practices

Blood Transfusion

- Blood components and indications
- Transfusion practices during cardiac surgery

Transfusion Algorithms

- Massive transfusion protocols
- Goal-directed transfusion therapy

Transfusion Complications

- Transfusion reactions
- Transfusion-related lung injury
- Infection risks

UNIT V (8 Hours)

Thromboelastography and Hemostatic Monitoring

Thromboelastogram

- Principles of thromboelastography
- Interpretation of TEG parameters

Clinical Applications

- TEG during ECMO
- TEG in bleeding patients
- Coagulation monitoring strategies

UNIT VI (6 Hours)

Blood Conservation Techniques

Autologous Blood Donation

- Principles and indications

Acute Normovolemic Hemodilution

- Blood pooling techniques
- Clinical applications

Blood Salvage

- Intraoperative blood salvage
- Postoperative autologous blood salvage

UNIT VII (4 Hours)

Erythropoietin Therapy and Hemostatic Abnormalities

Erythropoietin Therapy

- Indications and applications
- Replacement of blood loss

Hemostatic Abnormalities

- Pathophysiology of bleeding disorders
- Epidemiology of hemostatic abnormalities

UNIT VIII (4 Hours)

Antifibrinolytics and Cell Saver Systems

Antifibrinolytics

- Tranexamic acid
- Epsilon aminocaproic acid
- Clinical uses during cardiac surgery

Cell Saver Systems

- Principles of cell saver
- Clinical applications and limitations

Topical Hemostatic Agents

- Topical agents for reducing blood loss
- Surgical hemostatic techniques

Textbook

1. Cardiopulmonary bypass; Principles and practice, Glenn P. Gravelee, Richard F. Davis, Mark Kurusz & Joe R. Utley; 2nd edition; Lippincott Williams & Wilkins 2000.
2. Techniques in Extracorporeal circulation, Philip H. Kay & Christopher M. Munsch

PRACTICALS

HEMATOLOGY AS RELEVANT TO PERFUSION, BLOOD TRANSFUSION AND BLOOD CONSERVATION

Total hours 60 hours

1. Draw and discuss coagulation cascade
2. Describe action and uses of heparin
3. Describe action & side effects of protamine
4. Describe on heparin alternatives
5. Platelet dysfunction during CPB
6. Leukocyte depletion during CPB
7. Factors causing hemolysis during CPB
8. Monitoring of anti-coagulation during CPB
 - a). ACT
 - b). Heparin protation titration
 - c). Heparin concentration
 - d). Sonoclot
 - e). Thromboelastography
9. Discuss coagulation disorder associated CPB
10. Draw and discussion on algorithm approach for hemostatic therapy in cardiac patients.
11. Draw and discussion on algorithm approach for postoperative red cell transfusion in cardiac surgical patients.
12. Cost effectiveness of autologous blood donation in cardiac surgery.

Dissertation Work – II

Learning Objectives

- To develop advanced research skills in perfusion technology and extracorporeal circulation.
- To understand scientific methods for clinical and experimental research in perfusion practice.
- To enhance skills in data collection, statistical analysis, interpretation, and scientific documentation.
- To develop the ability to prepare, present, and defend a dissertation based on evidence-based research.
- To improve critical thinking and problem-solving skills related to perfusion technology and patient care.

Learning Outcomes

After completion of the subject, the student will be able to:

- Conduct independent research in advanced areas of perfusion technology.
- Apply appropriate research methodology and statistical tools for data analysis and interpretation.
- Prepare a scientifically structured dissertation report following ethical and academic standards.
- Present and defend research findings effectively during viva voce examination.
- Correlate research findings with clinical applications in perfusion and extracorporeal circulation practice.

Areas of Research

- Advanced cardiopulmonary bypass techniques
- ECMO and extracorporeal life support systems
- Mechanical circulatory support devices and VADs
- Goal-directed perfusion and perfusion monitoring
- Blood conservation and anticoagulation strategies during CPB
- Neuromonitoring and cerebral protection during cardiac surgery
- Pediatric and neonatal perfusion techniques
- Organ protection during extracorporeal circulation
- Perfusion in minimally invasive and robotic cardiac surgery
- Perfusion-related complications and quality assurance
- Hybrid cardiac procedures and extracorporeal support
- Clinical audits and evidence-based perfusion practices

Dissertation Activities

- Continuation and completion of research work
- Advanced review of literature and updating references
- Clinical data collection, documentation, and validation
- Statistical analysis and interpretation of research findings
- Preparation of tables, graphs, and result analysis
- Preparation of dissertation manuscript and formatting
- Preparation of abstract, summary, and conclusions
- Preparation of seminar presentation and viva voce
- Submission of final dissertation report

Evaluation Methods

- Internal assessment by research supervisor
- Periodic dissertation progress evaluation
- Dissertation submission and evaluation
- External examiner assessment
- Viva voce examination
- Research presentation and defense
- Assessment of research methodology and statistical interpretation
- Evaluation of dissertation formatting and scientific writing skills