
**CURRICULUM / STATUTES & REGULATIONS
FOR
5 YEARS DEGREE PROGRAMME
IN
CARDIAC SURGERY
(MS Cardiac Surgery)**



**UNIVERSITY OF HEALTH SCIENCES,
LAHORE**

1. Nomenclature of the Proposed Course

The name of degree programme shall be MS Cardiac Surgery. This name is well recognized and established for the last many decades worldwide.

2. Course Title:

MS Cardiac Surgery

3. Training Centers

Departments of Cardiac Surgery (accredited by UHS) in affiliated institutes of University of Health Sciences Lahore.

4. Duration of Course

The duration of MS Cardiac Surgery course shall be five (5) years (first year in Part I, first two years in Part II and next three years in Part III) with structured training in a recognized department under the guidance of an approved supervisor. The course is structured in three parts:

Part I is structured for the 1st calendar year. The candidate shall undertake didactic training in Basic Medical Sciences, Behavioural Sciences, Biostatistics & Research Methodology. At the end of first year the examination shall be held in Basic Sciences. The clinical training in fundamental concepts of Surgery shall start from the 1st day of enrollment.

Part II is structured for the 1st and 2nd calendar year. The candidate shall undertake clinical training in fundamental concepts of Surgery. At the end of 2nd year, the examination shall be held in fundamental concepts of Surgery. The clinical training in Cardiac Surgery shall start from 3rd year onwards in the recognized institutions.

Part III is structured for 3rd, 4th and 5th calendar years in MS Cardiac Surgery. It has two components; Clinical and Research. The candidate shall undergo clinical training to achieve educational objectives of MS Cardiac Surgery (knowledge & skills) along with rotation in relevant fields. Over the five years duration of the course, candidate will spend total time equivalent to one calendar year for

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research during the training. Research can be done as one block in 5th year of training or it can be done in the form of regular periodic rotations over five years as long as total research time is equivalent to one calendar year.

5. Admission Criteria

- I. For admission in MS Cardiac Surgery course, the candidate shall be required to have:
 - MBBS degree
 - Completed one year House Job
 - One year experience in Cardiac Surgery/General surgery/Allied surgical discipline in the given order of preference
 - Registration with PMDC
 - Passed Entry Test conducted by the University & aptitude interview by the Institute concerned
 - Having up to the mark credentials as per UHS rules (no. of attempts in each professional, any gold medals or distinctions, relevant work experience, Rural/ Army services, research experience in a recognized institution, any research article published in a National or International Journal) may also be considered on case to case basis.

- II. Exemptions: A candidate holding FCPS/MRCS/Diplomate/equivalent qualification in General Surgery shall be exempted from Part-I & Part-II Examinations and shall be directly admitted to Part-III Examinations, subject to fulfillment of requirements for the examination.

6. Registration and Enrollment

- Total number of students enrolled for the course must not exceed 2 per supervisor/year.
- The maximum number of trainees that can be attached with a supervisor at a given point of time (inclusive of trainees in all years/phases of MS training), must not exceed 6.
- Beds to trainee ratio at the approved teaching site shall be at least 5 beds per trainee.

- The University will approve supervisors for MS courses.
- Candidates selected for the courses after their enrollment at the relevant institutions shall be registered with UHS as per prescribed Registration Regulation.

7. Accreditation Related Issues Of The Institution

A. Faculty

Properly qualified teaching staff in accordance with the requirements of Pakistan Medical and Dental Council (PMDC)

B. Adequate Space

Including class-rooms (with audiovisual aids), demonstration rooms, computer lab and clinical pathology lab etc.

C. Library

Departmental library should have latest editions of recommended books, reference books and latest journals (National and International).

- Accreditation of Cardiac Surgery training program can be suspended on temporary or permanent basis by the University, if the program does not comply with requirements for residents training as laid out in this curriculum.
- Program should be presented to the University along with a plan for implementation of curriculum for training of residents.
- Programs should have documentation of residents training activities and evaluation on monthly basis.
- To ensure a uniform and standardized quality of training and availability of the training facilities, the University reserves the right to make surprise visits of the training program for monitoring purposes and may take appropriate action if deemed necessary.

AIMS AND OBJECTIVES OF THE COURSE

AIM

The aim of five years MS programme in Cardiac Surgery is to train residents to acquire the competency of a specialist in the field so that they can become good teachers, researchers and clinicians in their specialty after completion of their training.

GENERAL OBJECTIVES

MS Cardiac Surgery training should enable a student to:

1. Access and apply relevant knowledge to clinical practice:
 - Maintain currency of knowledge
 - Apply scientific knowledge in practice
 - Appropriate to patient need and context
 - Critically evaluate new technology
2. Safely and effectively performs appropriate surgical procedures:
 - Consistently demonstrate sound surgical skills
 - Demonstrate procedural knowledge and technical skill at a level appropriate to the level of training
 - Demonstrate manual dexterity required to carry out procedures
 - Adapt their skills in the context of each patient and procedure
 - Maintain and acquire new skills
 - Approach and carries out procedures with due attention to safety of patient, self and others
 - Critically analyze their own clinical performance for continuous improvement
3. Design and implement effective management plans:
 - Recognize the clinical features, accurately diagnose and manage cardiological problems
 - Formulate a well-reasoned provisional diagnosis and management plan based on a thorough history and examination
 - Formulate a differential diagnosis based on investigative findings

- Manage patients in ways that demonstrate sensitivity to their physical, social, cultural and psychological needs
 - Recognize disorders of the nervous system and differentiate those amenable to surgical treatment
 - Effectively manage the care of patients with cardio-trauma including multiple system trauma
 - Effectively recognize and manage complications
 - Accurately identify the benefits, risks and mechanisms of action of current and evolving treatment modalities
 - Indicate alternatives in the process of interpreting investigations and in decision-making
 - Manage complexity and uncertainty
 - Consider all issues relevant to the patient
 - Identify risk
 - Assess and implement a risk management plan
 - Critically evaluate and integrate new technologies and techniques.
4. Organize diagnostic testing, imaging and consultation as needed:
- Select medically appropriate investigative tools and monitoring techniques in a cost-effective and useful manner
 - Appraise and interpret appropriate diagnostic imaging and investigations according to patients' needs
 - Critically evaluates the advantages and disadvantages of different investigative modalities
5. Communicate effectively:
- Communicate appropriate information to patients (and their family) about procedures, potentialities and risks associated with surgery in ways that encourage their participation in informed decision making
 - Communicate with the patient (and their family) the treatment options including benefits and risks of each
 - Communicate with and co-ordinate health management teams to achieve an optimal surgical environment
 - Initiate the resolution of misunderstandings or disputes

- Modify communication to accommodate cultural and linguistic sensitivities of the patient

6. Recognize the value of knowledge and research and its application to clinical practice:

- Assume responsibility for self-directed learning
- Critically appraise new trends in Cardiac Surgery
- Facilitate the learning of others.

7. Appreciate ethical issues associated with Cardiac Surgery:

- Consistently apply ethical principles
- Identify ethical expectations that impact on medico-legal issues
- Recognize the current legal aspects of informed consent and confidentiality
- Be accountable for the management of their patients.

8. Professionalism by:

- Employing a critically reflective approach to Cardiac Surgery
- Adhering with current regulations concerning workplace harassment
- Regularly carrying out self and peer reviewed audit
- Acknowledging and have insight into their own limitations
- Acknowledging and learning from mistakes

9. Work in collaboration with members of an interdisciplinary team where appropriate:

- Collaborate with other professionals in the selection and use of various types of treatments assessing and weighing the indications and contraindications associated with each type
- Develop a care plan for a patient in collaboration with members of an interdisciplinary team
- Employ a consultative approach with colleagues and other professionals
- Recognize the need to refer patients to other professionals.

10. Management and Leadership

- Effective use of resources to balance patient care and system resources
- Identify and differentiate between system resources and patient needs
- Prioritize needs and demands dealing with limited system resources.
- Manage and lead clinical teams

- Recognize the importance of different types of expertise which contribute to the effective functioning of clinical team.
- Maintain clinically relevant and accurate contemporaneous records

11. Health advocacy:

- Promote health maintenance of patients
- Advocate for appropriate health resource allocation
- Promote health maintenance of colleagues and self scholar and teacher

SPECIFIC LEARNING OUTCOMES

On completion of the training programme, Cardiac Surgery trainees including those pursuing an academic pathway will be expected to have demonstrated competence in all aspects of the published syllabus. The specific training component would be targeted for establishing clearly defined standards of knowledge and skills required to practice Cardiac Surgery at secondary and tertiary care level with proficiency in the Basic and applied clinical sciences, Basic cardiac surgical care, Cardiac intensive care, Emergency medicine and Complementary surgical disciplines.

- Describe and demonstrate a working knowledge of the anatomy of heart and great vessels, including
 - Cardiac chambers (atria and ventricles)
 - Cardiac valves (mitral, aortic, tricuspid, pulmonic)
 - Coronary arteries
 - Intrinsic neural conduction system
 - Extrinsic neural innervation (sympathetic and parasympathetic)
 - Great vessels (cavae, aorta, innominate artery, carotid arteries, and subclavian arteries)
- Describe and demonstrate working knowledge of cardiac physiology, including:
 - Electro-physiology (action potential, depolarization, repolarization, mechanisms of rhythm control)
 - Determinants of cardiac output (heart rate and stroke volume)
 - Interactions and control mechanisms (preload, afterload, contractility, Frank-Starling Law, peripheral resistance)
 - Determinants of myocardial oxygen consumption
 - Normal pressures, waveforms, and oxygen saturation in cardiac chambers
 - Identify the control mechanisms and normal physiology of peripheral vessels. Relate each of these to a clinical example:
 - Arterial autoregulation
 - Venous flow regulation
 - Interrelationship of cardiac output, peripheral blood flow, and autoregulation
- Demonstrate knowledge of the pathophysiologic conditions of the heart and great vessels which are amenable to surgical correction including the pathophysiology of congenital cardiac disease:
 - Coarctation of the aorta
 - Patent ductus arteriosus
 - Atrial septal defects
 - Ventricular septal defects
 - Complex cyanotic cardiac disease
 - Transportation of great vessels
 - Tetralogy of Fallot
 - Pulmonary atresia

- Total anomalous venous return
- Acquired cardiac disease including:
 - Myocardial ischemia
 - Valvular heart disease (stenotic and regurgitant)
 - Endocarditis
 - Ischaemic Heart Disease
 - Aorto-vascular Disease
 - Heart Failure
 - Ventricular aneurysms
 - Thoracic aneurysms
 - Trauma to the heart and great vessels
 - Disorders of the Pericardium
 - Disorders of the Mediastinum
- Discuss the information obtained from the history and physical examination pertinent to cardiac and peripheral vascular pathophysiology. Determine the interactions of those details and their implications on planned surgical procedures and outcomes. Consider the following for risk assessment and perioperative management:
 - Patient age
 - Risk factors for cardiovascular disease (family history, smoking, hypertension, diabetes mellitus, hyperlipidemia, and obesity)
 - Symptoms/signs associated with coronary artery disease, ventricular dysfunction, and valvular dysfunction
 - Pulmonary dysfunction (pulmonary hypertension, chronic obstructive pulmonary disease [COPD], previous pulmonary resection)
 - Neurologic abnormalities
 - Renal dysfunction
 - Hematologic abnormalities
 - Hepatic dysfunction
 - Cerebrovascular, peripheral vascular, or aneurysmal disease
 - Gastrointestinal considerations
 - Metabolic, nutritional, genetic, immune, and oncologic abnormalities
 - Psychiatric conditions, psychological and social interactions
 - Re-operative chest surgery
 - Miscellaneous considerations (prior operations including vascular or valvular prostheses, substance abuse, dental status, interactions of medications)
- Discuss the use and interpretation of cardiovascular diagnostic tests in identification of cardiovascular pathology, including:
 - Electrocardiography
 - Echocardiography (transthoracic and transesophageal)
 - Traditional roentgenography
 - Cardiac catheterization and arteriography
 - Peripheral vascular arteriography
 - Vascular ultrasonography

 - Computer and magnetic resonance imaging
 - Radionuclide scintigraphy (multi-gated acquisition [MUGA], stress, and Persantine thallium)

- Demonstrate the use and principles associated with various cardiac monitoring methods, including:
 - Intra-arterial and central venous pressure transducers
 - Pulmonary artery catheters
 - Left atrial catheters
 - Temporary percutaneous and intracardiac pacing wires
- Discuss techniques, mechanisms of action, and potential complications for mechanical and pharmacologic support of the circulation, including:
 - Inotropic agents (dopamine, dobutamine, epinephrine, norepinephrine, amrinone, isoproterenol)
 - Pre- /after- load agents (Nipride, nitroglycerine, Neo-synephrine)
 - Intra-aortic balloon pump
 - Ventricular assist devices
 - Cardiac pacing
- Describe and assess the operative indications, risk, and expected outcomes associated with several cardiac surgical procedures, including:
 - Coronary artery bypass and minimally invasive direct coronary artery by pass surgery
 - Valvular replacement/repair (aortic, mitral, tricuspid)
 - Pacemaker/automatic implantable cardiac defibrillator (AICD)insertion
 - Intra-aortic balloon insertion
 - Percutaneous transluminal coronary angioplasty (PTCA)
 - Valve repair/replacement
 - Operative management of common uncomplicated congenital conditions (e.g. PDA, atrial and ventricular septal defects, coarctation, shunts and PA banding)
 - Exposure to and experience in more complex operative procedures (e.g. valve surgery, Tetralogy of Fallot, pulmonary atresia, Fontan procedures, extra cardiac conduits, AV canal defects.)
 - Operations of the ascending aorta, aortic arch and descending thoracic aorta
 - Pericardial drainage procedure
- Describe the role of the surgeon as it relates to the procedures of the peripheral vascular system
 - Dialysis Procedures
 - Arteriovenous fistula
 - Arteriovenous graft
 - Embolectomy/thrombectomy
 - Carotid endarterectomy
 - Bypass grafting
 - Femoral - popliteal – tibial
 - Aorto - iliac – femoral
 - Repair of aneurysms
 - Aortic
 - Endovascular
 - Inferior vena cava filters
 - Sympathectomy
 - Amputations

- Vascular Instruments including surgical supplies i.e. Fogarty catheters, vessel loops, tapes and dopplers.
- Identification of various types of synthetic grafts
- Discuss the complications of cardiac surgery and methods used to reduce their incidence. Complications including death, myocardial infarction, stroke, bleeding, arrhythmias, low cardiac output syndrome, cardiac tamponade, pneumothorax, sternal and extremity wound infections, respiratory and renal failure
- Review the management of postoperative cardiac surgery patients in the intensive care unit.
- The management of the following post-cardiac surgery variances, including the monitoring, prevention, and the therapeutic intervention of:
 - Arrhythmias (ventricular and atrial)
 - Bleeding (correction of coagulopathy, indications for re-exploration)
 - Infection (methods of prophylaxis, empiric and culture-specific therapy)
 - Low cardiac output and hypotension
 - Postoperative hypertension
- Demonstrate working knowledge and use of the following postoperative support systems
 - Cardiac drugs (inotropic, chronotropic, after-load-reducing, anti-platelet, beta-blockade, ACE inhibition, diuretics)
 - Mediastinal and pleural drainage
 - Mechanical ventilation, airway management systems
 - Temporary and permanent pacemakers
 - Intra-aortic balloon pumps and other ventricular assist devices
 - Dialysis and ultrafiltration
 - Cardiopulmonary bypass and extracorporeal membrane oxygenation
- Summarize the diagnostic evaluation and indications for each of the following surgical procedures:
 - Coronary artery bypass grafting
 - Adult valvular repair and replacement procedures (mechanical vs. bioprosthetic)
 - Resection of ventricular aneurysms
 - Resection and grafting of thoracic aneurysms
 - Combination operations of valve replacement and coronary artery bypass grafting
 - Surgical treatment of idiopathic hypertrophic sub-aortic stenosis
- Discuss the evaluation and therapeutic options available for surgical management of cardiac trauma such as:
 - Traumatic transection of the aorta and other great vessels
 - Blunt and penetrating cardiac and great vessel injury
- Outline the post-hospitalization follow-up and management of cardiac surgery patients to include:
 - Instructions to the patient
 - Follow-up clinic visit (including physical examination, electrocardiogram [ECG], Chest x-ray)
 - Long-term follow-up for coronary and valve patients (including anticoagulation adjustment where indicated)

Skills and Procedures

- Competency-Based Performance Objectives:
 - Perform preoperative evaluation, history and physical examination of cardiac surgery patients
 - Obtain and interpret indicated diagnostic studies.
 - Discuss diagnostic and therapeutic approaches to specific acquired and congenital cardiac diseases with the attending physicians.
- Assist with selected cardiac and general surgery cases such as:
 - Pacemaker and defibrillator insertions
 - Saphenous vein harvest and wound closure for coronary bypass operations
 - Valve and coronary operations
 - Pericardial drainage operations
 - Tracheostomy
 - Minor vascular repairs
- Provide postoperative cardiac surgery follow-up care for the following cases:
 - Coronary surgery
 - Valve surgery
 - Thoracic aortic surgery
 - Pacemaker and defibrillator placement
 - Perform percutaneous insertion of chest tubes and intravenous, intra-arterial, and pulmonary artery catheters with supervision.
- Serve as first assistant on selected major cardiothoracic cases, including:
 - Coronary artery bypass surgery, minimally invasive direct coronary artery bypass
 - Valvular replacements and repairs, including minimally invasive procedures
 - Thoracic aortic surgery
 - Congenital cardiac surgery
 - Complex defibrillators
 - Emergency thoracotomies
- Perform cardiac procedures, under supervision, including the following:
 - Insert intra-aortic balloon pump
 - Pacemaker implantation
 - Median sternotomy incision
 - Aortic cannulation for cardiopulmonary bypass
 - Saphenous vein and internal thoracic artery harvest
 - Perform proximal coronary anastomoses
 - Repair of vascular trauma
 - Graft replacement of aorta in selected cases
- Coordinate the work-up of emergency cardiac surgery cases with:
 - Emergency room or trauma team
 - Cardiac catheterization laboratory
 - Diagnostic imaging services
 - Laboratory (including blood bank)
 - Anesthesia

- Operating room
- Perfusion services
- Assist with emergency cardiac surgery, including trauma cases.
- Recognize and prescribe treatment for complications of cardiac surgery such as:
 - Gastrointestinal bleeding
 - Cerebrovascular accident
 - Endocrine abnormalities
 - Pulmonary complications
 - Renal dysfunction
 - Coagulopathy
 - Dysrhythmias
 - Low cardiac output status

Research Experience:

All residents in the categorical program are required to complete an academic outcomes-based research project during their training. This project can consist of original bench top laboratory research, clinical research or a combination of both. The research work shall be compiled in the form of a thesis which is to be submitted for evaluation by each resident before end of the training. The designated Faculty will organize and mentor the residents through the process, as well as journal clubs to teach critical appraisal of the literature.

Curriculum/Statutes & Regulations-MS Cardiac Surgery
REGULATIONS

1. Scheme of the Course

A summary of five years course in MS Cardiac Surgery is presented as under:

Course Structure	Components	Examination
Part I	<p>Basic Medical Sciences Anatomy, Physiology, Biochemistry, Pathology, Pharmacology, Behavioural Sciences and Biostatistics & Research Methodology</p>	<p>Part-I examination at the end of 1st year of MS Cardiac Surgery programme.</p> <ul style="list-style-type: none"> • Written: Paper I: MCQs Paper II: SEQs
Part-II	<ul style="list-style-type: none"> • Fundamental Concepts in Surgery : Training in basic clinical techniques of Surgery with compulsory rotations for two years starting from first day of enrollment 	<p>Part-II examination at the end of 2nd year of MS Cardiac Surgery programme.</p> <ul style="list-style-type: none"> • Written: Papers 1 & 2 : Basic Principles of Surgery • Oral & Practical/ Clinical Examination <ul style="list-style-type: none"> • OSCE • Clinical Examination (Long case, Short cases) • Log Book
Part-III	<p style="text-align: center;"><u>Clinical component of Part III</u></p> <ul style="list-style-type: none"> • Professional Education in Cardiac Surgery : Training in Cardiac Surgery during 3rd, 4th & 5th year of MS Cardiac Surgery programme. Three years of training with compulsory & optional rotations in relevant fields <p style="text-align: center;"><u>Research component of Part III</u></p> <p>Research work/Thesis writing project must be completed and thesis be submitted before the end of training.</p>	<p>Part-III examination in specialized components of Cardiac Surgery at the end of 5th year of MS Cardiac Surgery programme.</p> <ul style="list-style-type: none"> • Written: Papers 1 & 2: Problem-based questions in the subject • Oral & Practical/ Clinical Examination <ul style="list-style-type: none"> • OSCE/ • Clinical Examination (Long case, Short cases) • Log Book <p>Part-III thesis examination with defense at the end of fifth (5th) year of MS Cardiac Surgery programme.</p>

2. Examinations

Part-I Examination

1. All candidates admitted in MS Cardiac Surgery course shall appear in Part-I examination at the end of first calendar year.
2. The examination shall be held on biannual basis.
3. The candidate who fails to pass the examination in 3 consecutive attempts availed or un-availed, shall be dropped from the course.
4. The examination shall have two components:

Paper-I MCQs (single best)	100 Marks
Paper-II SEQs	100 Marks
5. Subjects to be examined shall be Basic Sciences relevant to Cardiac surgery (Anatomy, Physiology, Biochemistry, Pathology, Pharmacology), Behavioural Sciences and Biostatistics & Research Methodology.
6. To be eligible to appear in Part-I examination the candidate must submit;
 - i. duly filled, prescribed Admission Form to the Controller of Examinations duly recommended by the Principal/Head of the Institution in which he/she is enrolled;
 - ii. a certificate by the Principal/Head of the Institution, that the candidate has attended at least 75% of the lectures, seminars, practical/clinical demonstrations;
 - iii. Examination fee as prescribed by the University
7. To be declared successful in Part-I examination the candidate must secure 60% marks in each paper.

Part-II Examination

1. All candidates admitted in MS Cardiac Surgery course shall appear in Part-II examination at the end of second calendar year.
2. The examination shall be held on biannual basis.
3. The candidate who fails to pass the examination within 3 years of passing the Part-I examination shall be dropped from the course.
4. The examination shall have the following components:
 - a. Written 200 Marks
 - b. OSCE 50 Marks
 - c. Clinical examination 100 Marks
 - d. Log Book Evaluation 80 Marks (40 marks per year)
5. There shall be two written papers of 100 marks each:

Papers 1 & 2: Principles of General Surgery
6. The types of questions shall be of Short/Modified essay type and MCQs (single best).
7. Oral & practical/clinical examination shall be held in clinical techniques in General Surgery.
8. To be declared successful in Part-II examination the candidate must secure 60% marks in each component and 50% in each sub-component.
9. Only those candidates, who pass in theory papers, will be eligible to appear in the Oral & Practical/clinical Examination.
10. The candidates, who have passed written examination but failed in oral & practical/ clinical examination, will re-appear only in oral & practical/clinical examination.
11. The maximum number of attempts to re-appear in oral & practical /clinical Examination alone shall be three, after which the candidate shall have to appear in both written and oral & practical/clinical examinations as a whole.
12. To be eligible to appear in Part-II examination the candidate must submit;
 - i. duly filled, prescribed Admission Form to the Controller of Examinations duly recommended by the Principal/Head of the Institution in which he/she is enrolled;

- ii. a certificate by the Principal/Head of the Institution, that the candidate has attended at least 75% of the lectures, seminars, practical/clinical demonstrations;
- iii. a certificate of having passed the Part-I examination;
- iv. Examination fee as prescribed by the University.

Part-III Examination

1. All candidates admitted in MS Cardiac Surgery course shall appear in Part-III (clinical) examination at the end of structured training programme (end of 5th calendar year), and having passed the part I & II examinations. However, a candidate holding FCPS / MRCS / Diplomate / equivalent qualification in General Surgery shall be exempted from Part-I & Part-II Examinations and shall be directly admitted to Part-III Examinations, subject to fulfillment of requirements for the examination.
2. The examination shall be held on biannual basis.
3. To be eligible to appear in Part-III examination the candidate must submit;
 - i. duly filled, prescribed Admission Form to the Controller of Examinations duly recommended by the Principal/Head of the Institution in which he/she is enrolled;
 - ii. a certificate by the Principal/Head of the Institution, that the candidate has attended at least 75% of the lectures, seminars, practical/clinical demonstrations;
 - iii. Original Log Book complete in all respect and duly signed by the Supervisor (for Oral & practical/clinical Examination);
 - iv. certificates of having passed the Part-I & part-II examinations;
 - v. Examination fee as prescribed by the University.
4. The Part-III clinical examination shall have the following components:

▪ Written	300 marks
▪ Oral & practical/clinical examination	300 marks
▪ Log Book Evaluation	120 marks (40 marks per year)
5. There shall be two written papers of 150 marks each.
6. Both papers shall have problem-based Short/Modified essay questions and MCQs.
7. Oral & practical/clinical examination shall have 300 marks for:

i. 1 Long Case	100
ii. 4 Short Cases	100(25 marks each)
iii. OSCE	100

8. To be declared successful in Part-III examination the candidate must secure 60% marks in each component and 50% in each sub-component.
9. Only those candidates, who pass in theory papers, will be eligible to appear in the Oral & Practical/ Clinical Examination.
10. The candidates, who have passed written examination but failed in Oral & Practical/ Clinical Examination, will re-appear only in Oral & Practical / Clinical examination.
11. The maximum number of attempts to re-appear in oral & practical /clinical Examination alone shall be three, after which the candidate shall have to appear in both written and oral & practical/clinical examinations as a whole.
12. The candidate with 80% or above marks shall be deemed to have passed with distinction.
13. *Log Book/Assignments:* Through out the length of the course, the performance of the candidate shall be recorded on the Log Book.
14. The Supervisor shall certify every year that the Log Book is being maintained and signed regularly.
15. The Log Book will be developed & approved by the Advanced Studies & Research Board.
16. The evaluation will be maintained by the Supervisor (in consultation with the Co- Supervisor, if appointed).
17. The performance of the candidate shall be evaluated on annual basis, e.g., 40 marks for each year in five years MS Cardiac Surgery course. The total marks for Log Book shall be 200. The log book shall reflect the performance of the candidate on following parameters:
 - Year wise record of the competence of skills.
 - Year wise record of the assignments.
 - Year wise record of the evaluation regarding attitude & behaviour
 - Year wise record of journal club / lectures / presentations / clinico-pathologic conferences attended & / or made by the candidate.

3. Submission / Evaluation of Synopsis

1. The candidates shall prepare their synopsis as per guidelines provided by the Advanced Studies & Research Board, available on UHS website.
2. The research topic in clinical subject should have 30% component related to basic sciences and 70% component related to applied clinical sciences. The research topic must consist of a reasonable sample size and sufficient numbers of variables to give training to the candidate to conduct research, to collect & analyze the data.
3. Synopsis of research project shall be submitted by the end of the 3rd year of MS program. The synopsis after review by an Institutional Review Committee shall be submitted to the University for consideration by the Advanced Studies & Research Board, through the Principal / Dean /Head of the institution.

4. Submission of Thesis

1. Thesis shall be submitted by the candidate duly recommended by the Supervisor.
2. The minimum duration between approval of synopsis and submission of thesis shall be one year, but the thesis can not be submitted later than 8 years of enrolment.
3. The research thesis must be compiled and bound in accordance with the Thesis Format Guidelines approved by the University and available on website.
4. The research thesis will be submitted along with the fee prescribed by the University.

5. Thesis Examination

1. All candidates admitted in MS course shall appear in Part-III thesis examination at the end of 5th year of their training course.
2. Only those candidates shall be eligible for thesis evaluation who have passed Part I, II & III (clinical) Examinations.
3. The examination shall include thesis evaluation with defense.

4. The Vice Chancellor shall appoint three external examiners for thesis evaluation, preferably from other universities and from abroad, out of the panel of examiners approved by the Advanced Studies & Research Board. The examiners shall be appointed from respective specialty. Specialists from General Surgery and Allied surgical Disciplines may also be appointed/co-opted, where deemed necessary.
5. The thesis shall be sent to the external examiners for evaluation, well in time before the date of defense examination and should be approved by all the examiners.
6. After the approval of thesis by the evaluators, the thesis defense examination shall be held within the University on such date as may be notified by the Controller of Examinations. The Controller of Examinations shall make appropriate arrangements for the conduct of thesis defense examination in consultation with the supervisor, who will co-ordinate the defense examination.
7. The thesis defense examination shall be conducted by two External Examiners who shall submit a report on the suitability of the candidate for the award of degree. The supervisor shall act as coordinator.

6. Award of MS Cardiac Surgery Degree

After successful completion of the structured courses of MS Cardiac Surgery and qualifying Part-I, Part-II and Part-III examinations, the degree with title MS Cardiac Surgery shall be awarded.

CONTENT OUTLINE

Part I MS Cardiac Surgery

Basic Sciences:

Student is expected to acquire comprehensive knowledge of Anatomy, Physiology, Pathology (Microbiology), Biochemistry, Pharmacology relevant to surgical practice appropriate for Cardiac Surgery

1. Anatomy

- Cell Biology: Cytoplasm – Cytoplasmic matrix, cell membrane, cell organelles, cytoskeleton, cell inclusions, cilia and flagella.
- Nucleus – nuclear envelope, nuclear matrix, DNA and other components of chromatin, protein synthesis, nucleolus, nuclear changes indicating cell death.
- Cell cycle, mitosis, meiosis, cell renewal.
- Cellular differentiation and proliferation.
- Tissues of Body: Light and electron microscopic details and structural basis of function, regeneration and degeneration. Confocal microscopy.
- The systems/organs of body – Cellular organization, light and electron microscopic features, structure function correlations, and cellular organization.

- The surface structures of the heart
- Relation to other structure within the thorax
- The thorax: the thoracic wall & thoracic cavity
- Surface anatomy of the thoracic wall and thoracic cavity
- Openings of the thorax

Structure of the Thoracic Wall

- Anterior chest wall
- Posterior chest wall
- Lines of orientation
- Sternum
- Costal cartilages
- Ribs
- Diaphragm
- Intercostal spaces
- Intercostal muscles
- Intercostal arteries and veins
- Intercostal nerves
- Suprapleural membrane
- Endothoracic fascia
- Major thoracic arteries and veins
- Muscles of the thoracic wall

The Thoracic Cavity

- Basic anatomy
- Mediastinum
- Contents of the anterior, posterior, middle, superior and inferior mediastinum
- Relations of the contents of the mediastinum
- Pleurae
- Blood, lymphatic and nerve supply of the pleura

Heart

- External anatomy
- Coronary (atrioventricular) sulcus
- Anterior and posterior interventricular sulci
- Apex beat of the heart
- The general structure of arteries, veins, and microcirculation

Valves

- Atrioventricular (AV)
- General description
- Anulus fibrosus
- Valve leaflets (cusps)
- Chordae tendineae
- Papillary muscles
- R AV valve (tricuspid)
- L AV valve (mitral or bicuspid)
- Semilunar
- Auscultation points for the valves of the heart.

Cusps

- Pulmonic
- Aortic
- Stenosis
- Insufficiency and regurgitation

Wall

- Epicardium
- Myocardium

Cardiac Muscle

- Purkinje fibers
- Endocardium
- Trabeculae carneae
- Pectinate muscles

Conducting System

- Sinoatrial (SA) node (pacemaker)
- Internodal pathways
- Atrioventricular (AV) node
- His Bundle

Vessels Entering Heart

- Right atrium
- Superior vena cava (SVC)
- Inferior vena cava (IVC)
- Coronary sinus
- Left atrium
- Right and left pulmonary veins

Vessels leaving heart

- Right ventricle
- Pulmonary trunk
- Right and left pulmonary Arteries
- Left ventricle
- Aorta

Coronary Circulation

- R coronary artery
- Acute marginal branch
- Posterior interventricular branch (posterior descending)
- L coronary artery
- Anterior interventricular branch (left anterior descending)
- Diagonal branches
- Septal branches
- Venous return
- Great cardiac vein
- Coronary sinus
- Tributaries
- The Flow of Blood through Pulmonary Circulation and to the Various Regions of Body through Systemic Circulation.

Lymph Drainage and Nerve supply of the Heart

- The lymphatic system
- Overview
- Defence
- Fluid connection
- Blood connection
- Lymphatic vessels
- Main arteries and veins of head, neck
- Heart/lungs connection

Upper Respiratory Tract

- Blood, lymphatic and nerve supply of the larynx, trachea and bronchi
- Muscles of the larynx and trachea

Lower Respiratory Tract

- Bronchopulmonary segments
- Lungs
- Bronchioles, alveoli
- Blood supply, lymph drainage and nerve supply of the lungs

Salient Features of the Embryology of the Cardiovascular System

- Structural and functional differences between the smooth skeletal and cardiac types of muscle.
- Fine structure of skeletal and cardiac muscle fibers, and its relationship to the mechanism of contraction.
- Characteristics of the cardiac muscle contraction, duration, refractory period, pacemaker and rhythmicity.
- Specialized conducting tissue of the heart.
- Microscopic structure of the heart including conducting system
- Development of the heart and vascular system and common developmental anomalies such as septal defects, patent ductus arteriosus, Fallot's tetralogy and coarctation of aorta.
- General structural features of atria, ventricles, conducting tissues, and valves of the heart and their relationship to cardiac function.
- Blood supply of heart.
- Structure and functions of the arteries, arterioles, capillaries and veins
- The embryonic period and foetal development of the cardiovascular and respiratory systems
- Cardiovascular and respiratory changes at birth

2. Physiology

- Cellular membrane function
- Membrane structure and function
- Membrane transport of non-electrolytes (diffusion and osmosis)
- Membrane transport of electrolytes (membrane potentials)
- Physiologic anatomy of the heart, the atria, ventricles, pericardium and myocardium
- Properties of cardiac muscle
- Cardiac muscle: electrical and mechanical properties.
- Metabolism
- Origin of the HR beat, the electrical activity of the heart (normal and findings is cardiac and systemic diseases)
- Origin and propagation of cardiac impulse
- Mechanism of production of heart sounds, their location, characters and relationship with the cardiac cycle.
- The cardiac cycle
- Pressure change during cardiac cycle
- The stroke volume and stroke out-put, cardiac out-put
- Regulation of cardiac function.
- The normal electrocardiogram and characters of its various components.
- Significance of its parts, voltage and calibration, principles and methods of recording, electrocardiographic leads and general information obtained from ECG.
- Physiology and abnormalities of apex beat.
- Cardiac output, amount, distribution, measurement, control, cardiac index and cardiac reserve.
- The special excitatory and conductive system of the heart and their control
- Abnormalities of the cardiac rhythms

- Echocardiography, exercise tolerance test and the basis of ETT.
- Patho-physiology of cardiac failure, valvular heart disease and hypertension. Interpretation of data of diagnostic tests.
- Functional classification of blood vessels
- Peripheral circulation: pressure and resistance
- The arterial blood pressure
- The arterial pressure pulse
- The physiology of the veins
- The jugular venous pulse
- The physiology of the capillaries
- Lymph and lymphatics
- Arterial and arteriolar circulation capillary circulation, lymphatic circulation and venous circulation
- Laws of haemodynamics governing flow, pressure and resistance in blood vessels
- Vasomotor system and control of blood vessels
- Characters of arterial pulse and venous pulse
- Significance of central venous pressure.
- Hypertension
- Mechanism of haemorrhage and shock
- Coronary, cutaneous, splanchnic and peripheral circulation.
- Cardiovascular regulatory mechanisms local regulation
- Endothelium; systemic regulation by hormones and systemic regulation by nervous system.
- Circulation through special organs: organs: coronary circulation, cerebral circulation and pulmonary circulation.
- Cardiovascular homeostasis in health and diseases: exercise, gravity, shock, hypertension and heart failure
- Pathophysiology and classification of edema
- The cutaneous circulation, coronary circulation, cerebral circulation and pulmonary circulation
- Hemorrhage or bleeding, circulatory shock
- Respiration, gas exchange & diffusion
- Perfusion and ventilation/perfusion matching
- Cardiopulmonary integration
- The blood. Major cellular and fluid components
- The blood: plasma: clotting, fibrinolysis
- Water, electrolytes (sodium, potassium, calcium) and their distribution
- Mechanism of edema
- Isotonic, hypertonic, and hypotonic, alterations in sodium and water balance
- Acid - base imbalances: pathophysiology of acidosis and alkalosis
- Heat exchange, filters and reservoirs

3. Biochemistry

- Membrane biochemistry and signal transduction
- Gene expression and the synthesis of proteins
- Bioenergetics; fuel oxidation and the generation of ATP

- Enzymes and biologic catalysis
- Tissue metabolism

VITAMINS

- Classification, components, sources, absorption and functions (physiological and biochemical role).
- Daily requirements, effects of deficiency and hypervitaminosis.
- Salient morphologic features of diseases related to deficiency or excess of vitamins.

MINERALS

- Sources of calcium, phosphorous, iron, iodine, fluorine, magnesium and manganese.
- Trace elements and their clinical importance.
- Absorption and factors required for it.
- Functions and fate.

METABOLISM

- Metabolic rate and basal metabolic rate
- Factors influencing metabolic rate, principles of measurement.

Carbohydrates

- Classification and dietary sources.
- Digestion, absorption and utilization of dietary carbohydrates. Glucose tolerance test.
- Glycogenesis, glycolysis, gluconeogenesis, glycogenolysis, processes with the steps involved and effects of hormones.
- Citric acid cycle, steps involved, its significance and the common final metabolic pathway.
- Hexose monophosphate shunt: mechanism and significance.

Lipids

- Classification of simple, derived and compound lipids.
- Dietary sources.
- Digestion, absorption, utilization and control.
- Fatty acid oxidation with steps involved.
- Ketogenesis and its significance.
- Lipotropic factors and their actions. Lipoproteins, types and importance.

Proteins and Amino Acids

- Classification and dietary sources of proteins.
- Digestion, absorption, utilization and control.
- Fate of amino acids.
- Urea formation with steps involved.
- Functions and effects of deficiency.

Nucleoproteins:

- Structure and metabolism.
- Pigment Metabolism
- Basic concept of endogenous and exogenous pigments.
- Causes of pigmentation and depigmentation.
- Disorders of pigment metabolism, inherited disorders, acquired disorders from deficiency or excess of vitamins, minerals, fats, carbohydrates, proteins etc.

BALANCED DIET

- Requisites of an adequate diet.

- Role of carbohydrates, fats, proteins, minerals, vitamins and water in diet.
- Principles of nutrition as applied to medical problems

4. Pathology

Pathological alterations at cellular and structural level along with brief introduction to Microbiology related to surgical procedures and Haematological pathology as related to cardiac surgery:

Cell Injury and adaptation

- Reversible and Irreversible Injury
- Fatty change, Pathologic calcification
- Necrosis and Gangrene
- Cellular adaptation
- Atrophy, Hypertrophy,
- Hyperplasia, Metaplasia, Aplasia

Inflammation

- Acute inflammation
- Cellular components and chemical mediators of acute inflammation
- Exudates and transudate
- Sequelae of acute inflammation
- Chronic inflammation
- Etiological factors and pathogenesis
- Distinction between acute and chronic (duration) inflammation
- Histologic hallmarks
- Types and causes of chronic inflammation, non-granulomatous & granulomatous

Haemodynamic disorders

- Etiology, pathogenesis, classification and morphological and clinical manifestations of Edema, Haemorrhage, Thrombosis, Embolism, Infarction & Hyperaemia
- Shock; classification etiology, and pathogenesis, manifestations.
- Compensatory mechanisms involved in shock
- Pathogenesis and possible consequences of thrombosis
- Difference between arterial and venous emboli

Neoplasia

- Dysplasia and Neoplasia
- Benign and malignant neoplasms

- Etiological factors for neoplasia
- Different modes of metastasis
- Tumor staging system and tumor grade

Immunity and Hypersensitivity

- Immunity
- Immune response
- Diagnostic procedures in a clinical Immunology laboratory
- Protective immunity to microbial diseases
- Tumour immunology

- Immunological tolerance, autoimmunity and autoimmune diseases.
- Transplantation immunology
- Hypersensitivity
- Immunodeficiency disorders
- Immunoprophylaxis & Immunotherapy

Haematology

- Normal blood picture & variation in disease

Related Microbiology

- Role of microbes in various cardiovascular diseases
- Infection source
- Main organisms that cause cardiovascular and pulmonary diseases
- Surgically important micro-organisms in cardiac surgical procedures
- Nosocomial infections
- Pathogenic bacteria
- Vegetative organisms
- Spores
- Important viruses
- Important parasites
- Sterilization and disinfection
- Infection prevention
- Immunization
- Personnel protection from communicable diseases
- Use of investigation and procedures in laboratory

Special Pathology

- Vascular phenomenon in pathology e.g. Ischemia, infarction, thrombosis
- Shock etc.
- Rheumatic heart diseases
- Atherosclerosis
- Ischemic heart diseases
- Hypertensive heart diseases
- Cardiac failure
- Cardiac tumour
- Cardiomyopathies
- Pericardial diseases
- Endocardial diseases
- Miscellaneous

5. Pharmacology

Introduction to Pharmacology

- Receptors
- Mechanisms of drug action
- Drug-receptor interactions
- Pharmacokinetic process
 - Absorption
 - Distribution

- Metabolism
- Elimination
- Drug effect
 - Beneficial responses
 - Harmful responses
 - Allergic responses
 - Drug dependence, addiction
 - Abuse and tolerance
- Dosage forms and routes of administration
 - Oral routes
 - Parenteral routes
 - Topical routes
- The drug prescription
- Factors that influence drug effects
- Special considerations in elderly
- Special considerations in pediatric

6. Biostatistics & Research Methodology

- Introduction to bio-statistics
- Introduction to bio- medical research
- Why research is important?
- What research to do?
 - Selecting a field for research
 - Drivers for health research
 - Participation in national and international research
 - Participation in pharmaceutical company research
 - Where do research ideas come from
 - Criteria for a good research topic
- Ethics in health research
- Writing a scientific paper
- Making a scientific presentation
- Searching the literature

7. Behavioural Sciences

- Bio-psycho-social (bps) model of health care
- Use of non-medicinal interventions in clinical practice
- Communication skills
- Counseling
- Informational skills
- Crisis intervention/disaster management
- Conflict resolution
- Breaking bad news
- Medical ethics, professionalism and doctor-patient relationship
- Hippocratic oath
- Four pillars of medical ethics (autonomy, beneficence, non-maleficence and justice)
- Informed consent and confidentiality
- Ethical dilemmas in a doctor's life

- Delivery of culturally relevant care and cultural sensitivity
- Psychological aspects of health and disease
- Psychological aspect of health
- Psychological aspect of disease
- Stress and its management
- Psychological aspect of pain
- Psychological aspect of aging

Part II

MS Cardiac Surgery

Fundamental Principles of Surgery

- History of surgery
- Preparing a patient for surgery
- Principles of operative surgery: asepsis, sterilization and antiseptics
- Surgical infections and antibiotics
- Basic principles of anaesthesia and pain management
- Acute life support and critical care:
 - Pathophysiology and management of shock
 - Fluids and electrolyte balance/ acid base metabolism
 - Haemostasis, blood transfusion
- Trauma: assessment of polytrauma, triage, basic and advanced trauma
- Accident and emergency surgery
- Wound healing and wound management
- Nutrition and metabolism
- Principles of burn management
- Principles of surgical oncology
- Principles of laparoscopy and endoscopy
- Organ transplantation
- Informed consent and medicolegal issues
- Molecular biology and genetics
- Operative procedures for common surgical manifestations e.g cysts, sinuses, fistula, abscess, nodules, basic plastic and reconstructive surgery
- Principles of basic diagnostic and interventional radiography
- Principles and interpretation of conventional and advanced radiographic procedures

Common Surgical Skills

Incision of skin and subcutaneous tissue:

- Langer's lines
- Healing mechanism
- Choice of instrument
- Safe practice

Closure of skin and subcutaneous tissue:

- Options for closure
- Suture and needle choice
- Safe practice

Knot tying:

- Choice of material
- Single handed
- Double handed
- Superficial
- Deep

Tissue retraction:

- Choice of instruments

- Placement of wound retractors
- Tissue forceps

Use of drains:

- Indications
- Types
- Insertion
- Fixation
- Management/removal

Incision of skin and subcutaneous tissue:

- Ability to use scalpel, diathermy and scissors

Closure of skin and subcutaneous tissue:

- Accurate and tension free apposition of wound edges

Haemostasis:

- Control of bleeding vessel (superficial)
- Diathermy
- Suture ligation
- Tie ligation
- Clip application
- Plan investigations
- Clinical decision making
- Case work up and evaluation; risk management

Pre-operative assessment and management:

- Cardiorespiratory physiology
- Diabetes mellitus
- Renal failure
- Pathophysiology of blood loss
- Pathophysiology of sepsis
- Risk factors for surgery
- Principles of day surgery
- Management of comorbidity

Intraoperative care:

- Safety in theatre
- Sharps safety
- Diathermy, laser use
- Infection risks
- Radiation use and risks
- Tourniquets
- Principles of local, regional and general anaesthesia

Post-operative care:

- Monitoring of postoperative patient
- Postoperative analgesia
- Fluid and electrolyte management
- Detection of impending organ failure
- Initial management of organ failure
- Complications specific to particular operation
- Critical care

Blood products:

- Components of blood
- Alternatives to use of blood products

- Management of the complications of blood product transfusion including children

Antibiotics:

- Common pathogens in surgical patients
- Antibiotic sensitivities
- Antibiotic side-effects
- Principles of prophylaxis and treatment

Safely assess the multiply injured patient:

- History and examination
- Investigation
- Resuscitation and early management
- Referral to appropriate surgical subspecialties

Technical Skills

- Central venous line insertion
- Chest drain insertion
- Diagnostic peritoneal lavage
- Bleeding diathesis & corrective measures, e.g. warming, packing
- Clotting mechanism; Effect of surgery and trauma on coagulation
- Tests for thrombophilia and other disorders of coagulation
- Methods of investigation for suspected thromboembolic disease
- Anticoagulation, heparin and warfarin
- Role of V/Q scanning, CT angiography and thrombolysis
- Place of pulmonary embolectomy
- Awareness of symptoms and signs associated with pulmonary embolism and DVT
- Role of duplex scanning, venography and d-dimer measurement
- Initiate and monitor treatment

Diagnosis and Management of Common Paediatric Surgical Conditions:

- Child with abdominal pain
- Vomiting child
- Trauma
- Groin conditions
 - Hernia
 - Hydrocoele
 - Penile inflammatory conditions
 - Undescended testis
 - Acute scrotum
- Abdominal wall pathologies
- Urological conditions
- Constipation
- Head / neck swellings
- Intussusception
- Abscess
- In growing toenail

In terms of general experience it is expected that trainees would have gained exposure to the following procedures and to be able to perform those marked (*) under direct supervision.

- Elective Procedures
 - Inguinal hernia

- (not neo-natal)
 - Orchidopexy
 - Circumcision*
 - Lymph node biopsy*
 - Abdominal wall herniae
 - Insertion of CV lines
 - Management of in growing toenails*
 - EUA rectum*
 - Manual evacuation*
 - Open rectal biopsy
 - Excision of skin lesions*
- Emergency Procedures
 - Appendicectomy
 - Incision and drainage of abscess*
 - Pyloromyotomy
 - Operation for testicular torsion*
 - Insertion of pleural drain*
 - Insertion of suprapubic catheter*
 - Reduction of intussusception

Part III- MS Cardiac Surgery

Clinical Component

1. General Cardiac surgery

- Diagnosis, investigation and treatment of heart disease
- Risk assessment and stratification
- Cardiopulmonary resuscitation
- Cardiac arrhythmias
- Complications of surgery
- Renal dysfunction
- Multiorgan failure
- Cardiac rehabilitation
- Blood transfusion and blood products
- Wound infection and sternal disruption
- Diagnosis investigation and assessment of IHD
- Operative treatment - Off pump and on pump surgery
- Results of surgery – survival, graft patency, recurrence
- Role of PCI and non operative treatment
- Management of cardiovascular risk factors
- Diagnosis investigation and assessment of valvular heart disease
- Timing of surgical intervention in valve disease
- Options for operative management of hear valve disease including:
- Valve replacement/repair (mechanical, biological stented and stentless grafts, homografts and autografts)
- Valve design: materials, configuration and biomechanics.
- Results of surgery – survival, valve thrombosis, endocarditis, bleeding.
- Interpretation of survival and follow up data
- Cardiac performance and long term functional status
- Surgery for conduction problems
- Surgical treatment of arrhythmias

Clinical Skills

- History and examination of the cardiovascular system including conduit, drug history, identification of co morbidity and risk assessment
- Interpretation of routine haematology and biochemical investigations
- Interpretation of haemodynamic data
- Chest radiograph
- ECG including exercise ECG
- Coronary angiography
- Cardiac catheterization data
- Echocardiography including 2D, Doppler and TOE and stress echo
- Nuclear cardiac surgery
- Cardiopulmonary resuscitation
- Diagnosis and treatment of cardiac arrhythmias
- Management of post cardiac surgical patient
- Management of complications of surgery

- Cardiac rehabilitation
- Blood transfusion and blood products, including safe use of blood
- Wound infection and sternal disruption
- Valve selection
- Anticoagulation management including complications.

Technical Skills and Procedures

- Saphenous vein harvest
- Median Sternotomy
- Mammary/radial artery harvest
- Preparation for and management of cardiopulmonary bypass
- Proximal aortovenous anastomosis
- Distal coronary anastomosis
- Heart Valve replacement
- Surgical re-exploration for bleeding or tamponade

2. Critical Care and Postoperative Management

- The management of critically ill cardiothoracic surgical patients in the pre and post operative periods
- Cardiopulmonary resuscitation
- Management of cardiac surgical patient
- Treatment of cardiac arrhythmia
- Management of complications of surgery
- Blood transfusion and blood products
- Wound infection and sternal disruption
- Neuropsychological consequences of surgery and critical care

Clinical Skills

- History and examination of the post-operative and critically ill patient
- Analysis and interpretation of post operative and critical care charts and documentation
- Routine haematology and biochemical investigations
- Chest radiograph and ECG
- Management of fluid balance and circulating volume
- Pain control
- Wound management
- Management of surgical drains
- Antimicrobial policy and prescribing
- Management of post-operative haemorrhage
- Cardiopulmonary resuscitation
- Management of complications of surgery
- Blood transfusion and blood products including safe usage of blood
- Wound infection and sternal disruption

Interpretative Knowledge:

- Evaluation and interpretation of haemodynamic data
- Interpretation of ECG
- Use of anti-arrhythmic drugs

Recognition, evaluation and treatment of cardiac arrhythmias

- Understanding and use of cardiac pacing
- Recognition, evaluation and treatment of ventilatory abnormalities
- Interpretation of blood gas results
- Airway management
- Understanding of ventilatory techniques and methods
- Understanding of anaesthetic drugs and methods

Recognition, evaluation and treatment of multiorgan dysfunction:

- Renal dysfunction and support
- GIT dysfunction, feeding and nutrition
- Recognition and evaluation of cerebral and neuropsychological problems

Technical Skills and Procedures

- Recognition, evaluation and treatment of haemodynamic abnormalities
- Use of defibrillator
- Practical use of inotropes and vasoactive drugs
- Use of intra aortic balloon pump
- Echocardiography including TOE

Practical Skills:

- Arterial cannulation
- Central venous cannulation
- Pulmonary artery catheterization
- Intra aortic balloon pump insertion
- Intra aortic balloon pump timing and management
- Tracheostomy
- Fibreoptic bronchoscopy
- Chest aspiration
- Chest drain insertion
- Chest drain management

3. Cardiopulmonary Bypass, Myocardial Protection and Circulatory Support

Cardiopulmonary Bypass (CPB)

- Principles and practice of CPB
- Relevant equipment and technology and its application
- Monitoring during CPB
- Inflammatory and pathophysiological response to bypass
- Pulsatile and non-pulsatile flow
- Effect of CPB on pharmacokinetics
- Priming fluids and haemodilution

- Acid base balance – pH and alpha stat
- Neuropsychological consequences of CPB
- Cell salvage and blood conservation
- Principles and practice of myocardial preservation
- Cardioplegia solutions and delivery modes.
- Non-cardioplegic techniques of preservation
- Mechanical circulatory support in the pre-operative, peri-operative and post-operative periods
- Intra aortic balloon pump – indications for use, patient selection and complications
- Understanding of relevant equipment and technology
- Ventricular assist devices – indications for use, patient selection and complications

Clinical Skills

- Practical Knowledge of the Principles and practice of CPB
- Relevant equipment and technology and its application
- Monitoring during CPB
- Myocardial management throughout the peri-operative period
- Patient selection for mechanical circulatory support
- Insertion and positioning of the intra aortic balloon pump
- Management of the balloon pump including timing and trouble shooting
- Care of the patient with intra aortic balloon pump, including recognition and management of complications

Technical Skills and Procedures

- Median sternotomy open and close
- Cannulation and institution of cardiopulmonary bypass
- Safe conduct of CPB – problem solving and troubleshooting
- Weaning from bypass and decannulation
- Femoral cannulation and decannulation
- Repeat sternotomy, with pericardial dissection, cardiac mobilization and cannulation

Myocardial Protection

- Myocardial cellular physiology
- Myocardial function and dysfunction
- Haemodynamics and arrhythmias
- Coronary arterial and venous anatomy
- Scientific foundations of myocardial preservation
- Principles and practice of myocardial preservation
- Cardioplegia solutions and delivery modes.
- Non-cardioplegic techniques of preservation

Clinical Skills

- Myocardial management throughout the perioperative period
- Ability to adapt preservation technique to clinical situation

Technical Skills and Procedures

- Relevant cannulation techniques and appropriate delivery of cardioplegia

Circulatory Support

- Haemodynamics: physiology and measurement
- Cardiac arrhythmias
- Haemostasis, thrombosis and bleeding
- Anatomy of the femoral triangle and peripheral vascular system
- Inotropes, vasodilators and vasoconstrictors
- Anti-arrhythmic drugs
- Haemostatic drugs
- Antiplatelet, anticoagulant and thrombolytic drugs
- Mechanical circulatory support in the preoperative, perioperative and postoperative periods
- Intra aortic balloon pump - indications for use, patient selection and complications
- Physiology of the balloon pump
- Understanding of relevant equipment and technology
- Ventricular assist devices, indications for use, patient selection and complications

Clinical Skills

- Patient selection for mechanical circulatory support
- Insertion and positioning of the intra aortic balloon pump
- Management of the balloon pump including timing and trouble shooting
- Care of the patient with intra aortic balloon pump, including recognition and management of complications

4. Ischaemic Heart Disease

- The preliminary assessment and initial management of patients with complications of myocardial infarction, including mitral regurgitation, aneurysm and septal defects.
- The assessment and management of patients with coronary heart disease, including elective and emergency presentations.
- Diagnosis, investigation and treatment of heart disease
- Risk assessment and stratification
- Cardiopulmonary resuscitation
- Cardiac arrhythmias
- Complications of surgery
- Renal dysfunction
- Multiorgan failure
- Cardiac rehabilitation
- Blood transfusion and blood products
- Wound infection and sternal disruption
- Diagnosis investigation and assessment of IHD
- Operative treatment - Off pump and on pump surgery
- Results of surgery - survival, graft patency, recurrence
- Arterial revascularisation
- Redo coronary artery surgery
- Role of PCI and non operative treatment

- Management of cardiovascular risk factors
- Complications of myocardial infarction and ischaemic heart disease
- VSD, mitral regurgitation, aneurysm.

Clinical Skills

- Cardiovascular system and general history and examination including conduit, drug history, identification of comorbidity and risk assessment
- Routine haematology and biochemical investigations
- Interpretation of haemodynamic data
- Chest radiograph
- ECG including exercise ECG
- Coronary Angiography
- Cardiac Catheterization data
- Echocardiography including 2D, Doppler and TOE and stress echo
- Nuclear cardiac surgery
- Cardiopulmonary resuscitation
- Diagnosis and treatment of cardiac arrhythmias
- Management of post cardiac surgical patient
- Management of complications of surgery
- Cardiac rehabilitation
- Blood transfusion and blood products
- Wound infection and sternal disruption

Technical Skills and Procedures

- Saphenous vein harvest
- Mammary artery/radial artery harvest
- Preparation for and management of cardiopulmonary bypass
- Proximal coronary anastomosis
- Distal coronary anastomosis
- Isolated, first time coronary artery surgery
- (May include both off pump and on pump options and arterial revascularisation strategies)
- Repeat coronary artery surgery
- Complications of ischaemic heart disease including post infarction VSD, mitral regurgitation and left ventricular aneurysm

5. Heart Valve Disease

- Risk assessment and stratification
- Management of cardiovascular risk factors
- Diagnosis investigation and assessment of valvular heart disease
- Surgical intervention in valve disease
- Indications for operative management including:
- Valve replacement/repair (mechanical, biological stented and stentless grafts, homografts and autografts)
- Valve design: materials, configuration and biomechanics.
- Results of surgery – survival, valve thrombosis, endocarditis, bleeding.
- Interpretation of survival and follow up data

- Cardiac performance and long term functional status
- Surgery for conduction problems
- Surgical treatment of arrhythmias
- Cardiopulmonary resuscitation
- Care of the cardiac surgical patient
- Complications of surgery

Clinical Skills

- Cardiovascular system and general history and examination including drug history, identification of co morbidity and risk assessment
- Interpretation of Routine haematology and biochemical investigations
- Interpretation of haemodynamic data
- Chest radiograph
- ECG interpretation including exercise ECG
- Coronary angiography
- Cardiac catheterization data including left and right heart data
- Echocardiography (thoracic and transoesophageal) including 2D, Doppler and stress echo
- Nuclear cardiac surgery
- Cardiopulmonary resuscitation
- Diagnosis and treatment of cardiac arrhythmias
- Management of post cardiac surgical patient
- Management of complications of surgery
- Cardiac rehabilitation
- Blood transfusion and blood products
- Wound infection and sternal disruption
- Non operative management of endocarditis
- Valve selection
- Anticoagulation management including complications

Technical Skills and Procedures

- Isolated, uncomplicated aortic valve replacement (stented biological or mechanical)
- Isolated uncomplicated mitral valve replacement
- Tricuspid valve surgery
- Combined valve and graft surgery
- Surgical strategies for managing the small aortic root
- Aortic root surgery including stentless valves, and root replacement
- Redo Valve surgery
- Valve surgery for endocarditis
- Techniques for surgical ablation of arrhythmias
- Mitral valve repair
- Alternative surgical approaches to valve surgery including thoracotomy, transseptal approaches, and minimal access surgery

6. Congenital Heart Disease

- The anatomy, pathophysiology natural history and management of the following conditions

Septal Defects

- Heart defects caused by a hole in the septal wall of the heart, which separates the left and right sides of the heart
- Atrial Septal Defect (ASD)
- Ventricular Septal Defect (VSD)
- Atrioventricular Canal Defect
- Mitral Valve Conditions
- Patent Ductus Arteriosus

Defects Causing Obstruction in the Heart or Blood Vessels

- Any narrowing or blockage of blood flow
- Aortic Stenosis (AS)
- Coarctation of the Aorta
- Pulmonary Stenosis (PS)

Complex and Cyanotic Defects

- Heart defects resulting in less-than-normal oxygen levels in blood that is pumped to the body
- Ebstein's Anomaly
- Pulmonary Atresia with and without ventricular septal defect
- Tetralogy of Fallot (TOF)
- Transposition of the Great Arteries (atrial and arterial switch)
- Tricuspid Atresia
- Total Anomalous Pulmonary Venous Return (TAPVR)
- Truncus Arteriosus

Problems with Development of the Heart

- Hypoplastic Left Heart Syndrome (HLHS)
- Double Outlet Right Ventricle (DORV)
- Pulmonary Hypertension associated with congenital heart disease
- Marfan's Syndrome
- Bicuspid Aortic Valve Disease
- Total anomalous pulmonary venous drainage
- Truncus arteriosus
- Double outlet right ventricle
- Pulmonary atresia plus VSD and Major aortopulmonary collateral arteries (MAPCAs)
- Pulmonary atresia and intact septum
- Single ventricle
- Partial and complete atrioventricular septal defects
- Diagnosis, investigation and treatment of congenital heart disease
- Results of surgery - survival, common complications and management.
- Late complications of surgery for congenital heart disease
- Role of interventional cardiac surgery.
- Role of mechanical assistance; Intraaortic Balloon Pump (IABP), Ventricular Assist Devices (VAD) and Extracorporeal Membrane Oxygenation (ECMO)
- Indications for referral for transplantation
- Risk assessment and stratification

- Cardiopulmonary resuscitation
- Cardiac arrhythmias
- Renal dysfunction
- Multiorgan failure

- Cardiac rehabilitation
- Blood transfusion and blood products
- Wound infection and sternal disruption

Clinical Skills

- Cardiovascular system and general history and examination of child or adult with congenital heart disease
- Interpretation of routine haematology and biochemical investigations
- Chest radiograph and ECG
- Cardiac catheterization data including interpretation of haemodynamic data, shunt and resistance calculations
- Echocardiography in congenital heart disease, including 2D, doppler and Transesophageal echocardiography (TOE)
- Principles of paediatric intensive care
- Management of adults and children following congenital heart surgery
- Management of complications of surgery
- Cardiopulmonary resuscitation
- Diagnosis and treatment of cardiac arrhythmias
- Blood transfusion and blood products
- Wound infection and sternal disruption

Technical Skills and Procedures

- Sternotomy - open and close
- Thoracotomy - open and close
- Preparation for and management of cardiopulmonary bypass including partial bypass
- Approaches for ECMO, cannulation and management.
- Types of cardiac prosthesis and indications for use
- Pulmonary Artery (PA) banding and shunts
- Transposition of the great arteries- switch procedure
- Fontan procedure
- Rastelli procedure
- Hypoplastic left heart
- Norwood procedure
- Extra Corporeal Membrane Oxygenation
- Transplantation
- Surgical management of the following common uncomplicated conditions:
 - Patent ductus arteriosus
 - Atrial septal defect
 - Ventricular septal defect
 - Coarctation
 - PA banding and shunts

7. Aortovascular Disease

- Risk assessment
- Cardiopulmonary resuscitation
- Cardiac arrhythmias

- Complications of surgery
- Renal dysfunction
- Multiorgan failure
- Blood transfusion and blood products
- Wound infection and sternal disruption
- Natural history of aortic disease
- Diagnosis, investigation and assessment of aortic disease
- Knowledge of operative treatment including spinal cord and cerebral preservation strategies
- Type A dissection
- Type B dissection
- Traumatic aortic rupture
- Thoraco-abdominal aneurysm
- Results of surgery – survival, complication rates
- Non-surgical management including the role of endovascular stenting
- Management of cardiovascular and non-cardiovascular risk factors

Clinical Skills

- Interpretation of routine haematology and biochemical investigations
- Interpretation of haemodynamic data
- Chest radiograph
- ECG including exercise ECG
- Coronary Angiography
- Aortography
- Cardiac catheterization data
- Echocardiography including 2D, Doppler and TOE and stress echo
- CT scanning
- MRI scanning
- Cardiopulmonary resuscitation
- Diagnosis and treatment of cardiac arrhythmias
- Management of post cardiac surgical patient
- Management of complications of surgery
- Cardiac rehabilitation
- Blood transfusion and blood products
- Wound infection and sternal disruption

Technical Skills and Procedures

- Intraoperative monitoring
- Spinal cord protection
- Preparation for and management of cardiopulmonary bypass, including alternative, non-bypass strategies for descending aortic surgery
- Hypothermic strategies
- Femoral cannulation
- Surgery for acute dissection of the ascending aorta
- Aortic root replacement for chronic aortic root disease
- Complex aortic surgery including arch surgery, descending aortic and thoraco-abdominal aortic surgery

8. Cardiothoracic Trauma

- The assessment and management of patients with minor and major cardiothoracic trauma.
- Principles of trauma management
- Principles of emergency resuscitation following cardiac arrest
- The mechanism and patterns of injury associated with blunt, penetrating, blast and deceleration injuries to the chest
- The definitive care of blunt, penetrating and deceleration injuries to the chest.
- The indications and use of appropriate investigations in thoracic trauma management
- Pain relief in chest trauma, including epidural anaesthesia.
- Indications for immediate, urgent and delayed thoracotomy in trauma
- Operative management in appropriate situations.
- Operative management of complex cases including great vessel injury to be developed in the post CCT period

Assessment of Multiply Injured Patients Including Children

- Safely assess the multiply injured patient.
- History and examination
- Investigation
- Resuscitation and early management
- Referral to appropriate surgical subspecialties
- Technical Skills and Procedures
- Central venous line insertion
- Chest drain insertion
- Diagnostic peritoneal lavage

Clinical Skills

- Assessment and management of airway, breathing and circulation
- Maintenance of an adequate airway and respiratory support
- Protection of the cervical spine
- Circulatory resuscitation
- Establishment of appropriate monitoring
- Assessment and management of pain and anxiety
- Examination and assessment of the of the chest, including respiratory cardiovascular and circulatory systems
- Recognition and management of immediately life threatening situations: obstructed airway, tension pneumothorax, massive haemothorax, open chest wound, flail chest and cardiac tamponade
- Recognition and management of potentially life threatening situations: lung contusion, bronchial rupture, blunt cardiac injury, intrathoracic bleeding, oesophageal injury, simple pneumothorax and major vascular injury
- Recognition of potentially life threatening penetrating injuries to the chest and abdomen
- Interpretation of chest x-ray, ECG, arterial blood gases and echocardiography
- Detection and treatment of cardiac arrhythmias

- Management of the widened mediastinum including appropriate investigations and multidisciplinary consultation

Technical Skills and Procedures

- Establish an emergency airway (surgical and non-surgical)
- Insertion and management of thoracic drains
- Establish adequate venous access and monitoring.
- Pericardiocentesis and subxiphoid pericardial window for tamponade
- Subxiphoid pericardial window for tamponade
- Postero-lateral thoracotomy, antero-lateral thoracotomy and thoracotomy-laparotomy
- Bilateral Anterior Thoracotomy
- Median sternotomy and closure
- Repair of cardiac injuries
- Repair of pulmonary and bronchial injuries
- Management of the complications of chest trauma including retained haemothorax and empyema
- Repair of oesophageal injuries
- Repair of aortic transection

9. Paediatric Cardiac Surgery

Common Paediatric Disorders:

- Aortic, mitral, tricuspid and pulmonary valve disease
- Atrial septal defects
- Atrioventricular canal defects
- Coarctation of the aorta
- Coronary artery anomalies
- Double outlet right ventricle
- Ebstein's anomaly
- Hypoplastic left heart syndrome and single ventricle complex
- Patent ductus arteriosus
- Tetralogy of Fallot
- Total and partial anomalous pulmonary venous return
- Transposition of the great arteries
- Truncus arteriosus
- Vascular rings
- Ventricular septal defects

Clinical Skills:

- Pediatric heart failure management & Surgery
- Pediatric ECGs
- Pediatric Event (arrhythmia) monitoring
- Pediatric Holter monitoring
- Pacemaker implantation and monitoring
- ICD implantation and monitoring
- Tilt table testing
- Electrophysiologic studies
- Arrhythmia ablation

- Interpretation of necessary laboratory services, including cardiac catheterization, endomyocardial biopsy and echocardiography.

Technical and Procedural Skills:

- Endomyocardial Biopsy
- Minimally invasive cardiac surgery
- Open-heart surgery
- Within these categories, we perform many surgical treatments, including:
- Neonatal / Congenital Heart Surgery
- Coronary Revascularization
- Coronary artery bypass grafting (CABG)
- Balloon Angioplasty
- Balloon Septostomy
- Stenting
- Atrial Septal Defect (ASD) Repair
- Ventricular Septal Defect
- Tetralogy of Fallot Repair
- Arterial Switch for TGA
- Atrioventricular Canal Surgery
- Bidirectional Glenn
- Fontan
- Heart Valve Repair and Replacement ; Balloon Valvuloplasty
- Mitral Valve Replacement Surgery
- Complex Mitral Valve Repair
- Mechanical & Tissue Replacement
- Tricuspid Valve Surgery
- Aortic Valve Replacement
- Ross Procedure for AVR
- Patent Ductus Arteriosus
- Coarctation of the Aorta Repair
- Systemic to Pulmonary Shunt
- On and Off-Pump Procedures
- The Ross Procedure
- Homograft Replacement
- Left Ventricular Remodeling
- Heart assist devices
- Endovascular Repair of Aortic Aneurysms
- Arrhythmias Surgery
- Endarterectomy
- Pre-transplant evaluation
- Post-transplant management including immunosuppression, care of rejection episodes and complications of immunosuppressive agents.
- Close coordination with referring physician in long-term care of transplant patients.

10. Nuclear Cardiac surgery & Oncology

- Use and interpretation of cardiovascular diagnostic tests in identification of cardiovascular pathology
- Basic physics and instrumentation in Nuclear Cardiology

- Standard treadmill stress tests.
- The mechanism of action, efficacy, indications, and contraindications of pharmacological stress testing.
- The clinical outcome assessment.
- Indications for specific Nuclear Cardiology tests, the safe use of radionuclides, basic instrumentation, and image processing.
- Most commonly used radionuclides, including their physical properties and bio-availability
- Imaging studies with regards to coronary anatomy and various potential acquisition abnormalities
- Radiopharmaceutical agents in Nuclear Cardiac surgery: properties and kinetics.
- Myocardial perfusion imaging: Planar and SPECT
- Protocol and techniques, acquisition, processing, and quantification of cardiac images.
- Artifacts: Types of artifacts, detection, and attenuation correction.
- Exercise treadmill and pharmacological stress testing (with myocardial perfusion imaging).
- Radionuclide imaging in risk assessment of CAD.
- Suspected or known CAD.
- Risk assessment in acute coronary syndromes.
- Risk assessment before non-cardiac surgery
- Radionuclide evaluation post CABG and PCI
- Radionuclide imaging in the emergency department and chest pain unit
- Assessment of myocardial viability by radionuclide imaging
- PET and other applications of radionuclide imaging

Diagnostic techniques, including:

- Magnetic resonance imaging
- Multi-detector and electron-beam computed tomography
- Positron emission tomography

Pre-operative evaluation for cardiac surgery

- Echocardiography (transthoracic and transesophageal)
- Coronary stenting
- Echo-wall motion/stress echocardiography
- Cardiopulmonary stress testing
- Coronary artery bypass grafting vs. Percutaneous coronary intervention
- Traditional roentgenography
- Cardiac catheterization and arteriography
- Peripheral vascular arteriography
- Vascular ultrasonography
- Computer and magnetic resonance imaging
- Radionuclide scintigraphy (multi-gated acquisition [MUGA], stress, and Persantine thallium)

Cardiac Oncology

Clinical presentation, diagnosis and surgical management of the following cardiac tumours:

Benign:

- Myxoma
- Rhabdomyoma

- Fibroma
- Hemangioma
- Atrioventricular nodal
- Granular cell
- Lipoma
- Paraganglioma
- Myocytic hamartoma
- Histiocytoid cardiomyopathy
- Inflammatory psuedotumor
- Other benign tumors

Malignant:

- Sarcoma
- Lymphoma

11. Cardiac Surgery Therapeutics

- Pharmacokinetics and pharmacodynamics of common drugs related to cardiac surgery
- The drug prescription
- Factors that influence drug effects
- Special considerations in elderly
- Special considerations in pediatric

Cardiac glycosides (Class I-IV)

- Inotropic agents
- Antiarrhythmic drugs
- Antianginal agents
- Drugs effecting skeletal muscle
- Anaesthetics
- Analgesics
- Diuretic therapy in cardiovascular diseases
- Narcotic and sedative therapy
- Anti-hypertensive therapies
- Anticoagulant, fibrinolytic and thrombolytic therapy and the cardiac perfusion
- Steroid therapy and the cardiac perfusion
- Bronchodilator therapy
- Diabetic therapies and the cardiac perfusion
- Cardiac preserving/energy supplying agents
- New cardiopulmonary and renal agents
- Medications regimens related to transplantation of organs
- Various antimicrobial agents/antibiotics commonly used in cardiovascular diseases
- Solutions
- Composition and therapy
- Volume and tonicity
- Specific electrolytes
- Blood substitutes
- Myocardial Drug Therapy

12. Intrathoracic Transplantation & Surgery For Heart Failure

- Haemodynamics of heart failure.
- Molecular mechanisms underlying heart failure.
- Haemodynamics of cardiac constriction.
- Mechanisms and outcomes of respiratory failure.
- Causes of cardiac failure.
- Causes of respiratory failure.
- Major and minor histocompatibility antigen systems.
- Mechanisms of immune activation and pathological consequences for transplanted organs.
- Modes of action of commonly used drugs in heart failure:
- Resynchronization therapy: techniques and indications
- Indications for, contraindications to and assessment for heart transplantation.
- Indications for, contraindications to and assessment for lung and heart/lung transplantation.
- Criteria for brain stem death, management of the brain-dead donor, criteria for matching donor and recipient.
- Management of patients after intrathoracic organ transplantation, including complications
- Results of heart transplantation, lung transplantation and non-transplant interventions for heart failure.

Clinical Skills

- Cardiovascular system and general history and examination including conduit, drug history, identification of comorbidity and risk assessment
- Routine haematology and biochemical investigations
- Interpretation of haemodynamic data
- Chest radiograph
- ECG including exercise ECG
- Coronary angiography
- Cardiac catheterization data
- Echocardiography including 2D, Doppler and TOE and stress echo
- Nuclear cardiac surgery
- Cardiopulmonary resuscitation
- Management of brain-dead donor
- Diagnosis and treatment of cardiac arrhythmias
- Management of post cardiac surgical patient
- Management of complications of surgery
- Cardiac rehabilitation
- Blood transfusion and blood products
- Wound infection and sternal disruption

Technical Skills and Procedures

- Transplantation
- Donor Retrieval
- Implantation of heart
- Implantation of lung and heart/lung

- Surgery for heart failure
- Surgical revascularisation for ischaemic cardiomyopathy
- Ventricular reverse remodeling surgery
- Mitral valve repair for cardiac failure
- Implantation of extracorporeal VAD
- Implantation of intracorporeal VAD

13. Disorders of the Pericardium

- Pathology of the pericardium.
- Pathophysiological consequences of pericardial constriction and tamponade.
- Clinical, echocardiographic and imaging techniques used to detect pericardial disease and assess its consequences.
- Techniques for pericardial drainage using guided needle aspiration
- Surgical drainage by sub-xiphoid, thoracotomy or VATS approaches.
- Surgical techniques for pericardiectomy.
- Materials used for pericardial replacement, their value and limitations and the situations in which used.
- Post-operative complications following resection of the pericardium and its prosthetic replacement.

Clinical Skills

- The assessment and management of patients with disorders of the pericardium and pericardial cavity; including surgical management if appropriate and utilizing both VATS and open strategies
- Clinical history and examination
- Interpretation of laboratory, physiological and imaging techniques, including echocardiography.
- Recognition and assessment of pericardial tamponade and constriction.
- Techniques for pericardial drainage using guided needle aspiration
- Recognition of pericardial herniation and cardiac strangulation.
- Patient selection with assessment of function and risk.
- Management of patients making an uncomplicated or complicated recovery from pericardial surgery.

Technical Skills and Procedures

- Uncomplicated pericardial fenestration procedures
- Pericardial fenestration in complex cases.
- Pericardiectomy for relief of constriction
- Resection of the pericardium and replacement, in appropriate situations, with prosthetic materials.
- Competence in dealing with the complications of pericardial resection and replacement.

14. Preventive Cardiology & Rehabilitation

- Lipid management; Dyslipidemias
- Assessment of cardiovascular risk

- Smoking
 - High blood pressure
 - Family history of heart problems
 - Age (45 years old for males; 50 years old for women)
 - Post-menopausal status in women
 - Diabetes
 - Obesity
 - Inactivity
 - High levels of fat in the blood (hyperlipidemia)
 - Medical therapy for chronic coronary artery disease
 - Risks and benefits of cardiac rehabilitation
 - Arrhythmia management
 - Appropriate management of anticoagulation with the necessary indications
- Risk factors and educate patients in reducing risk factors:

Cardiovascular Rehabilitation

- Phase I: patient recovering from a cardiovascular episode such as a heart attack or stroke. Patients receive:
 - Information on heart, valve and/or vascular disease
 - Education on managing risk factors
 - Guidance for setting up a safe home exercise program
- Phase II: patients teaching how to manage heart, valve and vascular disease risk through lifestyle changes.
- Exercise regimen that includes
 - Warm-ups and stretching
 - Monitored exercise sessions with frequent checks of blood pressure, heart rate, blood oxygen saturation, etc., by staff
 - Work on various types of equipment, including treadmills, bikes, rowers and steps
 - Cool-down and relaxation sessions
 - Resistance training
 - Exercise prescription that includes development of a program for home exercise
- Phase III (Intermediate Maintenance) : patients who need to improve their conditioning with staff assistance and monitoring.
- Phase IV is long-term maintenance : patients who have completed the immediate and intermediate phases.
- Preventive Maintenance
- Education on heart disease and stroke
- Exercise prescriptions developed by staff
- Home program development plans
- Resistance training
- Monitoring of vital signs once a month

Part-III Thesis Component (Fifth year of MS Cardiac Surgery Programme)

RESEARCH/ THESIS WRITING

Total of one year will be allocated for work on a research project with thesis writing. Project must be completed and thesis be submitted before the end of training. Research can be done as one block in 5th year of training or it can be stretched over five years of training in the form of regular periodic rotations during the course as long as total research time is equivalent to one calendar year.

Research Experience

The active research component program must ensure meaningful, supervised research experience with appropriate protected time for each resident while maintaining the essential clinical experience. Recent productivity by the program faculty and by the residents will be required, including publications in peer-reviewed journals. Residents must learn the design and interpretation of research studies, responsible use of informed consent, and research methodology and interpretation of data. The program must provide instruction in the critical assessment of new therapies and of the surgical literature. Residents should be advised and supervised by qualified staff members in the conduct of research.

Clinical Research

Each resident will participate in at least one clinical research study to become familiar with:

1. Research design
2. Research involving human subjects including informed consent and operations of the Institutional Review Board and ethics of human experimentation
3. Data collection and data analysis
4. Research ethics and honesty
5. Peer review process

This usually is done during the consultation and outpatient clinic rotations.

Case Studies or Literature Reviews

Each resident will write, and submit for publication in a peer-reviewed journal, a case study or literature review on a topic of his/her choice.

Laboratory Research

Bench Research

Participation in laboratory research is at the option of the resident and may be arranged through any faculty member of the Division. When appropriate, the research may be done at other institutions.

Research involving animals

Each resident participating in research involving animals is required to:

1. Become familiar with the pertinent Rules and Regulations of the University of Health Sciences Lahore i.e. those relating to "Health and Medical Surveillance Program for Laboratory Animal Care Personnel" and

"Care and Use of Vertebrate Animals as Subjects in Research and Teaching"

2. Read the "Guide for the Care and Use of Laboratory Animals"
3. View the videotape of the symposium on Humane Animal Care

Research involving Radioactivity

Each resident participating in research involving radioactive materials is required to

1. Attend a Radiation Review session
2. Work with an Authorized User and receive appropriate instruction from him/her.

METHODS OF INSTRUCTION/COURSE CONDUCTION

As a policy, active participation of students at all levels will be encouraged. Following teaching modalities will be employed:

1. Lectures
2. Seminar Presentation and Journal Club Presentations
3. Group Discussions
4. Grand Rounds
5. Clinico-pathological Conferences
6. SEQ as assignments on the content areas
7. Skill teaching in ICU, Operation theatres, emergency and ward settings
8. Attend genetic clinics and rounds for at least one month.
9. Self study, assignments and use of internet
10. Bedside teaching rounds in ward
11. OPD & Follow up clinics
12. Long and short case presentations

In addition to the conventional teaching methodologies interactive strategies like conferences will also be introduced to improve both communication and clinical skills in the upcoming consultants. Conferences must be conducted regularly as scheduled and attended by all available faculty and residents. Residents must actively request autopsies and participate in formal review of gross and microscopic pathological material from patients who have been under their care. It is essential that residents participate in planning and in conducting conferences.

1. Clinical Case Conference

Each resident will be responsible for at least one clinical case conference each month. The cases discussed may be those seen on either the consultation or clinic service or during rotations in specialty areas. The resident, with the advice of the Attending Surgeon on the Consultation Service, will prepare and present the case(s) and review the relevant literature.

2. Monthly Student Meetings

Each affiliated medical college approved to conduct training for MS Cardiac Surgery will provide a room for student meetings/discussions such as:

- a. Journal Club Meeting
- b. Core Curriculum Meetings
- c. Skill Development

a. Journal Club Meeting

A resident will be assigned to present, in depth, a research article or topic of his/her choice of actual or potential broad interest and/or application.

Two hours per month should be allocated to discussion of any current articles or topics introduced by any participant. Faculty or outside researchers will be invited to present outlines or results of current research activities. The article should be critically evaluated and its applicable results should be highlighted, which can be incorporated in clinical practice. Record of all such articles should be maintained in the relevant department.

b. Core Curriculum Meetings

All the core topics of Cardiac Surgery should be thoroughly discussed during these sessions. The duration of each session should be at least two hours once a month. It should be chaired by the chief resident (elected by the residents of the relevant discipline). Each resident should be given an opportunity to brainstorm all topics included in the course and to generate new ideas regarding the improvement of the course structure

c. Skill Development

Two hours twice a month should be assigned for learning and practicing clinical skills.

List of skills to be learnt during these sessions is as follows:

1. Residents must develop a comprehensive understanding of the indications, contraindications, limitations, complications, techniques, and interpretation of results of those technical procedures integral to the discipline
2. Residents must acquire knowledge of and skill in educating patients about the technique, rationale and ramifications of procedures and in obtaining procedure-specific informed consent. Faculty supervision of residents in their performance is required, and each resident's experience in such procedures must be documented by the program director.
3. Residents must have instruction in the evaluation of medical literature, clinical epidemiology, clinical study design, relative and absolute risks of disease, medical statistics and medical decision-making.
4. Training must include cultural, social, family, behavioral and economic issues, such as confidentiality of information, indications for life support systems, and allocation of limited resources.
5. Residents must be taught the social and economic impact of their decisions on patients, the primary care physician and society. This can be achieved by attending the bioethics lectures
6. Residents should have instruction and experience with patient counseling skills and community education.
7. This training should emphasize effective communication techniques for diverse populations, as well as organizational resources useful for patient and community education.
8. Residents should have experience in the performance of Cardiac Surgery related clinical laboratory and radionuclide studies and basic

laboratory techniques, including quality control, quality assurance and proficiency standards

9. Each resident will manage at least the following essential cardiac surgical cases and observe and participate in each of the following procedures, preferably done on patients under supervision initially and then independently (pg.13-14)

3. Annual Grand Meeting

Once a year all residents enrolled for MS Cardiac Surgery should be invited to the annual meeting at UHS Lahore.

One full day will be allocated to this event. All the chief residents from affiliated institutes will present their annual reports. Issues and concerns related to their relevant courses will be discussed. Feedback should be collected and suggestions should be sought in order to involve residents in decision making.

The research work done by residents and their literary work may be displayed.

In the evening an informal gathering and dinner can be arranged. This will help in creating a sense of belonging and ownership among students and the faculty.

LOG BOOK

The residents must maintain a log book and get it signed regularly by the supervisor. A complete and duly certified log book should be part of the requirement to sit for MS examination. Log book should include adequate number of diagnostic and therapeutic procedures observed and performed, the indications for the procedure, any complications and the interpretation of the results, routine and emergency management of patients, case presentations in CPCs, journal club meetings and literature review.

Proposed Format of Log Book is as follows:

Candidate's Name: _____

Roll No. _____

The above mentioned procedures shall be entered in the log book as per format:

Procedures Performed

Sr.#	Date	Name of Patient, Age, Sex & Admission No.	Diagnosis	Procedure Performed	Supervisor's Signature
1					
2					
3					
4					

Emergencies Handled

Sr.#	Date	Name of Patient, Age, Sex & Admission No.	Diagnosis	Procedure/Management	Supervisor's Signature
1					
2					
3					
4					

Case Presented

Sr.#	Date	Name of Patient, Age, Sex & Admission No.	Case Presented	Supervisor's Signature
1				
2				
3				
4				

Seminar/Journal Club Presentation

Sr.#	Date	Topic	Supervisor's signature
1			
2			
3			
4			

Evaluation Record

(Excellent, Good, Adequate, Inadequate, Poor)

At the end of the rotation, each faculty member will provide an evaluation of the clinical performance of the fellow.

Sr.#	Date	Method of Evaluation (Oral, Practical, Theory)	Rating	Supervisor's Signature
1				
2				
3				
4				

EVALUATION & ASSESSMENT STRATEGIES

Assessment

It will consist of action and professional growth oriented ***student-centered integrated assessment*** with an additional component of ***informal internal assessment, formative assessment*** and measurement-based ***summative assessment***.

Student-Centered Integrated Assessment

It views students as decision-makers in need of information about their own performance. Integrated Assessment is meant to give students responsibility for deciding what to evaluate, as well as how to evaluate it, encourages students to '**own**' the evaluation and to use it as a basis for self-improvement. Therefore, it tends to be growth-oriented, student-controlled, collaborative, dynamic, contextualized, informal, flexible and action-oriented.

In the proposed curriculum, it will be based on:

- Self Assessment by the student
- Peer Assessment
- Informal Internal Assessment by the Faculty

Self Assessment by the Student

Each student will be provided with a pre-designed self-assessment form to evaluate his/her level of comfort and competency in dealing with different relevant clinical situations. It will be the responsibility of the student to correctly identify his/her areas of weakness and to take appropriate measures to address those weaknesses.

Peer Assessment

The students will also be expected to evaluate their peers after the monthly small group meeting. These should be followed by a constructive feedback according to the prescribed guidelines and should be non-judgmental in nature. This will enable students to become good mentors in future.

Informal Internal Assessment by the Faculty

There will be no formal allocation of marks for the component of Internal Assessment so that students are willing to confront their weaknesses rather than hiding them from their instructors.

It will include:

- a. Punctuality
- b. Ward work
- c. Monthly assessment (written tests to indicate particular areas of weaknesses)
- d. Participation in interactive sessions

Formative Assessment

Will help to improve the existing instructional methods and the curriculum in use

Feedback to the faculty by the students:

After every three months students will be providing a written feedback regarding their course components and teaching methods. This will help to identify strengths and weaknesses of the relevant course, faculty members and to ascertain areas for further improvement.

Summative Assessment

It will be carried out at the end of the programme to empirically evaluate cognitive, psychomotor and affective domains in order to award diplomas for successful completion of courses.

MS Cardiac Surgery Examinations

Part I MS Cardiac Surgery

Total Marks: 200

All candidates admitted in MS Cardiac Surgery course shall appear in Part I examination at the end of first calendar year.

Components of Part-I Examination:

Paper-I, 100 MCQs (single best, having one mark each)	100 Marks
Paper-II, 10 SEQs (having 10 marks each)	100 Marks

Topics included in papers:

	Paper-I	Paper-II
1. Anatomy	(20 MCQs)	(2 SEQs)
2. Physiology	(20 MCQs)	(2 SEQs)
3. Pathology	(20 MCQs)	(2 SEQs)
4. Biochemistry	(15 MCQs)	(1 SEQs)
5. Pharmacology	(15 MCQs)	(1 SEQ)
6. Behavioural Sciences	(05 MCQs)	(1 SEQ)
7. Biostatistics & Research Methodology	(05 MCQs)	(1 SEQ)

Part II- MS Cardiac Surgery

Total Marks: 430

All candidates admitted in MS Cardiac Surgery course shall appear in Part II examination at the end of second calendar year.

There shall be two written papers of 100 marks each, Oral & practical/ clinical examination of 150 marks and log book assessment of 80 marks.

Topics included in papers 1 & 2:

Basic Principles of Surgery

Components of Part II Examination

Theory:

Paper 1:	<u>100 Marks</u>	3 Hours
10 SEQs (No Choice; 05 marks each)	50 Marks	
50 MCQs	50 Marks	

Paper 2:

10 SEQs (No Choice; 05 marks each)
50 MCQs

100 Marks

50 Marks
50 Marks

3 Hours

Only those candidates, who pass in theory papers, will be eligible to appear in the Oral & Practical/Clinical Examination.

Oral & Practical/ Clinical Examination shall be held in clinical techniques relevant to General Surgery.

OSCE

50 Marks

10 stations each carrying 05 marks of 10 minutes duration; each evaluating performance based assessment with five of them interactive

Clinical

100 Marks

Four short cases (each 15 marks)
One long case:

60 Marks
40 Marks

Log Book

80 Marks

Part III MS Cardiac Surgery**Total Marks: 960**

All candidates admitted in MS Cardiac Surgery course shall appear in Part-III examination at the end of structured training programme (end of 5th calendar year and after clearing Part I & II examinations).

There shall be two written papers of 150 marks each, practical/ clinical examination of 300 marks, log book assessment of 120 marks and thesis examination of 200 marks.

Part III MS Cardiac Surgery**Clinical Examination****Total Marks: 720****Topics included in paper 1**

- | | |
|---|-----------|
| 1. Congenital Heart Diseases | (15 MCQs) |
| 2. Ischaemic & Valvular Heart Diseases | (15 MCQs) |
| 3. Cardiothoracic Trauma | (15 MCQs) |
| 4. Aortovascular & Pericardial Diseases | (10 MCQs) |
| 5. Cardiac Surgery Therapeutics | (10 MCQs) |
| 6. Nuclear Cardiac surgery & Oncology | (10 MCQs) |

Topics included in paper 2

- | | |
|--|-----------|
| 1. Critical Care and Post-operative Management | (15 MCQs) |
| 2. General Cardiac Surgery | (15 MCQs) |
| 3. Paediatric Cardiac Surgery | (15 MCQs) |
| 4. Cardiopulmonary Bypass, Myocardial Protection and Circulatory Support | (15 MCQs) |
| 5. Intrathoracic Heart transplantation and Surgery for Heart Failure | (10 MCQs) |
| 6. Preventive Cardiology & Rehabilitation | (05 MCQs) |

Components of Part III Clinical Examination**Theory****Paper I**

15 SEQs (No Choice)
75 MCQs

150 Marks

75 Marks
75 Marks

3 Hours

Paper II

15 SEQs (No Choice)
75 MCQs

150 Marks**3 Hours**

75 Marks

75 Marks

The candidates, who pass in theory papers, will be eligible to appear in the clinical & viva voce.

OSCE/ Viva**100 Marks**

10 stations each carrying 10 marks of 10 minutes duration; each evaluating performance based assessment with five of them interactive

Clinical**200 Marks**

Four short cases (each 25 marks)
One long case:

100 Marks

100 Marks

Log Book**120 Marks****Part III MS Cardiac Surgery****Thesis Examination****Total Marks: 200**

All candidates admitted in MS Cardiac Surgery course shall appear in Part-III (thesis examination) at the end of 5th year of the MS programme and not later than 8th calendar year of enrolment. The examination shall include thesis evaluation with defense.

RECOMMENDED BOOKS

1. Mastery in Cardiothoracic Surgery, 2nd Ed. By L.R. Kaiser, 2007
2. Key Topics in Cardiac Surgery by Augustin Tang, 2005
3. Complications in Cardiothoracic Surgery: avoidance and treatment by A. G. Little, 2004
4. Keklin and Barrot Boys Cardiac Surgery, Morphology, Diagnostic Criteria, 3rd ed., 2003
5. Manual of preoperative care in cardiac surgery by Robert M. Bojar, 199
6. Recent advances in surgery by C.D. Johnson, 1998
7. Apleton and Lange's Review of Surgery, by W. Simon, 3rd ed. 1998
8. Cardiac surgery in the adult by L.Henery, 1997
9. Bailey and Love short practice of surgery by Charles C.Wan, 1996
10. Manual of preoperative care in cardiac surgery by Robert M. Bojar, 1994
11. Pediatric cardiac surgery, 2nd ed, by M. Constantine,1994
12. Cardiac surgery an morphology and diagnostic criteria,,2nd ed. 1993
13. Medical care of cardiac surgical patient by Vlay, 1992
14. Extracorporeal circulation by H. Kay, 1992
15. The surgical clinics of North America: Reoperative abdominal surgery, 16. 1991
17. Cardiac pacing and electrophysiology by N. Sheriff, 1991
18. The Aortic valve by Emeney L. Arem, 1991
19. Heart and Heart lung transplantation by Baungar, 1990
20. Hepatic transplantation by W. James, 1990
21. Critical Leg Ischemia by Dormandy, 1990
22. Atlas of adult cardiac surgery by W.A.Gay, 1990
23. Cardiovascular Laser Therapy by J. M. Isner, 1989
24. Heart and Heart lung transplantation by J. Wallwork, 1989
25. Atlas of general surgery by H. Dudley, 1989
26. Principles of organ transplantation by M. Wayne, 1989
27. Year book of vascular surgery by Dergan, 1989
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