

CURRICULUM



MD CARDIOLOGY
RAWALPINDI MEDICAL UNIVERSITY
RAWALPINDI

**CURRICULUM/STATUTES & REGULATIONS FOR 5 YEARS DEGREE
PROGRAM IN CARDIOLOGY
(MD CARDIOLOGY)
RAWALPINDI MEDICAL UNIVERSITY (RMU)
RAWALPINDI**

STATUTES

Nomenclature Of The Proposed Course

The name of degree program shall be MD Cardiology. This name is well recognized and established for the last many decades worldwide.

Course Title:

MD Cardiology

Training Centers

Departments of Cardiology (accredited by RMU) in affiliated institutes of Rawalpindi Medical University.

Objectives:

1. To train in chosen clinical field through a competency based training system.
2. To develop skills in conducting research and its application to clinical environment.
3. To enable trainees to use modern techniques and technologies effectively.
4. To provide training in cognitive, psychomotor and affective domains.

Admission criteria:

Application for admission in MD Cardiology will require:

1. MBBS Degree
2. One Year of House Job
3. RMU students will be given 10% extra weightage

Duration of Course

The duration of MD Cardiology course shall be five (5) years with structured training in a recognized department under the guidance of an approved supervisor. The course is structured as follows:

The trainee will spend the initial six months of the induction period in the parent cardiology department for initial orientation, preparation of the synopsis and the research project and will undertake the mandatory workshops during this period. After initial six months, formal training and rotation in the field of general medicine for eighteen months will start in a recognized department with the approval of the supervisor in cardiology. During this period the resident must get the research synopsis approved by the concerned department of the university. During the period of rotation, the trainee will maintain a constant liaison with the supervisor in cardiology to keep him

updated about his progress in training. At the end of 2nd years, the candidate will take up Intermediate Examination. During the 3rd, 4th, & 5th years, of the program, there will be training rotations in clinical and interventional cardiology, both in diagnostic as well as therapeutic sections.

The candidate shall undergo clinical training to achieve educational objectives of MD Cardiology (knowledge & Skills) along with rotation in the relevant fields, which will be carried out during the 4th and 5th year of the program. The clinical training shall be competency based. There shall be generic and specialty specific competencies and shall be assessed by continuous Internal Assessment. (Appendix F&G).

The Research Component and thesis writing shall be completed over the five years duration of the course. The Candidate will spend total time equivalent to one calendar year for research during the training. Research can be done as one block or it can be done in the form of regular periodic rotation over five years as long as total research time is equivalent to one calendar year.

AIMS AND OBJECTIVES OF THE COURSE

AIM

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

GENERAL OBJECTIVES

MD Cardiology training should enable a resident to acquire:

1. Overall assessment of patient care that is effective, safe, timely, efficient, equitable and patient-centered.
2. Medical knowledge about established and evolving biomedical, clinical and cognate sciences (e.g., epidemiological and social-behavioral) and the application of this knowledge to patient care.
3. Interpersonal and communication skills that result in effective information exchange and teaming with patient, their families and other health professionals.
4. Professionalism, as manifested through a commitment to carrying out professional responsibilities, adherence to ethical principles and sensitivity to a diverse patient population, providing cost-effective, ethical and humanistic care.
5. System-based practice, as manifested by actions that demonstrate an awareness of and responsiveness to the larger context and system of health care and the ability to effectively call on system resources to provide care that is of optimal value.
6. Practice-based learning and improvement that involves investigation and evaluation of their own patient care, appraisal and assimilation of scientific evidence and improvement in patient care.

Basic Sciences & Therapeutics

- A trainee must have adequate knowledge about Medical ethics & Professional values and human basic sciences including anatomy, physiology, biochemistry,

pathology, pharmacology and behavioral sciences.

- A trainee must have a detailed knowledge of cardiovascular anatomy, physiology, biochemistry, pathology, pharmacology & therapeutics.

SPECIFIC LEARNING OUTCOMES

Following competencies are expected from a resident completing MD Cardiology training;

1. Adult/ Clinical Cardiology
2. Pediatric Cardiology
3. Cardiovascular Surgery

1. Adult/ Clinical Cardiology

Clinical Cardiology

Includes training to acquire a comprehensive knowledge and skill in the anatomy, patho-physiology, diagnosis and management of cardiovascular diseases.

Procedural Competencies

The trainee is expected to be competent in performing the following procedures by the end of core training. The trainee must be able to outline the indications for these interventions. For invasive procedures, the trainee must recognize the indications for the procedure, the importance of valid consent, aseptic technique, safe use of local anesthetics and minimization of patient discomfort.

- Venepuncture
- Cannula insertion, including large bore
- Arterial blood gas sampling
- Lumbar Puncture
- Pleural tap and aspiration
- Intercostal drain insertion: Seldinger technique
- Ascitic tap
- Abdominal paracentesis
- Central venous cannulation
- Initial airway protection: chin lift, Guedel airway, nasal airway, laryngeal mask
- Basic and, subsequently, advanced cardio-respiratory resuscitation
- Bronchoscopy
- Upper and lower GI endoscopy
- ERCP
- Liver biopsy
- Renal biopsy
- Bone marrow and lymph node biopsy
- Cytology: pleural fluid, ascitic fluid, cerebro-spinal fluid, sputum
- DC cardioversion
- Urethral catheterization
- Nasogastric tube placement and checking

- Electrocardiogram
- Knee aspiration
- Temporary cardiac pacing by internal wire or external pacemaker

ECG and Holter Monitoring

The goal of training in ECG and Holter monitoring is to become familiar with most clinically encountered arrhythmias, understand the clinical importance of these findings, and have a basic understanding of the physiologic mechanisms involved in ECG waveforms. For Holter monitoring, the resident should understand the differences in record.

ECG And Ambulatory Electrocardiography

- Patterns of electrocardiography
- Clinical implications, sensitivity, specificity and normal versus abnormal variants
- Electrocardiographic interpretation of Normal ECG
- General concepts of arrhythmia recognition in:
 - Sino atria
 - Atria
 - AV node
 - Ventricles
 - AV block
 - Abnormalities of ST and T segments
 - Chamber abnormalities
 - IVCD's
 - MI's
 - Pacemaker rhythms

Emergency Cardiology/ Cardiac Care Unit

A trainee in cardiology must acquire the knowledge and skills to recognize, evaluate and manage all manifestations of cardiovascular disease including:

- Acute coronary syndromes
- Hypertensive heart disease
- Cardiac arrhythmias
- Valvular heart disease
- Cardiomyopathy
- Pulmonary heart disease
- Peripheral vascular disease and Pulmonary Embolism
- Cerebral vascular disease
- Heart disease in pregnancy
- Adult congenital heart disease
- Coronary artery disease and its manifestations and complications
- Non-cardiac chest pain
- Acute and chronic congestive heart failure
- Cardio-Pulmonary Resuscitation
- Implantation of temporary pacemaker
- Minor surgical procedures like CVP, Arterial line, swan Ganz monitoring.

- Complications of therapy
- Aortic dissection and other vascular emergencies
- Hypotension, syncope and shock
- Pericardial diseases and cardiac tamponade

CARDIAC CARE UNIT CURRICULUM

Goals

- Become competent in the initial evaluation and comprehensive care of critically ill patients.
- Understand indications for admission to the ICU.
- Formulate and understand the differential diagnosis, diagnostic approach and treatment plan of specific conditions pertaining to critically ill patients.
- Set initial ventilator settings for patients with acute respiratory failure, indications for tracheal intubation and non-invasive ventilation.
- Understand and apply principles of resuscitation and stabilization of critically ill patients.
- Function as a member of a multidisciplinary team caring for critically ill patients. Become an effective communicator with family members and to learn how to address end of life issues with patients and family.

Specific Learning Objectives Patient care:

- Demonstrate competency in medical interviewing, physical diagnosis and data collection of critically ill patients.
- Formulate a differential diagnosis and outline a thorough, comprehensive and organized plan.
- Demonstrate organizational skills necessary for the care of critically ill patients, including prioritization of patient problems and the use of information technology.

Medical knowledge:

- Efficiently and effectively record daily progress and events in the medical record. Know the indications for invasive and non- invasive forms of ventilation. Understand the basic principles of mechanical ventilation, modes of ventilation, ventilatory parameters; approach to reducing ventilatory support; complications of mechanical ventilation; approach to patient dyssynchrony, distress or alarms; and indications for tracheostomy.
- Understand the principles and methods of fluid resuscitation for various shock states, the use of crystalloids or colloids, assessing perfusion at the bedside and the endpoints of resuscitation.
- Understand the approach to a patient with fever in the ICU, including diagnosis and treatment of hospital acquired infections as well as noninfectious causes of fever.
- Interpret simple and mixed acid-base disorders. Understand the clinical manifestations, pathophysiology and treatment of common electrolyte disturbances.
- Understand the pathophysiology and management of diabetic ketoacidosis.
- Understand and address the basic nutritional requirements of critically ill patients.
- Understand the diagnosis and treatment of anxiety, agitation, pain and delirium in the ICU, including the appropriate use of sedatives with paralytics and identification of drug/alcohol withdrawal syndromes.
- Understand the evaluation, approach and treatment of seizures (status epilepticus),

CVA, coma and the basic approach to diagnosis of brain death.

- Understand the indications/contraindications for DVT and stress ulcer prophylaxis.
- Understand the indications/contraindications for, risks of, and be able to perform: venipuncture, arterial puncture, arterial catheterization, central venous access, lumbar puncture & nasogastric tube placement.
- Participate in family meetings and be able to discuss general condition of a patient with immediate family members.

Communication skills

- Participate in family meetings and be able to discuss general condition of a patient with immediate family members.
- Demonstrate an ability to obtain informed consent for procedures and imaging studies
- Learn the process of death notification

PBPI/SBP

- Understand and implement procedures used to promote patient safety and minimize errors
- Understand and adhere to infection control practices

Professionalism

- Consistently demonstrate respect for patients and staff and place patients' interests above all other considerations

Daily Schedules & Rounds

This team is responsible for the provision of care to all patients in the MICU. The day interns are responsible for the care of their assigned patients, although they, as well as senior residents, should be familiar with all of the patients in the MICU. Before morning rounds begin the day interns should have examined each of their patients, reviewed the current data (laboratory studies and cultures) & formulated an organized, systematic plan for each component of the patient's problem list. In general presentations of existing patients on rounds should consist of:

1. Overnight events.
2. Vital data – Temp max, pulse range, BP range respiratory rate, ventilator settings (if applicable), oxygen saturation and input/output (including overall fluid balance and average hourly urine output).
3. Directed physical examination that is specific to that particular patient.
4. Review of laboratory results, including cultures (these must be reviewed daily!)
5. Review of the medication list, including dosages and intervals (many of our patients have fluctuating renal and hepatic function, therefore it is of paramount importance to review this information in order to identify and prevent toxicity).
6. Assessment – this must be brief and concise.
7. Plan – this must be organized and systems oriented! For example:
 - **Respiratory** – continue or change aspects of ventilation, etc.
 - **Infectious** – what antibiotics the patient is on and what are we trying cover, culture results, etc.
 - **Cardiovascular/Hemodynamic** – vasopressors in use, therapies being employed based on invasive monitoring, etc.

- **Hematologic** – bleeding problems, anticoagulation, etc.
- **Metabolic** - fingerstick monitoring, insulin requirements, electrolyte replacements, changes in renal function, etc.
- **Alimentary/Nutrition** – assessment of patient’s nutritional status, hepatic dysfunction, type of NGT feeds, rate of infusion, TPN/PPN, etc.
- **Neurologic** – sedatives or paralytic drugs, etc.
- **DVT Prophylaxis** – pneumatic compression devices (at the bare minimum) and LMWH if there are no bleeding issues or contraindications.
- **Stress Ulcer Prophylaxis** – either an H2 blocker or a PPI. (This applies to all patients who are mechanically ventilated or NPO.)

It is important to maintain a systematic approach even if there is no problem in a particular system. This ensures that all aspects of ICU care are being addressed. Afternoon rounds will begin at 5PM to provide follow-up of the days events, new admissions and plans for the on-call residents and fellow.

Notes & Documentation

- A progress note from either an intern or resident is required for each patient, every day!
- Please make sure to fill out consultation requests completely, including date and time called, reason for consultation; print and sign your name.
- Whenever a patient is being transferred to the general ward or to another service a detailed summary note, including presenting complaint and hospital course is required, in addition to the daily note.

Patients who die in the CCU require the following:

1. **Death Note** – a note documenting that there are no signs of life on physical examination.
2. **Death Summary** – a note that details why the patient was admitted and brief hospital course.
3. **Code Note (if applicable)** – a note documenting when a code was called, status of the patient on your arrival, ACLS protocol employed, duration of the code and outcome.
4. **Death Certificate.**
If a patient is discharged home from the ICU then a standard discharge note is required. Charts that are lacking these components are deemed incomplete and will require that the resident or intern go to Medical Records to complete deficient charts. Failure to comply with this policy will be noted by the Department of Medicine.

Standard Precautions

- Hand washing or use of an alcohol-based gel is mandatory before and after each patient interaction. This is the best way to reduce the spread of bacteria from patient to patient.
- Stethoscopes should be cleaned between each patient contact with an alcohol pad. Resistant bacteria require masks, gowns, and gloves for ANY contact in the room.

When used, dispose in proper receptacle IN the patient's room. Do not bring flow sheets or charts into isolation rooms.

- Respiratory masks are required for all patients on respiratory isolation.

Invasive Procedures

The Cardiology fellow is responsible for supervising or performing all relevant invasive procedures. Appropriate informed consent must be obtained from the patient prior to the procedure. Residents must be supervised for procedures they are not certified in, by a certified fellow. **Do not attempt to perform a procedure if you are not confident in your ability to do so.**

- **Central venous access site preference: jugular vs. subclavian vs. femoral. Femoral access should be obtained only for emergent access, since there is a higher risk for infection and DVT.**
- Sterile technique – cap, sterile gown & gloves, drapes, supervision. Please be very attentive to your field and maintenance of sterility. Remember, the technique you employ during the procedure will determine the likelihood of developing an infectious complication!
- Povidone iodine solution is used for sterilization in standard way.
- Antibiotic-coated central lines (blue catheters) should be changed every 10 days & arterial lines every 7 days. In addition all catheter sites should be evaluated each day for signs of infection.
- Guidewire line changes for central venous lines ONLY when a new stick cannot be done or when changing a PA catheter to TLC (See Protocol) – all venous catheter tips must be cut into a sterile container and sent for semi-quantitative culture.
- Procedure forms should be filled out for ALL invasive procedures done in the CCU.
- Do not draw blood from central lines because it breaks sterility.
- The nurses will do central line and arterial line dressings.

Orders

Verbal orders do not exist in the CCU.

- Admission orders on order sheets, including admission, attending of record, patient's condition, daily labs, etc.
- All orders must be communicated verbally to the nurse in addition to computer entry. This will ensure that all members of the team know what changes are occurring for a particular patient's care and that those changes will be implemented in a timely fashion.
- Ventilator changes must be ordered in the computer and communicated directly to the respiratory therapist.
- Review medication sheets daily from the nurses' medication list.
- TPN & PPN order must be in by 12 noon.

Labs

- Review need for daily labs, EKG's and CXR's.
- Respiratory therapists are certified to do radial ABGs only (and not other labs)

Clinical Protocols

- Sedation is titrated to the Ramsey scale. Use midazolam infusion if first choice is anxiolysis/sedation. For anticipated short term intubations, use propofol. For agitated delirium, use haloperidol by intermittent dosing, rarely by infusion.
- Neuromuscular blockade - preferred agent is cis-atracurium which is mostly metabolized in the blood and tissues, so it can be given in liver or renal failure. Dose is titrated to ventilator synchrony, and is monitored by the "train of four." A drug holiday should ideally be given once a day to permit a neurological exam, to see if the patient still needs to be paralyzed and if the level of sedation is adequate. Daily CK levels must be sent while the patient is on continuous neuromuscular blockade.
- DVT prophylaxis - pneumatic compression boots, low dose warfarin .Double prophylaxis (compression boots and something else) should be given to high risk patients (sedated paralysis, hemiplegia, and femoral lines - virtually all of our patients).
- GI prophylaxis - all mechanically ventilated or NPO patients must receive prophylaxis with an H2 blocker or PPI. If there is no clinical preference H2 blocker should be the default choice and whenever possible enterally.

Nutrition

Although the clinical nutritionist often assesses each patient and recommends nutritional orders, house staff is expected to understand and know the patient's nutritional regimen and requirements.

Boarding

Senior members of the team usually handle boarding of patients in other ICU's. Beds cannot be "saved" for potential admissions.

Bedside & Transport Equipment

You should be familiar with how to use the standard equipment, including bed controls, ambu-bags, IV pumps, monitoring equipment and inline suction catheters. For transporting patients, you should be familiar with the Lifepak/ambu-bag/oxygen mask and emergency medications, as well as what medications the patient are being transported with and which IV site can be used to administer medications in an emergency. **IF YOU DON'T KNOW HOW TO USE SOMETHING, SAY SO!!**

Privacy

Privacy should be maintained while examining a patient or doing a procedure remember to pull curtains appropriately. Also don't forget that though the patients may be sedated, they may still hear you talking about them, so use judgment when talking about prognosis, etc. If you remove restraints on a patient or put the side rails down to do a procedure, **PLEASE REMEMBER TO REPLACE THE RESTRAINTS AND PUT THE RAILS BACK UP.**

In order for the ICU experience to be valuable and rewarding it is important to spend as much time as possible at the patient's bedside in order to appreciate the clinical relevance of principles that are discussed on rounds, such as fluid resuscitation or changes in ventilator management. Also by working with other members of the team (nurses, nutritionists, pharmacists, physician assistants and respiratory therapists) you will maximize your knowledge base by understanding the different perspectives of caring for the critically ill. By making a therapeutic

decision and following up on its effect you will better understand the practice of Critical Care Medicine.

PALLIATIVE CARE CURRICULUM: One of our departmental performance improvement projects is to improve the teaching of palliative care. Our goals for you are straightforward.

Goals

By the end of the year we want you to achieve the following:

- Understand how to provide optimal care for patients whose conditions cannot be cured and those at the end of life
- Demonstrate proficiency in the use of analgesics, particularly narcotic analgesics, in the setting of chronic pain
- Know how to manage the common non-pain symptoms that arise in end of life care
- Be able to communicate effectively and empathically with patients and families in delivering bad news, and in discussing prognosis of common cancers, advance directives, DNR orders, switching from aggressive care to palliative or hospice care, and other issues in end of life care
- Understand the ethical issues involved in palliative care
- Utilize all available resources, including hospice care, to provide for patients' needs and ensure a smooth transition to outpatient care

Noninvasive Diagnostic Cardiology

Includes training in ECG and Holter monitoring, echocardiography, ETT, radionuclear cardiac diagnostic procedures including cardiac perfusion imaging procedure, cardiac CT scan and cardiac MRI. Training is comprised of the following rotations

Echocardiography

Trainee in cardiology must acquire a comprehensive knowledge and skills about the use of echocardiography. Training will include knowledge in the basic aspects of ultrasound, instrumentation, the ability to perform routine transthoracic and transesophageal studies. A trainee must acquire the knowledge and skill to use Doppler examination in clinical practice including Tissue Doppler imaging and strain/speckle tracking echocardiographic imaging. Salient features of training in echocardiography department include:

Echocardiography Procedures:

- Ultrasound transducer and the Doppler flow signals.
- Transesophageal echocardiography
- Intraoperative transesophageal echocardiography
- Stress echocardiography
- Dobutamine stress echocardiography
- Contrast echocardiography
- Tissue Doppler imaging
- Strain/speckle tracking echocardiographic imaging

Cognitive Skills:

- Indications for echocardiography.
- Case specific knowledge of differential diagnostic problems and specific echocardiography techniques required conducting a thorough investigation.
- Alternatives to echocardiography.
- Physical principles of echocardiography image formation
- Doppler evaluation of blood flow velocity measurement.
- Diagnosis and evaluation of cardiac abnormalities due to acquired and congenital heart disease.
- Fluid dynamics of normal and abnormal blood flow patterns due to acquired and congenital heart disease.
- The resident must show the ability to correlate the findings by cardiac auscultation and electrocardiography with echocardiography-Doppler results.
- The ability to communicate the results of the echocardiography examination to the patient, physician, and the medical record.
- Operation of the echocardiography equipment and all the controls affecting the quality of image acquisition.
- Quantitative analysis of the echocardiography examination and generation of an understandable report.
- All cardiology residents must acquire the knowledge and experience necessary to be fully capable of performing and interpreting M-Mode, 2-Dimensional and Doppler examination independently, under the supervision of the laboratory director and should be competent to perform and interpret various special echocardiographic procedures.
- For exercise and pharmacologic stress echocardiography, the trainee must have participated in at least 100 supervised studies beyond level 2 training; this represents a minimal amount of specialized training.

Exercise Tolerance Test (ETT)

During rotation in ETT lab, the trainee should be acquainted with the software and hardware used for the test. The trainee must develop a comprehensive knowledge about its different clinical utilities, patho-physiology, indications, contraindications, limitations, complications and interpretation of the test.

Nuclear Cardiology, Cardiovascular Imaging and Stress Testing

During rotation in Nuclear Cardiology department the trainee will get acquainted with performance of different diagnostic tests and their application in clinical cardiology.

- 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 Cardiology: 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 of 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
- Magnetic resonance imaging
- Multi-detector and electron-beam computed tomography
- Positron emission tomography other applications of radionuclide imaging

Cardiac Catheterization

The resident will acquire the cognitive and motor skills to safely perform cardiovascular diagnostic and therapeutic interventional catheterization procedure under the supervision of an attending cardiologist. The resident is also expected to learn about the indications, contraindications, post-procedural management as well as the knowledge and ability to handle the associated complications.

- Right heart catheterizations and pulmonary artery catheterizations with balloon-tipped, flow-guided catheters and will be trained to interpret the acquired hemodynamic data.
- Insertion of temporary right ventricular pacemakers as well as atrial pacemakers.
- Pulmonary angiography and left heart catheterization including ventriculography and coronary and graft angiography.
- Foreign body removal from the right-sided cardiac structure and pulmonary arterial tree.
- Pericardiocentesis for diagnostic or therapeutic purposes.
- Active participation in the performance of all PCI's and peri-procedural management.
- Active participation in peripheral diagnostic and interventional procedures including assessment of renovascular hypertension and PVOD.
- Learn the indications and safe performance of femoral closure devices and recognize and manage their potential complications.

The trainees will become familiar with catheterization laboratory equipment including:

- Physiologic recorders

- Transducers
- Blood gas and activated clotting time (ACT) analyzers
- Image intensifiers and other x-ray equipment
- Digital imaging
- Report generation

The trainees shall be instructed in the principles and management thereof:

- Shunt detection
- Cardiac output determination
- Wave-form pressure recording and analysis.
- Endomyocardial biopsy
- Insertion of intra-aortic balloon counterpulsation equipment

During the rotation in the catheterization laboratory the trainee gains experience in;

- The hemodynamics and anatomy of coronary artery disease
- Valvular Heart Disease
- Congenital Heart disease
- Cardiomyopathies
- Diseases of the aorta
- Pulmonary embolism and pulmonary hypertension
- Renovascular hypertension and peripheral vascular occlusive disease.

Pre-cath work-up of the patients prior to catheterization. This includes;

- Documentation in the chart of non-invasive tests that have been performed
- Obtaining reports of previous cardiac catheterizations, cardiac surgery and other pertinent angiograms.
- After the pre-cath work-up is completed the trainee discusses the case with the attending cardiologist who will be supervising the procedure.
- The trainees ensure that the appropriate pre-cath blood work-up has been obtained and is normal. Usual blood work includes CBC, platelet count, PT, PTT, electrolytes, BUN and creatinine and glucose. Clotting studies are particularly important in patients on oral anticoagulants.
- The trainees review the patient's medications and history of allergies. Patients with a history of iodine dye allergy, even an equivocal history, should receive dye allergy prophylaxis prior to catheterization.
- Patients undergoing a PTCA must get antiplatelet medication prior to the procedure unless clear-cut allergies are documented.
- Patients on long-action Insulin should have a reduction in their dose the morning of catheterization.
- Potassium should be in the normal range.
- Patients on Glucophage will have their drug held for 48-72 hours post procedure.
- The cardiovascular resident helps explain the indications and risks for the catheterization and the procedure to the patient and their family, and obtain an informed consent.
- The trainees are expected to participate in the follow-up of the patient after the procedure. This may include performance of closure devices and removal of any

sheaths after the procedure, often with continuation of GP IIB/IIIA inhibitor infusion.

- Laboratory, nursing and technical staff may assist in sheath removal.
- Catheterization reports will be completed on the day of the procedure.

Electrophysiology Laboratory

A cardiology trainee must have a sound knowledge of electrocardiography (ECG) and different invasive and noninvasive electrophysiological techniques used to assess patients with arrhythmias in Electrophysiology laboratory including Signal average ECG, Head-up Tilt test, cardiac pacemakers and other cardiac devices with various type and modes and EP Studies & ablations.

Clinical Electrophysiology Service

- Introduction to electrophysiology
- Principles of basic electrophysiology including determinants of the normal action potential and normal cardiac rhythm and conduction.
- Genesis of cardiac arrhythmias, including congenital and acquired arrhythmias syndromes and mechanism of action of antiarrhythmic drugs.
- Implantation of cardiac arrhythmia control devices
- Surface ECG interpretation (evaluation of normal and abnormal intervals, recognition of myocardial infarction/ischemia, metabolic and drug effects, conduction disturbances, accessory AV conduction locations, Exercise testing for arrhythmia assessment).
- Non-invasive testing modalities, such as ambulatory EKG recordings, telemetry, event recordings, Tilt-table testing, signal-averaged ECG's, exercise and pharmacological stress testing, heart rate variability, and T wave alternans.
- Bradyarrhythmias (sinus node dysfunction, AV conduction disorders) and tachyarrhythmias (atrial arrhythmias, reentrant arrhythmias, wide complex rhythms).
- Novel arrhythmogenic situations: long QT syndrome, Brugada syndrome, arrhythmogenic right ventricular dysplasia, idiopathic ventricular fibrillation.
- Invasive electrophysiologic evaluation, including principles of stimulation, sinus node function, AV nodal arrhythmias, his-purkinje system, ventricular arrhythmias, as well as ablation therapy for tachyarrhythmias.
- Basic pharmacokinetics and pharmacodynamics of drugs used in electrophysiology.
- Technique of electrical cardioversion and the sedation procedures that accompany this technique
- Indications and basic methods of placing pacemakers and automatic defibrillators.
- Evaluation of patients for syncope and assessment of risks for sudden cardiac death in certain high risk populations

Vascular Medicine

Management and treatment options of various vascular diseases.

- Ordering and interpretation of non-invasive testing
- Peripheral artery disease

- Acute arterial occlusions
- Carotid artery disease
- Cerebrovascular disease
- Aortic aneurysm
- Aortic dissection
- Renal artery stenosis
- Vasculitis
- Basal spasm
- Venous thrombosis
- Venous insufficiency
- Lymphedema
- Indications, strengths, and weakness of the various non-invasive test
- Technical aspects in the performance of modality
- Primary and secondary risks stratification
- Indications and limitations of percutaneous interventions in the treatment of peripheral vascular disease
- Surgical treatment of peripheral vascular disease

Vascular studies including:

- Duplex ultrasonography of the veins and arteries of the upper and lower extremities
- Duplex ultrasonography of the aorta and its branches
- Duplex ultrasonography of the carotid arteries
- Physiologic test of the peripheral arteries and veins

Pre-operative evaluation for non-cardiac surgery

Trainee in cardiology must acquire an adequate knowledge and skill to evaluate the risk assessment of patients requiring non-cardiac surgical procedures and must be well versed with different diagnostic and evaluation tools used for this purpose, both in elective and emergency conditions.

Cardiovascular Research: Includes opportunities for basic cardiac research.

Preventative Cardiology: Includes training in the application and implementation of guidelines and strategies for the prevention and early detection of cardiac diseases. Training in skills to manage modifiable risk factors for ischemic heart disease like weight management, dietary habits, exercise ,smoking etc through life style modification.

- Lipid management; Dyslipidemias
- Assessment of cardiovascular risk
- Smoking
- Blood pressure control
- Obesity
- Diabetes mellitus
- 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:

2. Pediatric Cardiology:

The trainee will have three months rotation in Pediatric Cardiology department to get adequate exposure to congenital and acquired pediatric cardiovascular diseases, their presentation, diagnosis and emergency and follow up management with special focus on the following:

- History taking and clinical examination
- Heart Failure
- Cyanotic Congenital Heart Disease {Tetralogy Of Fallot (TOF)}
- Acyanotic Congenital Heart Diseases {Ventricular Septal Defect (VSD), Patent Ductus Arteriosus (PDA), Atrial septal Defects (ASD)}
- Eisenmenger syndrome
- Rheumatic Fever
- Hypertension
- Viral Myocarditis
- Common Rhythm Disorders {Paroxysmal Atrial Tachycardia (PAT)}
- EKG findings for disease entities with congenital heart disease and their various arrhythmic presentations
- Echocardiographic appearance of normal heart and be able to recognize abnormal appearances of most common congenital heart disease defects
- Clinical findings of congenital heart disease as well as the long-term follow up care required with medical and surgical therapies for this patient population
- Appropriate management techniques for treating patients with congenital heart disease over lifetime follow

3. Cardiac Surgery Rotation

The trainee will have three months rotation in cardiovascular surgical department and will observe the cardiovascular surgical procedures for congenital and acquired cardiac problems both in adult and pediatric patients to acquire adequate knowledge and skill to assess indications, contraindications, complications & their management and post surgical management of patients in surgical intensive care (ITC) as well as in cardiac surgical wards and follow-up in OPD.

13. Clinical Case Conferences and Specialty Lectures

- Non-invasive Conference covering all aspects of echocardiographic, nuclear, magnetic resonance and CT imaging as well as an Integrated Imaging Conference and an Intra-Operative TEE Conference
- Cardiac CT/MR Conference
- Electrocardiographic/EP Conference
- Cardiology Grand Rounds
- Residents Journal Club
- Cardiology Research Conference
- Cardiac Catheterization Conference
- Interventional Cardiology Conference

- Vascular Medicine Conference

14. Clinical Rotations:

During the third, fourth and final year, the cardiology residents shall rotate in the following clinical services. This is accomplished through the supervised performance of consultations, daily hospital rounds and active participation in procedures under the supervision of attending faculty. Clinical decision-making and a cost-effective scholarly approach to cardiology problems are emphasized through teaching rounds, clinical rounds and clinical conferences. The 3rd year cardiology resident is expected to present cases at the clinical conferences.

Third Year MD Cardiology

- Three months Coronary care unit
- Three months consultation service
- Three months non-invasive service
- Three months cardiac catheterization laboratory.

During this time, the resident is expected to develop basic cognitive and procedural skills including:

- Left and right heart catheterization
- Temporary transvenous pacemaker insertion
- Intra-aortic balloon pump placement
- Exercise and chemical stress testing with or without imaging studies
- Transthoracic and transesophageal echocardiogram performance.

Fourth Year MD Cardiology

- The resident will complete the required time for the year, which include:
- Three months of echocardiography
- Two months of nuclear cardiology
- One month of other non-invasive cardiac testing including exercise stress testing, EKG interpretation and Holter monitoring
- Two months in the cardiac catheterization laboratory
- Two months in electrophysiology

The inpatient experience during the 3rd & 4th years will comprise eight months of non-laboratory clinical practice activities i.e. consultations, cardiac care unit and post-operative care of cardiac surgery patients. Two months will be devoted to the electrophysiology rotation and pacemaker follow-up as well as ICD follow-up. In addition to further developing clinical and echocardiographic skills, the resident will develop more complex procedural skills as outlined below (cardiac catheterization, interventional procedures, transesophageal echocardiograms and electrophysiology studies) and will develop an appreciation for the indications, contraindications and technical limitations of these procedures. He/she will serve as a primary teaching resource for medical students, residents and first year cardiology residents.

Final Year MD Cardiology

The final year resident in cardiovascular diseases can follow one of two tracks: invasive

or non-invasive.

During the invasive track the goals are perfection of procedural as well as clinical and cognitive skills.

Objective:

- The resident will participate actively in the performance of diagnostic cardiac catheterization as well as interventional procedures and will be involved in the training of junior residents assigned to the catheterization laboratory. All of this will be under the close supervision of the attending faculty.
- In the intensive care and cardiac care setting, the senior cardiology resident will supervise and assist in the performance of emergency procedures such as right heart catheterization, temporary pacemaker insertion, pericardiocentesis, and elective and emergency cardioversions.
- In the non-invasive track, the senior cardiovascular resident will spend more time in the echocardiography laboratory where he will be responsible for supervising exercise and chemical stress tests as well as improving his skills in echocardiography with particular emphasis on transesophageal echocardiography and intravascular ultrasound.
- In the electrophysiology laboratory, the senior resident will be participating in diagnostic electrophysiology procedures, ablation procedures, insertion of permanent pacemakers and insertion of implantable cardioverter defibrillators.
- The trainees will maintain records of participation in the form of a logbook documenting their participation in procedures such as cardiac catheterization, interventional procedures, echocardiograms, transesophageal echocardiograms, cardioversions, pacemaker implantations, and electrophysiologic procedures such as ablations.

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.

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 medical 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, emergency and ward settings
8. Attend genetic clinics and rounds for at least one month.
9. Attend sessions of genetic counseling
10. Self-study, assignments and use of internet
11. Bedside teaching rounds in ward
12. OPD & Follow up clinics
13. 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 Physician on the Consultation Service, will prepare and present the case(s) and review the relevant literature.

2. Monthly Resident Meetings

Each affiliated medical college approved to conduct training for MD Cardiology will provide a room for resident 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 Cardiology 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 (mentioned in the Log Book).
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 and becoming familiar with Project Professionalism Manual such as that of the American Board of Internal Medicine.
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 may attend the series of lectures on Nuclear Medicine procedures (radionuclide scanning and localization tests and therapy) presented to the Radiology residents.
9. Residents are required to assist in the advanced cardiac procedures on a limited basis for exposure to the technique. All trainees should be well versed in the indications for, management of and complications of patients with regard to interventional procedures at the end of the program. Cardiology residents are expected to acquire skill in the performance and interpretation of:
 - History and physical examination.
 - Cardiac diagnostic procedures.
 - Cardiopulmonary resuscitation and advanced cardiac life support
 - Complex resuscitative procedures and treatment of complex acute life threatening arrhythmias during the CCU rotation.
 - Elective cardioversion. Both inpatient and outpatient cardioversion of atrial fibrillation
 - Right and left heart catheterization including coronary arteriography
 - Intra-aortic balloon counterpulsation
 - Insertion and management of temporary pacemakers
 - Programming and follow-up surveillance of permanent pacemakers

- Exercise stress testing
- Echocardiography
- Pericardiocentesis
- Intracardiac electrophysiologic studies.
- Percutaneous transluminal coronary angioplasty and other interventional procedures
- Cardiovascular rehabilitation; prescription of exercise in cardiac patients.

The cardiology residents are expected to acquire skill in the interpretation of:

- Chest x-rays. On an individual basis with the attending radiologist as well as part of the didactic program.
- Electrocardiograms. As part of the bimonthly conference schedule ECG's are reviewed. All clinical services require ECG review. The trainee reads
- ECG's with the attending cardiologist.
- Ambulatory ECG recording
- Radionuclide studies of myocardial function and perfusion. Intensive rotation with didactic and practical interpretation.
- Ongoing research projects. The resident will have regular meetings with the program director to review research in progress.
- Cardiovascular literature.
- Residents should have experience in the performance of clinical laboratory and radionuclide studies and basic laboratory techniques, including quality control, quality assurance and proficiency standards.

3. Annual Grand Meeting

Once a year all residents enrolled for MD Cardiology 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 MD 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.

REGULATIONS

Scheme of the Course

A summary of five years course in MD Cardiology is presented as under: **Course**

Structure

At the End of 2nd year MD

Cardiology Program

Components

Principles of Internal Medicine
Relevant Basic Science (Physiology, Pharmacology, Pathology)

Examination

Intermediate Examination at the end of 2nd Year of M.D.

Cardiology Program
Written MCQs = 300 Marks
Clinical, TOACS/OSCE & ORAL = 200 Marks
Total = 500 Marks

At the end of 5th year of MD

Cardiology Program

Clinical component

☑ Professional Education in Cardiology

Training in Cardiology with compulsory/ optional rotations.

Research component

Research work / Thesis writing must be completed and thesis be submitted at least 6 months before the end of final year of the program.

Final Examination at the end of 5th year of M.D. Cardiology Program.

Written = 500 Marks
Clinical, TOACS/OSCE & ORAL = 500 Marks
Contribution of CIS = 100 Marks
Thesis Evaluation = 400 Marks
Total = 1500 Marks
Thesis evaluation and defense at the end of 5th year of M.D. Cardiology Program.

Intermediate Examinations M.D. Cardiology

All candidates admitted in M.D. Cardiology course shall appear in Intermediate examination at the end of 2nd calendar year.

Eligibility Criteria:

The candidates appearing in Intermediate Examination of the M.D. Cardiology Programme are required:

- To have submitted certificate of completion of mandatory workshops.
- To have submitted certificate of completion of first two years of training from the supervisor/ supervisors of rotations.
- To have submitted CIS assessment proforma from his/her own supervisor on 03 monthly basis and also from his/her supervisors during rotation, achieving a cumulative score of 75%.
- To have submitted certificate of approval of synopsis or undertaking / affidavit that if synopsis not approved with 30 days of submission of application for the Intermediate Examination, the candidate will not be allowed to take the examinations and shall be removed from the training program.
- To have submitted evidence of payment of examination fee.

Intermediate Examination Schedule and Fee

- a) Intermediate Examination at completion of two years training, will be held twice a year.
- b) There will be a minimum period of 30 days between submission of application for the examination and the conduction of examination.
- c) Examination fee will be determined periodically by the University.
- d) The examination fee once deposited cannot be refunded / carried over to the next examination under any circumstances.
- e) The Controller of Examinations will issue Roll Number Slips on receipt of prescribed application form, documents satisfying eligibility criteria and evidence of payment of examination fee.

Written Part of Intermediate Examination

The candidate of MD Cardiology program will appear in the subject of principles of Internal Medicine and relevant basic sciences.

Written Examination = 300 Marks

Clinical, TOACS/OSCE & ORAL = 200 Marks

Written Examination:

The marks of written exam will be divided as follows:

MCQs = 200 Marks

SEQs = 100 Marks

Total = 300 Marks

Principles of Internal Medicine = 70 MCQs 7 SEQs

Specialty specific = 10 MCQs 1 SEQs

Basic Sciences (Physiology, = 20 MCQs 2 SEQs

Pharmacology, Pathology)

Total = 100 MCQs 10 SEQs

Clinical, TOACS/OSCE & ORAL

Four Short Cases = 100 Marks

One Long Case = 50 Marks

TOACS/OSCE & Oral = 50 Marks

Total = 200 Marks

Declaration of Results

The Candidate will have to score 50% marks in written, Clinical, TOACS/OSCE & ORAL component and a cumulative score of 60% to be declared successful in the Intermediate Examination.

A maximum total of four consecutive attempts (availed or unavailed) will be allowed in the Intermediate Examination during which the candidate will be allowed to continue his training program. If the candidate fails to pass his Intermediate Examination within the above mentioned limit of four attempts, the candidate shall be removed from the training program, and the seat would fall vacant, stipend/ scholarship if any would be stopped.

Final Examination in MD Cardiology

At the end of 5th year of M.D. Cardiology Program

Eligibility Criteria:

To appear in the Final Examination the candidate shall be required:

- a) To have submitted the result of passing Intermediate Examination.
- b) To have submitted the certificate of completion of training, issued by the Supervisor will be mandatory.
- c) To have achieved a cumulative score of 75% in Continuous Internal assessments of all training years.
- d) To have got the thesis accepted and will then be eligible to appear in Final Examination.
- e) To have submitted no dues certificate from all relevant departments including library, hostel, cashier etc.
- f) To have submitted evidence of submission of examination fee.

Final Examination Schedule and Fee

- a. Final examination will be held twice a year.
- b. The candidates have to satisfy eligibility criteria before permission is granted to take the examination.
- c. Examination fee will be determined and varied at periodic intervals by the University.
- d. The examination fee once deposited cannot be refunded / carried over to the next examination under any circumstances.
- e. The Controller of Examinations will issue an Admittance Card with a photograph of the candidate on receipt of prescribed application form, documents satisfying eligibility criteria and evidence of payment of examination fee. This card will also show the Roll Number, date / time and venue of examination.

Components of Final Examination

Written Part of Final Examination Total marks 500

Clinical, TOACS/OSCE & ORAL Total marks 500

Contribution of CIS to the Final Examination Total marks 100

Thesis Evaluation Total marks 400

Written Part of Final Examination

- a) There will be two written papers which will cover the whole syllabus of the specialty of training with total marks of 500.
- b) The written examination will consist of 200 single best answer type Multiple Choice Questions (MCQs) and 10 Short Essay Questions (SEQs). Each correct answer in the Multiple Choice Question paper will carry 02 marks, but an incorrect response will result in deduction of 0.5 mark. Each Short Essay Question will carry 10 marks.
- c) The Total Marks of the Written Examination will be 500 and to be divided as follows:

Multiple Choice Question paper Total Marks = 400

Short Essay Question paper Total Marks = 100

- d) The candidates scoring a score of 50% marks in multiple choice question paper and short essay question paper will pass the written part of the final examination and will become eligible to appear in the clinical and TOACS/OSCE & Oral.

- e) The written part result will be valid for three consecutive attempts for appearing in the Clinical and Oral Part of the Final Examination. After that the candidate has to re-sit the written part of the Final Examination.

Clinical, TOACS/OSCE & ORAL:

- a) The Clinical and Oral Examination will consist of 04 short cases, 01 long case and TOACS/OSCE & Oral with 01 station for a pair of Internal and External Examiner. Each short case will be of 07 minutes duration, 05 minutes will be for examining the patient and 02 minutes for discussion. The Oral Examination will consist of laboratory data assessment, interpretation of Radiology images, ECG and others.
- b) The Total Marks of Clinical, TOACS/OSCE & ORAL will be 500 and to be divided as follows:
 - Short Cases Total Marks = 200
 - Long Case Total Marks = 100
 - TOACS/OSCE & ORAL Total Marks = 200
- c) A panel of four examiners will be appointed by the Vice Chancellor and of these two will be from UHS whilst the other two will be the external examiners. Internal examiner will act as a coordinator. In case of difficulty in finding an Internal examiner in a given subject, the Vice Chancellor would, in consultation with the concerned Deans, appoint any relevant person with appropriate qualification and experience, outside the University as an examiner.
- d) The internal examiners will not examine the candidates for whom they have acted as Supervisor and will be substituted by other internal examiner.
- e) The candidates scoring 50% marks in each component of the Clinical & Oral Examination will pass this part of the Final Examination.
- f) The candidates will have two attempts to pass the final examination with normal fee. A special administration fee of Rs.10,000 in addition to normal fee or the amount determined by the University from time to time shall be charged for further attempts.

Declaration of Result

For the declaration of result

- a) The candidate must get his/her Thesis accepted.
- b) The candidate must have passed the final written examination with 50 % marks and the clinical & oral examination securing 50% marks. The cumulative passing score from the written and clinical and TOACS/OSCE & Oral shall be 60%.
- c) The MD degree shall be awarded after acceptance of thesis and success in the final examination.
- d) On completion of stipulated training period, irrespective of the result (pass or fail) the training slot of the candidate shall be declared vacant.

Submission / Evaluation of Synopsis

- a) The candidates shall prepare their synopsis as per guidelines provided by the Advanced Studies & Research Board, available on university website.
- b) 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.
- c) Synopsis of research project shall be submitted by the end of the 2nd year of MD 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.

Submission of Thesis

- a) Thesis shall be submitted by the candidate duly recommended by the Supervisor.
- b) The minimum duration between approval of synopsis and submission of thesis shall be one year.
- c) The research thesis must be compiled and bound in accordance with the Thesis Format Guidelines approved by the University and available on website.
- d) The research thesis will be submitted along with the fee prescribed by the University.

Thesis Examination

- a. The candidate will submit his/her thesis at least 06 months prior to completion of training.
- b. The Thesis along with a certificate of approval from the supervisory will be submitted to the Registrar's office, who would record the date / time etc. and get received from the Controller of Examinations within 05 working days of receiving.
- c. The Controller of Examinations will submit a panel of eight examiners within 07 days for selection of four examiners by the Vice Chancellor. The Vice Chancellor shall return the final panel within 05 working days to the Controller of Examinations for processing and assessment. In case of any delay the Controller of Examinations would bring the case personally to the Vice Chancellor.
- d. The Supervisor shall not act as an examiner of the candidate and will not take part in evaluation of thesis.
- e. The Controller of Examinations will make sure that the Thesis is submitted to examiners in appropriate fashion and a reminder is sent after every ten days.
- f. The thesis will be evaluated by the examiners within a period of 06 weeks.
- g. In case the examiners fail to complete the task within 06 weeks with 02 fortnightly reminders by the Controller of Examinations, the Controller of Examinations will bring it to the notice of Vice Chancellor in person.
- h. In case of difficulty in find an internal examiner for thesis evaluation, the Vice Chancellor would, in consultation with the concerned Deans, appoint any relevant person as examiner in supersession of the relevant Clause of the University Regulations.
- i. There will be two internal and two external examiners. In case of difficulty in finding examiners, the Vice Chancellor would, in consultation with the concerned Deans, appoint minimum of three, one internal and two external examiners.
- j. The total marks of thesis evaluation will be 400 and 60% marks will be required to pass the evaluation.
- k. The thesis will be considered accepted, if the cumulative score of all the examiners is 60%.
- l. The clinical training will end at completion of stipulated training period but the candidate will become eligible to appear in the Final Examination at completion of clinical training and after acceptance of thesis. In case clinical training ends earlier,

the slot will fall vacant after stipulated training period.

Award of MD Cardiology Degree

After successful completion of the structured courses of MD Cardiology and qualifying Intermediate & final examinations, (written, clinical, TOACS/OSCE & Oral and thesis) the degree with title MD Cardiology shall be awarded.