CURRICULUM/STATUTES & REGULATIONS
FOR
5 YEARS DEGREE PROGRAMME
IN
CARDIOLOGY
(MD CARDIOLOGY)

UNIVERSITY OF HEALTH SCIENCES, LAHORE

STATUTES

1. Nomenclature Of The Proposed Course

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

2. Course Title:

MD Cardiology

3. Training Centers

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

4. Duration of Course

The duration of MD Cardiology 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 and Biostatistics & Research Methodology. At the end of first year the examination shall be held in Basic Medical Sciences. The clinical training in fundamental concepts of Internal Medicine shall start from the 1st day of enrollment.

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

Part III is structured for 3rd, 4th and 5th calendar years in MD Cardiology. The candidate shall undergo training to achieve educational objectives of MD Cardiology (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 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

1. For admission in MD Cardiology course, the candidate shall be required to have:
   - MBBS degree
   - Completed one year House Job
   - One year experience in Cardiology/Internal Medicine/Allied medical 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.

2. Exemptions: A candidate holding FCPS/MRCP/Diplomate American Board/equivalent qualification in Internal Medicine shall be exempted from Part-I & Part-II Examinations and shall be directly admitted to Part-III Examinations of the specialty, 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 MD 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 MD courses.
- Candidates selected for the courses after their enrollment at the relevant institutions shall be registered with UHS as per prescribed Registration Regulations.

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 Cardiology 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 MD programme 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:

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.

SPECIFIC LEARNING OUTCOMES

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

- **Clinical Cardiology:** Includes training in cardiac physiology, physical diagnosis, coronary artery disease, valvular heart disease, vascular disease and hypertension.

- **Cardiac Catheterization: T**he resident will acquire the cognitive and motor skills to perform left and right heart catheterization. All procedures shall be performed under the direct supervision of an attending cardiologist. The resident is also expected to learn the indications for coronary intervention and post-intervention management. Trainees with an interest in interventional cardiology may be offered advanced training in this field.

- **Noninvasive Diagnostic Cardiology.**

Includes training in perfusion imaging and radionuclear ventriculograms, as well as exposure to cardiac MRI. Training is comprised of the following rotations:

- **Echocardiography:** The goal of the echocardiography rotation is to train all residents in the essentials of clinical echocardiography. For all cardiology residents, training will include instruction in the basic aspects of ultrasound, instrumentation, the ability to perform routine transthoracic and transesophageal studies, including Doppler examinations, and to relate the findings to the patient's medical management. The trainees are responsible for the acquisition and interpretation of echocardiograms during this rotation, and are supervised by both technical staff and attending specialists in echocardiography.

- **Nuclear Cardiology and Stress Testing:** The goals of this rotation are to instruct the resident in the indications, the performance, and the interpretation of diagnostic nuclear cardiology and stress testing. The trainee is directly responsible to the attending of the exercise/nuclear lab for all components of this rotation.
- For exercise testing, the cardiology resident will become proficient with performing and interpreting maximal and submaximal exercise tests. He will also become familiar with exercise physiology, know the essentials of preparation for exercise testing (skin prep, electrode placement, etc.), and know the clinical importance of the findings. The trainee will be instructed in all types of pharmacologic testing (dipyridamole, adenosine, dobutamine), and learn when it is appropriate to use each method. The resident will be given primary responsibility to perform stress tests. Trainees will be instructed in the interpretation of stress test following myocardial infarction for the purpose of identifying high risk patients and prescribing appropriate exercise regimens for cardiovascular rehabilitation.

- **ECG and Holter:** The goal of training in ECG and Holter 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.

- **Electrophysiology and pacemaker follow-up.** Includes training in diagnostic EPS, ablation, cardiac pacing, and arrhythmia management. The cardiology residents are expected to acquire knowledge and experience in the diagnosis and management of arrhythmias, the indications and limitations of electrophysiologic studies, the appropriate use of antiarrhythmic agents and defibrillator devices. They will obtain adequate exposure to noninvasive and invasive techniques used to assess patients with arrhythmias. A minimum of 2 months is dedicated to this area.

- **Heart Failure and Transplantation:** Includes training in the evaluation and treatment of CHF and pre-transplant evaluation. The cardiology resident is expected to acquire an understanding of the pathophysiology, clinical evaluation, and management of patients with heart failure that includes detailed assessment of hemodynamics and cardiac function. Training will include both inpatient and outpatient settings, under the direct supervision of the attending on the heart failure/transplant service.

- **Interventional Cardiology;** Echocardiography: Includes training in 2D, M-mode, color flow Doppler echo, TEE and stress echocardiography.

- **Cardiovascular Research:** Includes opportunities for basic cardiac research.

- **Preventative Cardiology:** Includes training in the management of lipid disorders, prescription for exercise and stress management strategies.

Technical and Other Skills

Cardiology residents are expected to acquire skill in the performance and interpretation of:

- **History and physical examination.** This is supervised by faculty members while on the clinical services. The residents should take every opportunity to correlate their physical findings with results of cardiac diagnostic procedures.

- **Cardiopulmonary resuscitation and advanced cardiac life support.** Residents are expected to be supervised for complex resuscitative procedures and treat complex acute life threatening arrhythmias during the CCU rotation.

- **Elective cardioversion.** Both inpatient and outpatient cardioversion of atrial fibrillation shall be performed by the residents and is supervised by the faculty members.

- **Bedside right heart catheterization.** In the CCU, the cardiology resident will perform bedside right heart catheterization under the supervision of faculty members for the first several months until competence is demonstrated.

- **Insertion and management of temporary pacemakers.** Performed routinely in the electrophysiology and catheterization laboratories as well as emergently in the CCU.

- **Right and left heart catheterization** including coronary arteriography.
- **Exercise stress testing.** Residents should perform a initially supervised interpretation and then independently.
- **Echocardiography.** Residents should perform and interpret the Echo studies.

Cardiology residents are expected to acquire experience with the performance and interpretation of:

- Pericardiocentesis
- Programming and follow-up surveillance of permanent pacemakers.
- Intracardiac electrophysiologic studies.
- Intra-aortic balloon counterpulsation.
- Percutaneous transluminal coronary angioplasty and other interventional procedures.
- Cardiovascular rehabilitation.

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

- Chest x-rays.
- Electrocardiograms
- Ambulatory ECG recording.
- Radionuclide studies of myocardial function and perfusion
- Intensive rotation with didactic and practical interpretation.
- Ongoing research projects
- Cardiovascular literature.

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.

REGULATIONS

1. Scheme of the Course

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

Course Structure	Components	Examination
Part I	• **Basic Medical Sciences** Anatomy, Physiology, Biochemistry, Pathology, Pharmacology, Behavioural Sciences and Biostatistics & Research Methodology.	Part-I examination at the end of 1st year of MD Cardiology programme. • **Written:** Paper I: MCQs Paper II: SEQs

Part-II	• **Fundamental Concepts in Internal Medicine** :
	
	Training in clinical techniques of Internal Medicine with compulsory rotations for two years starting from the first day of enrollment
		Part-II examination at the end of 2nd year of MD Cardiology programme.
		
		• **Written:**
		Papers 1 & 2: Problem-based questions in Internal Medicine
		
		• **Oral & Practical/ Clinical Examination**
		  • OSCE
		  • Clinical Examination (Long case, Short cases)
		• **Log Book**

Part-III	**<u>Clinical component of Part III</u>**
	
	• **Professional Education in Cardiology**
	Training in Cardiology during 3rd, 4th and 5th years of MD program
	
	Three years of training with compulsory/ optional rotations in related fields (up to 6 months)
	
	<u>Research component of Part III</u>
	
	• **Research and Thesis Writing:**
	Research work/Thesis writing project must be completed and thesis be submitted before the end of training.
		Part III examination in specialized components of Cardiology at the end of 5th year of MD programme.
		
		• **Written:**
		Papers 1 & 2: Problem-based questions in the subject
		
		• **Oral & Practical / Clinical Examination**
		  • OSCE
		  • Clinical Examination (Long case, Short cases)
		• **Log Book**
		
		Part III thesis examination with defence at the end of fifth (5th) year of MD Cardiology programme.

2. Examinations

Part-I Examination

1. All candidates admitted in MD Cardiology courses shall appear in Part-I examination at the end of 1st 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 Cardiology (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 MD Cardiology course shall appear in Part-II examination at the end of 2nd calendar year, and having passed the part I examination.
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 Internal Medicine
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 Internal Medicine.
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 MD Cardiology 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 / MRCP / Diplomate American Board/equivalent qualification in Internal Medicine 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:* Throughout 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 MD Cardiology 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 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.

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 cannot 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 MD 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 Internal Medicine and related fields 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 MD Cardiology Degree

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

CONTENT OUTLINE

Part I MD Cardiology

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.

3 Cusps

- Pulmonic
- Aortic
- Stenosis
- Insufficiency and regurgitation

Wall

- Epicardium
- Myocardium

Cardiac Muscle

- Purkinje fibers
- Endocardium
- Trabeculae carnae
- Pectinate muscles

Conducting System

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

Vessels Entering Heart

- R atrium
- Superior vena cava (SVC)
- Inferior vena cava (IVC)
- Coronary sinus
- L atrium
- 2 r and 2 L pulmonary veins
- Vessels leaving heart
- R ventricle
- Pulmonary trunk
- R and L pulmonary AA
- L 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

- **Flow of Blood through Pulmonary Circulation and to 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.
- C.V 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

Biotechnology and concepts of molecular biology with special emphasis on use of recombinant DNA techniques in medicine and the molecular biology of cancer

4. Pathology

Pathological alterations at cellular and structural level along with brief introduction of Basic Microbiology and Haematological pathology as related to cardiology:

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

Haematopathology

- 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

- Nosocomial infections
- Bacterial growth and death
- 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
- 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

1. Introduction to Bio-Statistics
2. Introduction to Bio- Medical Research
3. Why research is important?
4. 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
5. Ethics in Health Research
6. Writing a Scientific Paper
7. Making a Scientific Presentation
8. Searching the Literature

7. Behavioural Sciences

1. Bio-Psycho-Social (BPS) Model of Health Care
2. Use of Non-medicinal Interventions in Clinical Practice
    - Communication Skills
    - Counseling
    - Informational Skills
3. Crisis Intervention/Disaster Management
4. Conflict Resolution
5. Breaking Bad News
6. 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
7. Delivery of Culturally Relevant Care and Cultural Sensitivity
8. 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 MD Cardiology

Internal Medicine training for first two years starting from first day of enrollment. Resident should get exposure in the following organ and system competencies (listed below) while considering and practicing each system in terms of: -

- Medical ethics
- Professional values, student teachers relationship
- Orientation of in-patient, out-patients and cardiology labs
- Approach to the patient
- History taking
- General physical examination
- Systemic examination
- Routine investigations
- Special investigations
- Diagnostic and therapeutic procedures

Course Contents:

1. Cardiovascular Medicine

Common and / or important Cardiac Problems:

- Arrhythmias
- Ischaemic Heart Disease: acute coronary syndromes, stable angina, atherosclerosis
- Heart Failure
- Hypertension – including investigation and management of accelerated hypertension
- Valvular Heart Disease
- Endocarditis
- Aortic dissection
- Syncope
- Dyslipidaemia

Clinical Science:

- Physiological principles of cardiac cycle and cardiac conduction
- Pharmacology of major drug classes: beta blockers, alpha blockers, ACE inhibitors, Angiotensin receptor blockers (ARBs), anti-platelet agents, thrombolysis, inotropes, calcium channel antagonists, potassium channel activators, diuretics, anti-arrhythmics, anticoagulants, lipid modifying drugs, nitrates, centrally acting anti-hypertensives

2. Dermatology;

Common and / or Important Problems:

- Cellulitis
- Cutaneous drug reactions
- Psoriasis and eczema
- Skin failure: e.g. erthryoderma, toxic epidermal necrolysis
- Urticaria and angio-oedema

- Cutaneous vasculitis
- Herpes zoster and Herpes Simplex infections
- Skin tumours
- Skin infestations
- Dermatomyositis
- Scleroderma
- Lymphoedema

Clinical Science:

- Pharmacology of major drug classes: topical steroids, immunosuppressants

3. Diabetes & Endocrine Medicine

Common and / or Important Diabetes Problems:

- Diabetic ketoacidosis
- Non-acidotic hyperosmolar coma / severe hyperglycaemia
- Hypoglycaemia
- Care of the acutely ill diabetic
- Peri-operative diabetes care

Common or Important Endocrine Problems:

- Hyper/Hypocalcaemia
- Adrenocortical insufficiency
- Hyper/Hyponatraemia
- Thyroid dysfunction
- Dyslipidaemia
- Endocrine emergencies: myxoedemic coma, thyrotoxic crisis, Addisonian crisis, hypopituitary coma, phaeochromocytoma crisis

Clinical Science:

- Outline the function, receptors, action, secondary messengers and feedback of hormones
- Pharmacology of major drug classes: insulin, oral anti-diabetics, thyroxine, anti-thyroid drugs, corticosteroids, sex hormones, drugs affecting bone metabolism

4. Gastroenterology and Hepatology

Common or Important Problems:

- Peptic Ulceration and Gastritis
- Gastroenteritis
- GI malignancy (oesophagus, gastric, hepatic, pancreatic, colonic)
- Inflammatory bowel disease
- Iron Deficiency anaemia
- Acute GI bleeding
- Acute abdominal pathologies: pancreatitis, cholecystitis, appendicitis, leaking abdominal aortic aneurysm
- Functional disease: irritable bowel syndrome, non-ulcer dyspepsia
- Coeliac disease
- Alcoholic liver disease
- Alcohol withdrawal syndrome
- Acute liver dysfunction: jaundice, ascites, encephalopathy
- Liver cirrhosis
- Gastro-oesophageal reflux disease

- Nutrition: indications, contraindications and ethical dilemmas of nasogastric feeding and EG tubes, IV nutrition, re-feeding syndrome
- Gall stones
- Viral hepatitis
- Auto-immune liver disease
- Pancreatic cancer

Clinical Science:

- Laboratory markers of liver, pancreas and gut dysfunction
- Pharmacology of major drug classes: acid suppressants, anti-spasmodics, laxatives, anti-diarrhoea drugs, aminosalicylates, corticosteroids, immunosuppressants, infliximab, pancreatic enzyme supplements

5. Renal Medicine

Common and / or Important Problems:

- Acute renal failure
- Chronic renal failure
- Glomerulonephritis
- Nephrotic syndrome
- Urinary tract infections
- Urinary Calculus
- Renal replacement therapy
- Disturbances of potassium, acid/base, and fluid balance (and appropriate acute interventions)

Clinical Science:

- Measurement of renal function
- Metabolic perturbations of acute, chronic, and end-stage renal failure and associated treatments

6. Respiratory Medicine

Common and / or Important Respiratory Problems:

- COPD
- Asthma
- Pneumonia
- Pleural disease: Pneumothorax, pleural effusion, mesothelioma
- Lung Cancer
- Respiratory failure and methods of respiratory support
- Pulmonary embolism and DVT
- Tuberculosis
- Interstitial lung disease
- Bronchiectasis
- Respiratory failure and cor-pulmonale
- Pulmonary hypertension

Clinical Science:

- Principles of lung function measurement
- Pharmacology of major drug classes: bronchodilators, inhaled corticosteroids, leukotriene receptor antagonists, immunosuppressants

7. Allergy

Common or Important Allergy Problems

- Anaphylaxis
- Recognition of common allergies; introducing occupation associated allergies
- Food, drug, latex, insect venom allergies
- Urticaria and angioedema

Clinical Science

- Mechanisms of allergic sensitization: primary and secondary prophylaxis
- Natural history of allergic diseases
- Mechanisms of action of anti-allergic drugs and immunotherapy
- Principles and limitations of allergen avoidance

8. Haematology

Common and / or Important Problems:

- Bone marrow failure: causes and complications
- Bleeding disorders: DIC, haemophilia
- Thrombocytopaenia
- anticoagulation treatment: indications, monitoring, management of over-treatment
- Transfusion reactions
- Anaemia: iron deficient, megaloblastic, haemolysis, sickle cell,
- Thrombophilia: classification; indications and implications of screening
- Haemolytic disease
- Myelodysplastic syndromes
- Leukaemia
- Lymphoma
- Myeloma
- Myeloproliferative disease
- Inherited disorders of haemoglobin (sickle cell disease, thalassaemias)
- Amyloid

Clinical Science:

- Structure and function of blood, reticuloendothelial system, erythropoietic tissues

9. Immunology

Common or Important Problems:

- Anaphylaxis (see also 'Allergy')

Clinical Science:

- Innate and adaptive immune responses
- Principles of Hypersensitivity and transplantation

10. Infectious Diseases

Common and / or Important Problems:

- Fever of Unknown origin
- Complications of sepsis: shock, DIC, ARDS
- Common community acquired infection: LRTI, UTI, skin and soft tissue infections, viral exanthema, gastroenteritis
- CNS infection: meningitis, encephalitis, brain abscess
- HIV and AIDS including ethical considerations of testing
- Infections in immuno-compromised host

- Tuberculosis
- Anti-microbial drug monitoring
- Endocarditis
- Common genito-urinary conditions: non-gonococcal urethritis, gonorrhoea, syphilis

Clinical Science:

- Principles of vaccination
- Pharmacology of major drug classes: penicillins, cephalosporins, tetracyclines, aminoglycosides, macrolides, sulphonamides, quinolones, metronidazole, anti-tuberculous drugs, anti-fungals, anti-malarials, anti-helminthics, anti-virals

11. Medicine in the Elderly

Common or Important Problems:

- Deterioration in mobility
- Acute confusion
- Stroke and transient ischemic attack
- Falls
- Age related pharmacology
- Hypothermia
- Continence problems
- Dementia
- Movement disorders including Parkinson's disease
- Depression in the elderly
- Osteoporosis
- Malnutrition
- Osteoarthritis

Clinical Science:

- Effects of ageing on the major organ systems
- Normal laboratory values in older people

12. Musculoskeletal System

Common or Important Problems:

- Septic arthritis
- Rheumatoid arthritis
- Osteoarthritis
- Seronegative arthritides
- Crystal arthropathy
- Osteoporosis – risk factors, and primary and secondary prevention of complications of osteoporosis
- Polymyalgia and temporal arteritis
- Acute connective tissue disease: systemic lupus erythematosus, scleroderma, poly- and dermatomyositis, Sjogren's syndrome, vasculitides

Clinical Science:

- Pharmacology of major drug classes: NSAIDS, corticosteroids, immunosuppressants, colchicines, allopurinol, bisphosphonates

13. Neurology

Common or Important Problems:

- Acute new headache
- Stroke and transient ischaemic attack
- Subarachnoid haemorrhage
- Coma
- Central Nervous System infection: encephalitis, meningitis, brain abscess
- Raised intra-cranial pressure
- Sudden loss of consciousness including seizure disorders (see also above syncope etc.)
- Acute paralysis: Guillian-Barré, myasthenia gravis, spinal cord lesion
- Multiple sclerosis
- Motor neuron disease

Clinical Science:

- Pathophysiology of pain, speech and language
- Pharmacology of major drug classes: anxiolytics, hypnotics inc. benzodiazepines, antiepileptics, anti-Parkinson's drugs (anti-muscarinics, dopaminergics)

14. Psychiatry

Common and /or Important Problems:

- Suicide and parasuicide
- Acute psychosis
- Substance dependence
- Depression

Clinical Science:

- Principles of substance addiction, and tolerance
- Pharmacology of major drug classes: anti-psychotics, lithium, tricyclic antidepressants, mono-amine oxidase inhibitors, SSRIs, venlafaxine, donepezil, drugs used in treatment of addiction (bupropion, disulpharam, acamprosate, methadone)

15. Cancer and Palliative Care

Common or Important Oncology Problems:

- Hypercalcaemia
- SVC obstruction
- Spinal cord compression
- Neutropenic sepsis
- Common cancers (presentation, diagnosis, staging, treatment principles): lung, bowel, breast, prostate, stomach, oesophagus, bladder)

Common or Important Palliative Care Problems:

- Pain: appropriate use, analgesic ladder, side effects, role of radiotherapy
- Constipation
- Breathlessness
- Nausea and vomiting
- Anxiety and depressed mood

Clinical Science:

- Principles of oncogenesis and metastatic spread
- Apoptosis
- Principles of staging
- Principles of screening

- Pharmacology of major drug classes in palliative care: anti-emetics, opioids, NSAIDS, agents for neuropathic pain, bisphosphonates, laxatives, anxiolytics

16. Clinical Genetics

Common and / or Important problems:

- Down's syndrome
- Turner's syndrome
- Huntington's disease
- Haemochromatosis
- Marfan's syndrome
- Klinefelter's syndrome
- Familial cancer syndromes
- Familial cardiovascular disorders

Clinical Science:

- Structure and function of human cells, chromosomes, DNA, RNA and cellular proteins
- Principles of inheritance: Mendelian, sex-linked, mitochondrial
- Principles of pharmacogenetics
- Principles of mutation, polymorphism, trinucleotide repeat disorders
- Principles of genetic testing including metabolite assays, clinical examination and analysis of nucleic acid (e.g. PCR)

17. Clinical Pharmacology

Common and / or Important problems:

- Corticosteroid treatment: short and long-term complications, bone protection, safe withdrawal of corticosteroids, patient counselling regarding avoid adrenal crises
- Specific treatment of poisoning with:
    - Aspirin,
    - Paracetamol
    - Tricyclic anti-depressants
    - Beta-blockers
    - Carbon monoxide
    - Opiates
        - Digoxin
        - Benzodiazepines

Clinical Science:

- Drug actions at receptor and intracellular level
- Principles of absorption, distribution, metabolism and excretion of drugs
- Effects of genetics on drug metabolism
- Pharmacological principles of drug interaction
- Outline the effects on drug metabolism of: pregnancy, age, renal and liver impairment

Investigation Competencies

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Outline the Indications for, and Interpret the Following Investigations:

- Basic blood biochemistry: urea and electrolytes, liver function tests, bone biochemistry, glucose, magnesium

- Cardiac biomarkers and cardiac-specific troponin
- Creatine kinase
- Thyroid function tests
- Inflammatory markers: CRP / ESR
- Arterial Blood Gas analysis
- Cortisol and short Synacthen test
- HbA1C
- Lipid profile
- Amylase
- Drug levels: paracetamol, salicylate, digoxin, antibiotics, anti-convulsants
- Full blood count
- Coagulation screen
- Haemolysis screen
- D dimer
- Blood film report
- Haematinics
- Blood / Sputum / urine culture
- Fluid analysis: pleural, cerebro-spinal fluid, ascitic
- Urinalysis and urine microscopy
- Auto-antibodies
- H. Pylori testing
- Chest radiograph
- Abdominal radiograph
- Joint radiographs (knee, hip, hands, shoulder, elbow, dorsal spine, ankle)
- ECG
- Peak flow tests
- Full lung function tests

More Advanced Competencies;

- Urine catecholamines
- Sex hormones (FSH, LH, testosterone, oestrogen and progesterone) & Prolactin
- Specialist endocrine suppression or stimulation tests (dexamethasone suppression test; insulin tolerance test; water deprivation test, glucose tolerance test and growth hormone)
- Coeliac serology screening
- Viral hepatitis serology
- Myeloma screen
- Stool testing
- HIV testing
- Ultrasound
- Detailed imaging: Barium studies, CT, CT pulmonary angiography, high resolution CT, MRI
- Imaging in endocrinology (thyroid, pituitary, adrenal)
- Renal imaging: ultrasound, KUB, IVU, CT
- Echocardiogram
- 24 hour ECG monitoring
- Ambulatory blood pressure monitoring
- Exercise tolerance test
- Cardiac perfusion scintigraphy

- Tilt testing
- Neurophysiological studies: EMG, nerve conduction studies, visual and auditory evoked potentials
- Bone scan
- Bone densitometry
- Scintigraphy in endocrinology
- V/Q scanning

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 anaesthetics 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 cardiorespiratory 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
- Skin Biopsy (this is not mandated for all trainees but opportunities to become competent in this technique should be available especially for trainees who subsequently wish to undertake specialist dermatology training)

Part-III- Specialty Training in Cardiology

SPECIFIC PROGRAM CONTENT

1. Adult / Clinical Cardiology

- History taking and examination
- Cardiac failure
- Arrhythmias and conduction defects
- Rheumatic Heart disease
- Endocarditis
- Myocarditis and cardiomyopathies
- Pericardial diseases
- Hypertension
- Cardiac tumor
- Cardiac manifestation of systemic disease.
- Traumatic cardiac injuries
- Atherosclerosis & Arteriosclerosis
- Pulmonary hypertension and Cor-pulmonale

2. Paediatric Cardiology

- 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 Arteriosis (PDA), Atrioseptal Defects (ASD)}
- Coarctation of the aorta
- Transposition of great vessels
- Status post fontan patients
- Ebstein anomaly
- Pulmonary stenosis
- Eisenmmenger syndrome
- Rheumatic Fever
- Hypertension
- Viral Myocarditis
- Common Rhythm Disorders {Paroxysmal Atrial Tachycardia (PAT)}
- Presentation of neonatal patients with congenital heart disease.
- EKG findings for disease entities with congenital heart disease and their various arrhythmic presentations.
- Chest x-ray findings of congenital heart disease patients.
- Echocardiographic appearance of normal heart and be able to recognize abnormal appearances of most common congenital heart disease defects
- Principles of management in children
- Surgical procedures for correction or palliation of congenital heart disease
- Post-operative management of patients with congenital heart disease
- Congenital heart disease that presents in the adult patient population

- 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. Emergency Cardiology / Cardiac Intensive Care Unit

- Acute coronary syndromes
  - Recognition
  - Management
  - Complications
  - Post intervention follow-up
- Aortic dissection
- Congestive heart failure and pulmonary edema
- Acute valvular complications
- Acute pulmonary embolism
- Pericardial diseases
- Primary arrhythmia
- Bedside procedural complications
- Cardiac arrhythmias
- Hypotension
- Hypertensive crisis
- Shock
- Cardiac Tamponade
- Acute arterial occlusions

Recognize and evaluate all manifestations of arteriosclerotic heart disease including:

- Acute coronary syndromes
- Hypertensive heart disease
- Cardiac arrhythmias
- Valvular heart disease
- Cardiomyopathy
- Pulmonary heart disease
- Peripheral vascular disease
- 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
- Acute myocardial infarction and other acute ischemic syndromes
- Unstable angina
- CPR
- Implantation of temporary pacemaker
- Minor surgical procedures like CVP, Arterial line, swan genz monitoring.
- Complications of therapy

INVASIVE CARDIOLOGY

4. Clinical Electrophysiology Service

- Introduction to electrophysiology
- Principals 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 action of antiarrhythmic drugs.
- Implantation of cardiac arrhythmia control devices
- Surface EKG 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 EKG'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-purkinjie 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

5. Cardiac Catheterization

- 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 (in-line)

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 including aortic stenosis
- Aortic insufficiency
- Mitral stenosis and mitral insufficiency
- Mitral valve prolapse
- Ventricular septal defects
- Atrial defects
- Ischemic and dilated cardiomyopathy
- 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 aspirin and clopidrogel 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 that were left in after the procedure, often with continuation of IV GP II BIIIA inhibitor drips.
- Laboratory, nursing and technical staff may assist in sheath removal.
- Catheterization reports will be completed on the day of the procedure.

6. Non Invasive Cardiology

Echocardiography:

- Cognitive Skills
- Indications for echocardiography and it's component parts.
- 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.
- Cardiac abnormality due to acquired and congenital heart disease.
- Fluid dynamics of normal and abnormal blood flow patters due to acquired and congenital heart disease.

Ultrasound Procedures:

- Ultrasound transducer and the Doppler flow signals.
- Transesophageal echocardiography
- Intraoperative transesophageal echocardiography
- Stress echocardiography
- Dobutamine stress echocardiography
- Contrast echocardiography
- 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.

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

All cardiology residents must provide 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 various special ultrasound 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.

7. Nuclear 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
- PET and other applications of radionuclide imaging

8. Cardiovascular Imaging

Diagnostic techniques, including:

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

Pre-operative evaluation for non-cardiac surgery

- Coronary stenting
- Echo-valvular disease
- Echo-wall motion/stress echocardiography
- Aortic disease
- Cardiopulmonary stress testing
- Nuclear cardiology
- Regurgitant valvular lesions
- Stenotic valvular lesions
- Coronary artery bypass grafting vs. Percutaneous coronary intervention

9. Heart Failure and Transplantation

Inpatient Experience

- Differential diagnosis of dilated cardiomyopathy and the means by which a diagnosis is established; working knowledge of indications for endomyocardial biopsy
- Various therapeutics in the acute setting including the use of oral medications such as diuretics, ACE-inhibitors, digoxin, nitrates, and other vasodilators. In addition, residents should understand the use of, and indications for intravenous inotropic therapy including dobutamine dopamine and milrinone.
- Indications for mechanical support in heart failure patients such as intra-aortic balloon counterpulsation and ventricular assist device therapy.
- Appropriate work up and management of patients with heart failure and coronary artery disease who may benefit from surgical revascularization.
- Working knowledge of the inpatient care of patients before and after cardiac transplantation.
- Working knowledge of the risks and benefits of cardiac transplantation, including the appropriate pre-transplant evaluation.
- Absolute and relative contraindications to cardiac transplantation.

- Care of patients immediately post-transplant, including the use of complex hemodynamic monitoring, inotropic and mechanical device support when needed.
- Use and actions of immunosuppressive drugs in the cardiac transplant recipient including cyclosporin, FK506 (Tacrolimus), azothioprine, celcept, and prednisone.
- Working knowledge of the treatment of both acute and chronic allograft rejection.
- Diagnosis and management of other post-transplant complications including bacterial, viral, and fungal infections, malignancy, and late graft vasculopathy.

Outpatient Experience

- During this continuity experience, the resident should participate in the care of patients who are both established in the clinic as well as those newly referred. These clinics are aimed at caring for patients with chronic heart failure, those being considered for cardiac transplantation, and those following cardiac transplantation.

Objectives for the outpatient experience include:

- Outpatient evaluation of patients with heart failure including the physical exam, differential diagnosis of their particular condition (systolic vs. diastolic dysfunction), and appropriate pharmacologic therapy.
- Appropriate counseling and emotional support of these often chronically ill patients including maximizing the patient's own participation in their care (i.e. dietary and medical compliance, self monitoring etc.).
- Predictive variables which portend a bad prognosis for the purpose of timing of cardiac transplantation.
- Outpatient evaluation and counseling of those patients referred for cardiac transplantation. The resident should understand factors that make a patient
  suitable or unsuitable for cardiac transplantation. Residents will attend biweekly meetings of a multidisciplinary transplant team, during which new patients are presented and discussed. In addition, the status of all inpatients (either pre or post-transplantation) are discussed.
- Outpatient care of patients in the pre-transplant phase while on the cardiac transplant list
- Patient in the outpatient setting following cardiac transplantation. This includes managing and adjusting the immunosuppressive regimen depending on the results of periodic endomyocardial biopsies. The heart failure/transplant service holds weekly meetings to review hemodynamic, biopsy, and other clinical data pertaining to individual patients.
- Working knowledge of the outpatient care of transplant patients suffering from various complications of immunosuppressive therapy that include cyclosporine-induced hypertension and renal dysfunction, prednisone-induced diabetes, etc.

- Appropriate diagnosis and management of infectious complications in non-acutely ill patients in the outpatient setting.

10. Cardiology Therapeutics

- Pharmacokinetics and pharmacodynamics of common drugs related to cardiology
- 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

11. Vascular Medicine

- 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

Vascular studies including:

- Duplex ultrasonography of the veins and arteries of the upper and lower extremities
- Duplex ultrasonography of the aorta and it's branches
- Duplex ultrasonography of the carotid arteries
- Physiologic test of the peripheral arteries and veins
- Management and treatment options of various vascular diseases.
- Primary and secondary risks stratification
- Indications and limitations of percutaneous interventions in the treatment of peripheral vascular disease
- Surgical treatment of peripheral vascular disease

12. Preventive Cardiology

- 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:

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 first 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 first two 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 / 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.
10. Residents are required to assist in the advanced cardiological 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 programme. 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.

Proposed Format of Log Book is as follows:

Candidate's Name: ----------

Supervisor ----------

Roll No. ----------

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

Residents should become proficient in performing the related procedures (pg. 43). After observing the technique, they will be observed while performing the procedure and, when deemed competent by the supervising physician, will perform it independently. They will be responsible for obtaining informed consent, performing the procedure, reviewing the results with the pathologist and the attending physician and informing the patient and, where appropriate, the referring physician of the results.

Procedures Performed

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

Cardiac 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 resident.

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

EVALUATION & ASSESSMENT STRATEGIES

Assessment

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

Resident-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, resident-controlled, collaborative, dynamic, contextualized, informal, flexible and action-oriented.

In the proposed curriculum, it will be based on:

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

Self-Assessment by the Resident

Each resident 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 resident to correctly identify his/her areas of weakness and to take appropriate measures to address those weaknesses.

Peer Assessment

The residents 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 degrees for successful completion of courses.

MD CARDIOLOGY EXAMINATIONS

Part I MD Cardiology
Total Marks: 200

All candidates admitted in MD Cardiology 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 paper:	**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	(10 MCQs)	(1 SEQ)
6. Behavioural Sciences	(10 MCQs)	(1 SEQ)
7. Biostatistics & Research Methodology	(05 MCQs)	(1 SEQ)

Part II MD Cardiology
Total Marks: 430

All candidates admitted in MD Cardiology course shall appear in Part II examination at the end of 2nd 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 paper 1

Principles of internal medicine including;

1. Pulmonary Medicine	(10 MCQs)
2. Cardiovascular Illness	(10 MCQs)
3. Endocrinology and Metabolism	(10 MCQs)
4. Clinical Pharmacology	(10 MCQs)
5. Allergy and Immunology	(05 MCQs)
6. Infectious Disease	(05 MCQs)

Topics included in paper 2

Principles of internal medicine including;

1. Nephrology	(10 MCQs)
2. Neurology	(10 MCQs)

3. Gastroenterology & Hepatology (10 MCQs)
4. Hematology & Oncology (10 MCQs)
5. Dermatology (05 MCQs)
6. Rheumatology (05 MCQs)

Components of Part II Examination

Theory:

Paper 1:	**100 Marks**	**3 Hours**
10 SEQs (No Choice; 05 marks each)	50 Marks	
50 MCQs	50 Marks	

Paper 2:	**100 Marks**	**3 Hours**
10 SEQs (No Choice; 05 marks each)	50 Marks	
50 MCQs	50 Marks	

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 basic clinical techniques relevant to internal medicine.

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 (15 marks each)	60 Marks
One long case:	40 Marks

Log Book **80 Marks**

Part III MD Cardiology
Total Marks: 920

All candidates admitted in MD 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, Oral & Practical/ Clinical examination of 300 marks, log book assessment of 120 marks and thesis examination of 200 marks.

Topics included in paper 1

1. Adult/Clinical Cardiology	(20 MCQs)
2. Pediatric Cardiology	(20 MCQs)
3. Nuclear Cardiology / Cardiovascular Imaging	(15 MCQs)
4. Emergency Cardiology	(10 MCQs)
5. Heart Failure and Transplantation	(10 MCQs)

Topics included in paper 2

1. Invasive Cardiology	(20 MCQs)
2. Non Invasive Cardiology	(20 MCQs)
3. Cardiology Therapeutics	(15 MCQs)
4. Preventive Cardiology	(10 MCQs)
5. Vascular Medicine	(10 MCQs)

Components of Part III Examination

Theory

Paper I	**150 Marks**	**3 Hours**
15 SEQs (No Choice)	75 Marks	
75 MCQs	75 Marks	

Paper II	**150 Marks**	**3 Hours**
15 SEQs (No Choice)	75 Marks	
75 MCQs	75 Marks	

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

OSCE **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 (25 marks each) 100 Marks
One long case: 100 Marks

Log Book **120 Marks**

Thesis Examination **200 Marks**

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