

**Residency Program
Doctor of Medicine (MD)
Curriculum (Phase-B)**

Cardiology



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1. Introduction:

1.1. Overview of the Specialty:

The specialty of Cardiology developed as a sub-specialization of physicians who are predominantly concerned with the care of patients of cardiovascular disorders. It is a branch of internal medicine concerned with prevention, investigation and therapy of, and research into, diseases involving the cardiovascular system. Care of patients with cardiovascular disorders embraces a wide range of clinical activities and cardiologists need a broad view of the cardiovascular of individual patients and the communities in which they live including an understanding of any prevailing healthcare inequalities. This requires knowledge of not only the diagnostic and therapeutic modalities available, but also an appreciation of the importance of the epidemiology and potential for prevention of cardiovascular disease.

Although cardiology is generally stereotyped as a highly practical skill based medical specialty, with invasive and non-invasive interventional skills as high-profile components of the workload, competence in other areas of practice such as cardiovascular clinical pharmacology and Cardiovascular imaging are equally important. Indeed the expert clinical management of patients with heart failure or cardiomyopathy or atrial fibrillation is as rewarding as the quasi surgical skills demanded of the coronary or electrophysiological interventionist.

Cardiologists generally work as hospital based specialists and need to integrate their work with not only community based primary care colleagues but also other hospital based physicians, e.g. diabetologists or nephrologists, as well as working closely with cardiothoracic surgeons and anesthesiologists and the imaging specialties, e.g. radiology

and nuclear medicine. Sub-specialisation within Cardiology has become commonplace with individuals focusing the development of their expertise in areas such as cardio vascular imaging, coronary intervention, cardiac arrhythmia, adult congenital heart disease, heart failure and hypertension

1.2. Program Overview:

Residents will undertake a three year intensive Phase B training after completion of Phase A training in order to achieve the levels of knowledge, skills and expertise required for clinical practice in the field of cardiovascular medicine. It is a competency-based program emphasizing on meaningful integration and contextualization. The two years phase A training program is designed to introduce and develop the broad range of core knowledge, skills, attitudes and behaviours required to become a competent physician. The knowledge and skills acquired during Phase A training are further focused and refined during Phase B training, which is a 3 years specialty-specific training in Cardiology.

The teaching, learning and assessment of the curriculum is facilitated by the provision of comprehensive, educationally oriented supervision and support, which is provided to all trainees across both the phases of the program.

2. Goals and objectives:

2.1. Goals:

1. To prepare cardiologists who would be able to meet and respond to the changing healthcare needs and expectation of the society.
2. To develop cardiologists who possess knowledge, skills and attitudes that will ensure that they are competent to practice cardiovascular medicine, safely and effectively.

3. To ensure that they have appropriate foundation for lifelong learning and further training in their specialty.
4. To help them to be a critical thinkers and problem solvers when managing health problems in the community they serve.

2.2. Learning Objectives:

Residents of this training program will be equipped to function effectively within the current and emerging professional, medical and societal contexts. At the completion of the training program in cardiology, as defined by this curriculum, it is expected that a new Cardiologist will have developed the clinical skills and have acquired the theoretical knowledge for competent Cardiologist practice.

The educational and training process aims to produce cardiologists who; -

- Can address all aspects of the healthcare needs of patients and their families.
- Maintain the highest standards appropriate in their professional field.
- Are aware of current thinking about ethical and legal issues.
- Are able to act as safe independent practitioners whilst recognizing the limitation of their own expertise and are able to recognize their obligation to seek assistance of colleagues where appropriate.
- Are aware of the procedures, and able to take appropriate action, when things go wrong, both in their own practice and in that of others.
- Will be honest and objective when assessing the performance of those they have supervised and trained.
- Can take advantage of information technology to enhance all aspects of patient care.

- Can develop management plans for the "Whole patient" and maintain a knowledge in other areas of medicine which impinge on the specialty of Cardiology.
- Understand that more effective communication between them and their patients can lead to more effective treatment and care.
- Apply appropriate knowledge and skill in the diagnosis and management of patients.
- Establish a differential diagnosis for patients presenting with medical problems by the appropriate use of the clinical history, examination and investigations.
- Are competent to perform the core investigations and procedures required in their specialties.
- Develop clinical practice which is based on an analysis of relevant clinical trials and to have an understanding of their research methodologies.
- Are able to apply the knowledge of biological and behavioural sciences in clinical practice.
- Are able to identify and take responsibility for their own educational needs and the attainment of these needs.
- Have developed the skills of an effective teacher.

3. Admission Requirements for Phase B Training:

- A. Residents who have successfully passed Phase A Final Examination in Medicine and Allied are eligible for enrolment in the Phase B Program.
- B. Candidates with FCPS / MD in Internal Medicine can be enrolled directly into Phase- B program.

4. Content (Syllabus) Outline: Detail in section 11:

The training is designed to develop both the generic and speciality-specific attributes necessary to practice

independently as a consultant cardiologist. The aim is to train individuals to provide the highest standard of service to patients with cardiovascular disorders. This includes the development of positive attitudes towards lifelong learning and the ability to adopt to future technological advances and the changing expectations of society. In-depth specialty-specific educational and training program in this phase will make the resident competent and prepare them for the specialty qualification. It will provide educational program covering the specialty of Cardiology and its subspecialties, Biostatistics, Research Methodology and Medical Education along with rotation specific clinical training.

4.1. Educational Program: (May be organized into Academic Modules)

4.1.1. Applied Basic Medical Sciences

- Applied Medical Sciences related to Cardiology with meaningful integration.

4.1.2. Cardiology Syllabus

The syllabus include the cardinal manifestations, definition, epidemiology, etiopathogenesis, genetics, clinical presentation, complications, differential diagnosis, investigations, treatment and prevention and prognosis of all cardiovascular diseases. In addition the trainee should be well versed with all the common and important pediatric cardiological diseases, It will also cover the recent advances that have occurred in the field of Cardiology.

4.1.3. Basic Courses on: (to be satisfactory completed)

- Research Methodology
- Medical Education

4.2. Phase B Training Rotations: (Annexure I)

Cardiology specialty training comprises rotations in:

- Cardiology inpatients, outpatients and ED	- 12m
- CCU	- 6m
- Non-Invasive Cardiac Lab. (ECG, ETT, Echo, Nuclear Cardiology, Cardiac-CT and CMR)	- 6m
- Cardiac Cath Lab	- 2m
- Pediatric Cardiology and Cardiac Surgery	- 1m
- Eligibility Assessment and Phase B Final Exam	- 3m

5. Teaching and Learning Methods:

The bulk of learning occurs as a result of clinical experiences (experiential learning, on-the-job learning) and self-directed study. The degree of self-directed learning will increase as trainees become more experienced. Teaching and learning occurs using several methods that range from formal didactic lectures to planned clinical experiences. Aspects covered will include knowledge, skills and practices relevant to the discipline in order to achieve specific learning outcomes and competencies. The theoretical part of the curriculum presents the current body of knowledge necessary for practice. This can be imparted using lectures, grand teaching rounds, clinico-pathological meetings, morbidity/mortality review meetings, literature reviews and presentations, journal clubs, self-directed learning, conferences and seminars.

6. Record of Training:

The evidence required to confirm progress through training includes:

- Details of the training rotations, the training plan agreed with weekly timetables and duty rosters; and numbers of practical procedures and outcomes.

- Confirmations of attendance at events in the educational programme, at departmental and inter-departmental meetings and other educational events.
- Confirmation (certificates) of attendance at subject-based/skills-training/instructional courses.
- Recorded attendance at conference and meetings.
- A properly completed **logbook** with entries capable of testifying to the training objectives which have been attained and the standard of performance achieved.
- CME activity.
- Supervisor's reports on Observed performance (in the workplace): of duties, practical procedures, of presentations made and teaching activity; of advising and working with others, of standards of case notes, correspondence and communication with others.

6.1. Logbook:

Residents are required to maintain a logbook in which entries of academic/professional work done during the period of training should be made on a daily basis, and signed by the supervisor. Completed and duly certified logbook will form a part of the application for appearing in Phase Final Examinations.

7. Research:

Development of research competencies is an important component of the Residency Program curriculum as they are an essential set of skills for effective clinical practice. Undertaking research helps to develop critical thinking and the ability to review medical literature. Every Resident shall carry out work on an assigned research project under the guidance of a recognized supervisor, the project shall be written and submitted in the form of a Thesis.

8. Assessment:

The assessment for certification of the MD degree of the University is comprehensive, integrated and phase-centered attempting to identify attributes expected of specialists for independent practice and lifelong learning and covers cognitive, psychomotor and affective domains. It keeps strict reference to the components, the contents, the competencies and the criteria laid down in the curriculum. Assessment includes both **Formative Assessment and Summative (Phase final) Examinations.**

8.1. Formative Assessment:

Formative assessment will be conducted throughout the training phases. It will be carried out for tracking the progress of residents, providing feedback, and preparing them for final assessment (Phase completion exams).

There will be Continuous (day-to-day) and Periodic type of formative assessment.

- **Continuous (day-to-day) formative assessment** in classroom and workplace settings provides guide to a resident's learning and a faculty's teaching / learning strategies to ensure formative lesson / training outcomes.
- **Periodic formative assessment** is quasi-formal and is directed to assessing the outcome of a **block placement** or **academic module completion**. It is held at the end of Block Placement and Academic Module Completion. The contents of such examinations include **Block Units** of the Training Curriculum and **Academic Module Units** of the Academic Curriculum.

8.1.1. End of Block Assessment (EBA):

End of Block Assessment (EBA) is a periodic formative assessment and is undertaken after completion of each training block, assessing knowledge, skills and attitude of the residents. Components of EBA are written examination, structured clinical Assessment (SCA), medical record review, and logbook assessment. Unsatisfactory block training must be satisfactorily completed to be eligible for phase final examination

8.1.2. Formative assessment for Academic modules for Biostatistics and Research Methodology and Medical Education to be done in the first nine months of Phase B training. Residents getting unsatisfactory grade must achieve satisfactory grade by appearing the re-evaluation examination to be eligible for the Phase B Final Examination.

8.2. Summative Examination:

Assessment will be done in two broad compartments.

- a) **Compartment A:** Consist of 3 (three) components.
1. Written Examination (Consisting of 2 papers).
 2. Clinical Examination (One long and four short cases).
 3. SCA and Oral (10 stations SCA, Oral one board consisting of 2 examiners).

Every Resident must pass all the 3 components of compartment-A separately. Candidates will be declared failed if he/she fails in one or more component (s) of the examination. He/she then have to appear all the 3 components in the next Phase B Final Examination.

- b) **Compartment B:** Thesis and Thesis defense.

8.2.1. Written Examination:

Two Papers: Contents of written papers listed in Annexure II

Question type and marks:

- Two Papers (Paper I and Paper II); 100 marks each; Time 3 hrs for each paper. Pass marks-60% of total of 2 papers.
- **Each paper will consist of Two Groups:**
- **Group A:**
 - 10 short questions (5 marks each)
 - These will assess the knowledge of different level and its application
- **Group B:**
 - 5 scenario based problem solving questions (10 marks for each).
 - The questions should focus to assess the capability of handling clinical problem independently and comprehensively as a specialist.
 - Suggested format:-
 - A scenario followed by question(s).
 - Questions may include diagnosis, differential diagnosis, investigation plan, treatment, follow up and patient education.

8.2.2. Clinical Examination: Long case and Short case:

- There will be one long case and four short cases.

i) Long case: Marks-100

- Directly observed
- Two examiners for each examinee.
- History taking and examination by the examinee – 30min.
- Discussion on the case 20 min.(presentation 6min, crossing 6x2min and decision 2min).

- Examiners will not ask any question nor stop the examinee in any way during history taking and physical examinations.
- Discussion should be done preferably as per structured format and proper weightage on different segments of clinical skills.

ii) Short cases : Marks-100

- Four in number
- Time 20-30 min. (Time will be equally divided for each short case)
- Crossing should be done with proper weightage on different segment of clinical skills.

iii) Pass marks: 60% of total of Long and Short Cases**8.2.3. Structured Clinical Assessment (SCA): Marks-100**

- 10 stations : 5 min each

8.2.4. Oral Examination: Marks-100

- One board consisting of 2 examiners.
- 20 minutes (9+9+2).

8.2.5. Pass marks in SCA and Oral: 60% of total (SCA and Oral.)**8.3. Thesis Evaluation:**

- **Marks: Thesis writing-200; Defense-100: Marks for acceptane-60% of total.**
- To be evaluated by 3 (three) evaluators:- 2 subject specialists and one academician preferably involve in research and teaching research methodology.
- Among the subject specialists one should be external.
- Evaluators should be in the rank of Professor/Associate Professor.

- Supervisor will attend the defense as an observer and may interact only when requested by the evaluators.
- Thesis must be submitted to the controller of Exam not later than 27 months of enrolment in Phase-B.
- Thêsis must be sent to the evaluators 2 (Two) weeks prior to assessment date.
- Evaluation will cover Thesis writing and its defense.
- For thesis writing evaluator will mark on its structure, content, flow, scientific value, cohesion, etc.
- For defense – Candidate is expected to defend, justify and relate the work and its findings.
- Assessment must be completed in next 3 months.
- Outcome of the assessment shall be in 4 categories – “Accepted”, “Accepted with minor correction”, “Accepted with major correction” and “Not Accepted”.

8.3.1. Description of terms:

- **Accepted:** Assessors will sign the document and resident will bound it and submit to the Controller of Examinations by 10 days of the examination.
- **Accepted with minor correction:** Minor correction shall include small inclusion/exclusion of section; identified missing references, correction of references and typographical and language problem. This should be corrected and submitted within 2 weeks.
- **Accepted with major correction:** Task is completed as per protocol with acceptable method but some re-analysis of result and corresponding discussion are to be modified. To be corrected, confirmed by Supervisor and submit within 3 (Three) weeks.

- **Not Accepted:** When work is not done as per protocol or method was faulty or require further inclusion or confirmation of study.
- To complete the suggested deficiencies and reappear in defense examination during its next Phase Final Examination.
- Candidate has to submit his/her thesis and sit for examination and pay usual examination fess for the examination.

8.3.2. Residents must submit and appear Thesis defense at notified date and time. However non- acceptance of the Thesis does not bar the resident in appearing the written, clinical and oral exam.

8.4. Qualifying for MD/MS Degree:

On passing both the compartments, the candidate will be conferred the degree of MD/MS in the respective discipline. If any candidate fails in one compartment he/she will appear in that compartment only in the subsequent Phase-B exam.

9. Supervision and Training Monitoring:

Training should incorporate the principle of gradually increasing responsibility, and provide each trainee with a sufficient scope, volume and variety of experience in a range of settings that include inpatients, outpatients, emergency and intensive care. All elements of work in training rotation must be supervised with the level of supervision varying depending on the experience of the trainee and the clinical exposure. Outpatient and referral supervision must routinely include the opportunity to personally discuss ail cases. As training progresses the trainee should have the opportunity for

increasing autonomy, consistent with safe and effective care for the patient. Trainees will at all times have a named Supervisor, responsible for overseeing their education.

Supervisors are responsible for supervision of learning throughout the program to ensure patient and / or laboratory safety, service delivery as well as the progress of the resident with learning and performance. They set the lesson plans based on the curriculum, undertake appraisal, review progress against the curriculum, give feedback on both formative and summative assessments as well as sign the logbook and portfolio. The residents are made aware of their limitations and are encouraged to seek advice and receive help at all times.

The Course Coordinator of each department coordinates all training and academic activities of the program in collaboration with the **Course Manager**. The **Course Director** of each faculty directs, guides and manages curricular activities under his / her jurisdiction and is the person to be reported to for all events and performances of the residents and the supervisors.

10. Curriculum Implementation, Review and Updating:

Both Supervisors and Residents are expected to have a good knowledge of the curriculum and should use it as a guide for their training programme. Since Cardiology has historically been rapidly changing specialty the need for review and updating of curricula is evident. The Curriculum is specifically designed to guide an educational process and will continue to be the subject of active redrafting, to reflect changes in both Cardiology and educational theory and practice. Residents and Supervisors are encouraged to discuss the curriculum and to feedback on content and issue regarding implementation at Residency Course Director. Review will be time tabled to occur

annually for any minor changes to the curriculum. The Curriculum will be reviewed with input from the various subspecialties of Cardiology.

11. Detail Content of Learning (The Syllabus):

The educational process in Cardiovascular Medicine aims to provide basic knowledge, intellectual, clinical and transferable skills to produce competent specialists in Cardiology. These specialists will be capable of providing specialized care of the highest order to patients with cardiovascular disorders in the community as well as clinical tertiary centers. They shall recognize the health needs of the community and carry out professional obligations ethically and keeping their standards by engaging in continuing medical education. The program also aims to introduce the candidate to the basics of scientific medical research.

A. Applied Basic Medical Sciences: (Scientific Basis of Cardiology)

I. Basic Principles in Cardiology

1. Cardiac Anatomy and Physiology
2. Cardiovascular biochemistry.
3. Cardiovascular Pathophysiology
4. Genetic and Molecular Basis of Cardiovascular Diseases
5. Clinical skills to diagnose and manage Cardiovascular Diseases.

II. Basic and Advanced Life Support

1. Perform and supervise the resuscitation of patients.

B. Diseases and Presentations:**I. Presentations and Manifestations of Cardiovascular Disease**

1. Assess and treat patients presenting with acute breathlessness.
2. Assess and treat patients presenting with chronic breathlessness.
3. Assess and treat patients presenting with chest pain.
4. Assess and treat patients with acute heart failure.
5. Assess and treat patients with chronic heart failure.
6. Assess and treat patients with pre-syncope and syncope.
7. Assess patients presenting with cardiovascular manifestations of sleep disorders.

II. Heart Diseases and Disorders

1. Assess and treat patients with stable angina.
2. Assess and treat patients who are critically ill with haemodynamic disturbances.
3. Assess and treat patients with acute coronary syndromes.
4. Assess and treat patients with, or at risk from, endocarditis.
5. Assess and treat patients with cardiac murmurs and valvular heart disease.
6. Assess and treat patients with arrhythmias.
7. Assess and treat patients with cardiomyopathy.
8. Assess and treat patients with cardiac tumours.
9. Assess and treat patients with pericardial disease.
10. Assess patients with cardiovascular disease prior to non-cardiac surgery.

III. Congenital and Inherited Heart Disease

1. Diagnose and manage patients with inherited heart disease.
2. Diagnose and manage patients with common forms of congenital heart disease.

IV. Conditions Affecting the Circulation

1. Assess and treat patients with hypertension.
2. Assess and treat patients with pulmonary hypertension.
3. Assess and treat patients with acute and chronic thromboembolic disease.
4. Assess and treat patients with diseases of the aorta.
5. Assess and treat patients with systemic vascular disease.
6. Assess and treat patients with lipid abnormalities.

V. At Risk Individuals and Groups

1. Assess and treat heart disease in patients who are pregnant or planning pregnancy.
2. Assess and manage heart disease in elderly patients.
3. Assess and manage heart disease in patients with co-morbidity.
4. Assess and treat patients with risk factors for atherosclerotic vascular disease.
5. Explain the risk of driving following a cardiac illness and advise patients on fitness to drive.

C. Practical Performance, Procedures and Investigations:**I. Electrocardiography and Holter Monitoring**

1. Perform and interpret electrocardiography and Holter monitoring procedures.

II. Exercise Testing

1. Supervise and interpret exercise testing.

III. Electrophysiology (EP) and Pacing

1. Describe the indications for electrophysiology study and explain the possible therapeutic options, including use of implantable cardioverter-defibrillators and ablative procedures.
2. Explain the principles of cardiac pacing and application of pacing to patient management.
3. Describe diagnostic and therapeutic electrophysiology.

IV. Pericardiocentesis

1. Perform pericardiocentesis in the diagnosis and treatment of patients with pericardial disease.

V. Cardioversion

1. Perform chemical and direct current cardioversion.

VI. Cardiovascular Imaging:

1. Perform and interpret echocardiography.
2. Use radiation equipment in the diagnosis, assessment and treatment of patients with cardiac disease.
3. Define the indications for nuclear cardiology and interpret the results of common cardiac nuclear medicine investigations.
4. Explain the applications and limitations of cardiac computed tomography (CT) and Cardiac magnetic resonance (CMR) imaging.

VII. Cardiac Catheterization and Angiography

1. Perform and interpret cardiac catheterization and angiography.

VIII. Coronary Angioplasty

1. Select and manage patients for percutaneous coronary intervention and related techniques.

IX. Cardiac Surgery

1. Describe the indications for cardiac surgery and manage patients before and after surgery.

X. Ambulatory Care

1. Assess and manage patients in the ambulatory care (outpatient) setting.

Annexure 1: Clinical Training Rotations

Block 1						
Months	1st	2nd	3rd	4th	5th	6th
Educational Program	Global burden of CVD, Applied anatomy and Physiology, Principles of molecular Cardiology, Genetic basis of CVD: Basic Courses: Biostatistics, Research Methodology, Basics of Medical Education					
Clinical Training Rotations	Inpatient, outpatient, Emergency					
Thesis Work	Protocol development/Submission/IRB clearance					

Block 2						
Months	7th	8th	9th	10th	11th	12th
Educational Program						
Clinical Training Rotations	Coronary Care Unit					
Thesis Work	Patient enrolment, intervention and data collection					

Block 3						
Months	13th	14th	15th	16th	17th	18th
Educational Program						
Clinical Training Rotations	Non-Invasive Lab					
Thesis Work	Patient enrolment, intervention and data collection					

Block 4						
Months	19th	20th	21st	22nd	23rd	24th
Educational Program						
Clinical Training Rotations	Inpatient, outpatient, Emergency					
Thesis Work	Patient enrolment, intervention and data collection					

Block 5						
Months	25th	26th	27th	28th	29th	30th
Educational Program						
Clinical Training Rotations	Cardiac Cath Lab					
Thesis Work	Data processing and Analysis					

Block 6						
Months	31st	32nd	33rd	34th	35th	36th
Educational Program						
Clinical Training Rotations	Paediatric Cardiology, Cardiac Surgery			Eligibility Assessment and Phase B Final Examination		
Thesis Work	Report writing and Submission					

Annexure 2: Contents of Written Papers

Contents of Paper 1

Global burden of CVD
Applied Anatomy and Physiology
Principles of Molecular Cardiology
Genetic Basis of CVD
History and Physical examination
ECG, ETT, Echocardiography
Cardiac Catheterization and ACG
Nuclear Cardiology
Cardiovascular CT and MR
Heart Failure
Cardiomyopathy and Specific Heart Muscle Disease
Arrhythmia and conduction defects
Syncope and SCD

Contents of Paper 2

Coronary heart disease
Systemic Hypertension
Cardiopulmonary Diseases
Valvular Heart Diseases
Congenital Heart Diseases
Pericardial Diseases
Infective Endocarditis
Anesthesia, Surgery and the Heart
Diabetes and Heart Disease
Heart Disease and Pregnancy
Heart and Kidney Diseases
Aging and CVD in the Elderly
Heart Diseases in Women
Diseases of the Great Vessels and Peripheral Vessels