



# **CURRICULUM MD CARDIOLOGY**

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**LIAQUAT UNIVERSITY OF MEDICAL & HEALTH SCIENCES,  
JAMSHORO, SINDH, PAKISTAN**

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**DEPARTMENT OF CARDIOLOGY**

## **STATUTES**

### **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.

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***Course Title:*** MD Cardiology

### ***Training Centers***

Departments of Cardiology (accredited by LUMHS) in affiliated institutes Liaquat University of Medical & Health Sciences Jamshoro.

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## **ABOUT THE LUMHS**

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Liaquat university of medical health sciences is top ranked public sector medical university of Pakistan Located in the province of Sindh on the right bank of river Indus at Jamshoro.

### **MILE STONES**

1. Started as a Medical School in 1881
2. Raised to the status of a Medical College in 1942.
3. Named as Liaquat Medical College in 1951.
4. Foundation Stone of Jamshoro Campus laid down in 1954.
5. Shifting to Jamshoro Campus completed in 1963
6. Beginning of Postgraduate Courses in 1963.
7. Dental Section & BDS Course added in 1963. In January 2001, Liaquat Medical College was upgraded to a full-fledged University, named "**Liaquat University of Medical & Health Sciences**". The former Liaquat Medical College was affiliated with University of Sindh
8. College of Pharmacy established in June 2015
9. Bilawal Medical College for Boys, LUMHS, Jamshoro, established in 2018
10. The College of Technology, LUMHS, Jamshoro, established in 2018 providing various undergraduate degree and Diploma programs in Diagnostic Radiology, Medical Laboratory Technology, Forensic Science, Blood Banking, Dentistry, neuroscience and Ophthalmology

### **VISION STATEMENT**

Liaquat University of Medical & Health Sciences seeks to be a top-tier healthcare institution, producing ingenious academic leaders, medical researchers, and healthcare advocates to serve global community.

**MISSION STATEMENT**

Fostering ideal learning environment to ensure modern scientific evidence based practices by imparting critical knowledge, analytical and psychomotor skills, and professional dedication among healthcare students, under the umbrella of virtuous professional, moral and ethical standards.

## DURATION OF COURSE

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

After admission in MD Cardiology Programme of University resident will spend first 6 Months in the relevant Department of Cardiology as **Induction period** during which resident will get orientation about the chosen discipline and will also undertake the **mandatory workshops** (Appendix E). The research project will be designed and the **synopsis** be prepared during this period.

On completion of Induction period the resident will start formal training in the Basic Principles of Internal Medicine for 18 Months. During this period the resident must get the research synopsis approved by AS&RB. At the end of 2<sup>nd</sup> years, the candidate will take up Intermediate Examination.

During the 3<sup>rd</sup>, 4<sup>th</sup>, & 5<sup>th</sup> years, of the Program, there will be two components of the training

- 1) Clinical training in cardiology
- 2) Research and thesis writing

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

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

## ADMISSION CRITERIA

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Applications for admission to MD Training Programs of Cardiology will be invited through advertisement in print and electronic media mentioning closing date of applications and date of Entry Examination.

**Eligibility:** The applicant on the last date of submission of applications for admission must possess the:

i) Basic Medical Qualification of MBBS or equivalent medical qualification recognized by Pakistan Medical & Dental Council.

ii) Certificate of one year's House Job experience in institutions recognized by Pakistan Medical & Dental Council Is essential at the time of interview. The applicant is required to submit Hope Certificate from the concerned Medical Superintendent that the House Job shall be completed before the Interview.

iii) Valid certificate of permanent or provisional registration with Pakistan Medical & Dental Council. Registration and Enrollment

As per policy of Pakistan Medical & Dental Council the number of PG Trainees/ Students per supervisor shall be maximum 05 per annum for all PG program

Beds to trainee ratio at the approved teaching site shall be at least 5 beds per trainee.

The University will approve supervisors for MD course.

Candidates selected for the courses after their enrollment at the relevant institutions shall be registered with LUMHS as per prescribed Registration Regulations.

## **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.

## VISION

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Liaquat University of Medical & Health Sciences, Jamshoro seeks to be a top-tier healthcare institution, producing ingenious academic leaders, medical researchers, and healthcare advocates to serve global community.

## MISSION

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The mission of the **MD Cardiology Program** is to produce highly competent, compassionate, ethical, and research-oriented consultant cardiologists who provide comprehensive, evidence-based cardiovascular care across preventive, diagnostic, therapeutic, rehabilitative, and critical care settings. The program is committed to developing specialists with advanced clinical expertise, procedural proficiency, professionalism, leadership, and scholarly inquiry, capable of addressing the growing burden of cardiovascular diseases while meeting the healthcare needs of Pakistan and international standards.

## RATIONALE

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Cardiovascular disease remains a major cause of morbidity and mortality and encompasses a broad spectrum of acute and chronic conditions, including ischemic heart disease, heart failure, arrhythmias, valvular heart disease, cardiomyopathies, congenital heart disease, hypertension, vascular disease, and cardiovascular emergencies.

The practice of cardiology requires integration of sound scientific knowledge with advanced clinical reasoning, diagnostic interpretation, procedural skills, emergency care, communication, ethical practice, multidisciplinary teamwork, research, teaching, and leadership.

The **MD Cardiology curriculum** should therefore be competency-based and structured to progressively develop the trainee from a supervised learner into an independent specialist. The curriculum should ensure that graduates are able to:

- Diagnose and manage common and complex cardiovascular disorders.
- Recognize and appropriately manage cardiovascular emergencies.
- Interpret ECGs, echocardiography, cardiac imaging, exercise testing, and haemodynamic data.
- Safely perform relevant cardiology procedures appropriate to their level of training.
- Manage patients in coronary care and other high-dependency settings.
- Provide evidence-based preventive and rehabilitative cardiovascular care.
- Communicate effectively with patients, relatives, and multidisciplinary teams.
- Demonstrate professionalism, ethical conduct, patient safety, and clinical accountability.
- Teach undergraduate and postgraduate learners.
- Undertake and critically appraise cardiovascular research.
- Demonstrate leadership, quality improvement, and lifelong learning.

## **SPECIFIC LEARNING OUTCOMES**

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### **I. Cognitive Domain**

- Recall cardiovascular anatomy, physiology, embryology, pathology, and pharmacology.
- List the causes of cardiovascular diseases.
- Recall international and national cardiology guidelines.
- Describe cardiovascular investigations and their indications.
- Explain the pathophysiology of ischemic heart disease, heart failure, arrhythmias, hypertension, valvular heart disease, cardiomyopathies, and congenital heart diseases.
- Explain the mechanisms of cardiovascular drugs.
- Explain principles of preventive cardiology and cardiac rehabilitation.
- Discuss evidence-based management strategies.
- Diagnose common and complex cardiovascular diseases.
- Apply evidence-based guidelines in patient management.
- Select appropriate diagnostic investigations.
- Prescribe appropriate pharmacological and non-pharmacological treatment.
- Manage cardiovascular emergencies.
- Interpret ECGs, echocardiography, stress tests, coronary angiography, cardiac CT, cardiac MRI, and hemodynamic studies.
- Formulate differential diagnoses based on clinical findings.
- Analyze clinical data to identify disease severity and prognosis.
- Integrate laboratory and imaging findings into clinical decision-making.
- Critically appraise current literature and clinical guidelines.
- Evaluate treatment options based on patient-specific factors.
- Assess procedural indications, risks, and outcomes.
- Evaluate quality indicators and patient safety outcomes. :
- Develop individualized evidence-based management plans.
- Design preventive cardiology and rehabilitation programs.

- Develop institutional clinical pathways.
- Design and conduct clinical research and quality improvement projects.

## **II. Psychomotor**

- Obtain comprehensive cardiovascular history.
- Perform complete cardiovascular examination.
- Perform bedside risk assessment.
- Interpret clinical signs accurately.

### **Perform and interpret 12-lead ECG.**

- Perform transthoracic echocardiography.
- Perform exercise stress testing.
- Interpret ambulatory ECG monitoring.
- Interpret cardiac imaging.
- Perform Advanced Cardiac Life Support (ACLS).
- Perform defibrillation and synchronized cardioversion.
- Manage cardiac arrest.
- Manage cardiogenic shock.
- Manage acute pulmonary edema.
- Temporary transvenous pacemaker insertion.
- Pericardiocentesis.
- Central venous catheter insertion.
- Arterial line placement.
- Right heart catheterization (under supervision progressing to independence).
- Coronary angiography (according to competency level).
- Hemodynamic monitoring.
- Intra-aortic balloon pump management.
- Perform bedside echocardiography in critically ill patients.
- Assist and progressively perform complex catheter-based procedures.

- Perform ultrasound-guided vascular access.
- Manage patients in the cardiac intensive care unit independently.

### **III. Affective Domain**

Demonstrate respect for patients, families, colleagues, and healthcare staff.

Recognize ethical principles in cardiovascular practice.

Appreciate cultural diversity and patient values.

Communicate effectively with patients and multidisciplinary teams.

Obtain informed consent appropriately.

Respond empathetically to patient concerns.

Participate actively in multidisciplinary discussions.

Advocate for patient-centered care.

Promote preventive cardiology and healthy lifestyles.

Demonstrate accountability and integrity.

Maintain confidentiality and professionalism.

Prioritize patient safety.

Integrate ethical principles into clinical decision-making.

Participate in clinical governance and quality improvement.

Lead multidisciplinary healthcare teams effectively.

Demonstrate lifelong learning and reflective practice.

Mentor junior trainees and medical students.

Lead cardiovascular services ethically and professionally.

Promote research, innovation, and continuous quality improvement.

Serve as a role model in clinical excellence and professionalism.

## **ANNUAL ACADEMIC & TRAINING SCHEDULE FOR MD RESIDENT (5-YEAR)**

The MD program follows an annual examination system. Credit hours are calculated using HEC-defined weekly contact-hour equivalence, mapped onto two 16-week teaching blocks per academic year.

- Annual examination system
- **32 teaching weeks per year** (excluding exams)
- Credit hours calculated using **HEC weekly contact-hour equivalence**
- Clinical service (night calls) reported **separately** from credit hours

| <b>Activity</b>                                                         | <b>Frequency</b> | <b>Duration<br/>per session</b> | <b>Weekly<br/>equivalent<br/>(hrs)</b> | <b>Annual<br/>teaching<br/>weeks</b> | <b>Annual<br/>contact<br/>hours</b> |
|-------------------------------------------------------------------------|------------------|---------------------------------|----------------------------------------|--------------------------------------|-------------------------------------|
| General ward round                                                      | 1 / week         | 2 hrs                           | 2.0                                    | 32                                   | 64                                  |
| Consultant round                                                        | 1 / week         | 2 hrs                           | 2.0                                    | 32                                   | 64                                  |
| Departmental CME                                                        | 1 / week         | 2 hrs                           | 2.0                                    | 32                                   | 64                                  |
| Journal club                                                            | 1 / fortnight    | 2 hrs                           | 1.0                                    | 32                                   | 32                                  |
| Case presentation                                                       | 1 / fortnight    | 2 hrs                           | 1.0                                    | 32                                   | 32                                  |
| Morbidity meeting                                                       | 1 / month        | 2 hrs                           | 0.5                                    | 32                                   | 16                                  |
| Mortality meeting                                                       | 1 / month        | 2 hrs                           | 0.5                                    | 32                                   | 16                                  |
| OPD (structured supervised learning)                                    | 1 / week         | 4 hrs                           | 4.0                                    | 32                                   | 128                                 |
| Indoor (structured supervised learning) Bedside Examination/ Procedures | 2/week           | 2 hrs                           | 4.0                                    | 32                                   | 128                                 |
| Clinical seminar                                                        | 1 / month        | 1 hr                            | 0.25                                   | 32                                   | 8                                   |
| Clinical Teaching to Juniors                                            | 1 / week         | 2 hrs                           | 2.0                                    | 32                                   | 64                                  |

|                                |        |              |            |    |            |
|--------------------------------|--------|--------------|------------|----|------------|
| <b>Protected research time</b> | Weekly | <b>6 hrs</b> | <b>6.0</b> | 32 | <b>192</b> |
|--------------------------------|--------|--------------|------------|----|------------|

**Total structured teaching contact hours per year = 616 hours**

**Activities NOT counted as credit hours (mandatory service training)**

| <b>Activity</b>      | <b>Frequency</b>      | <b>Duration</b> | <b>Reporting method</b>       |
|----------------------|-----------------------|-----------------|-------------------------------|
| Night duties/on-call | 2 per month (approx.) | 36 hrs each     | Logbook + supervisor sign-off |
| Emergency cover      | As roster             | Variable        | Competency-based assessment   |

**Note:** These hours are essential for clinical training but are **not credit-bearing under HEC rules** and therefore excluded from credit-hour computation.

**Credit-hour conversion used:**

- **Theory / academic activity:** 1 credit hour = **1 hour/week**
- **Practical / clinical / research:** 1 credit hour = **3 hours/week**
- Annual system expressed as **two 16-week teaching blocks per academic year** (32 teaching weeks/year)

**A. Credits per 16-week teaching block (½-year equivalent)**

| <b>Component</b>                                              | <b>Weekly hrs</b> | <b>Category</b>    | <b>Formula</b> | <b>Credits/block</b> |
|---------------------------------------------------------------|-------------------|--------------------|----------------|----------------------|
| Academic teaching (rounds, CME, JC, case conf, M&M, seminars) | 9.25              | Theory             | $9.25 \div 1$  | <b>9.25</b>          |
| OPD / supervised clinical learning                            | 4.0               | Practical          | $4.0 \div 3$   | <b>1.33</b>          |
| Indoor supervised clinical learning                           | 4.0               | Practical          | $4.0 \div 3$   | <b>1.33</b>          |
| Clinical Teaching to Juniors                                  | 2.0               | Practical          | $2.0 \div 3$   | <b>0.67</b>          |
| <b>Protected research</b>                                     | <b>6.0</b>        | Practical/Research | $6.0 \div 3$   | <b>2.00</b>          |

**Total per block =  $9.25 + 1.33 + 1.33 + 0.67 + 2.00 = 14.58$  credit hours**

*(Rounded to 2 decimal places)*

**B. Credits per academic year**

| Item                      | Credits         |
|---------------------------|-----------------|
| Credits per 16-week block | 14.58           |
| Blocks per year           | × 2             |
| <b>Credits per year</b>   | <b>29.16 CH</b> |

**C. Total Program Credit Hours (5 Years)**

| Item                                 | Credits         |
|--------------------------------------|-----------------|
| Credits per year                     | 29.16           |
| Years                                | × 5             |
| <b>TOTAL MD PROGRAM CREDIT HOURS</b> | <b>145.8 CH</b> |

**Program learning Outcomes (PLOs)**

| <b>PO No.</b> | <b>Program Outcome</b> | <b>Expected Graduate Competency</b>                                                                                                                     |
|---------------|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| PO-1          | Clinical Expertise     | Diagnose and manage the full spectrum of cardiovascular diseases using evidence-based medicine.                                                         |
| PO-2          | Patient Care           | Deliver safe, ethical, compassionate, patient-centered cardiovascular care across outpatient, inpatient, emergency, and intensive care settings.        |
| PO-3          | Diagnostic Competence  | Interpret ECG, echocardiography, stress testing, cardiac imaging, ambulatory monitoring, and hemodynamic investigations accurately.                     |
| PO-4          | Procedural Skills      | Perform essential diagnostic and therapeutic cardiovascular procedures independently with competence.                                                   |
| PO-5          | Emergency Cardiology   | Manage acute coronary syndromes, arrhythmias, cardiogenic shock, cardiac arrest, hypertensive emergencies, pulmonary embolism, and acute heart failure. |
| PO-6          | Preventive Cardiology  | Implement cardiovascular risk assessment, prevention strategies, rehabilitation, and lifestyle modification programs.                                   |
| PO-7          | Professionalism        | Demonstrate professionalism, ethics, confidentiality, accountability, empathy, and respect for diversity.                                               |
| PO-8          | Communication Skills   | Communicate effectively with patients, families, multidisciplinary teams, and healthcare organizations.                                                 |
| PO-9          | Research & Scholarship | Design, conduct, analyze, publish, and present cardiovascular research using scientific methodology.                                                    |
| PO-10         | Medical Education      | Teach undergraduate students, residents, nurses, and allied                                                                                             |

|       |                                     |                                                                                                                                          |
|-------|-------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
|       |                                     | health professionals using modern educational methods.                                                                                   |
| PO-11 | Leadership &<br>Quality Improvement | Lead multidisciplinary cardiovascular teams and participate in clinical governance, patient safety, and quality improvement initiatives. |
| PO-12 | Lifelong Learning                   | Critically appraise literature, practice evidence-based medicine, and engage in continuous professional development.                     |

## **COMPONENTS OF TRAINING:**

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### **Mandatory Workshops:**

1. Basic Life Support (BLS) Course
2. Research Methodology and Dissertation Writing
3. Communication Skills
4. Introduction to Computer and Internet

Any other workshop/s as may be introduced by the LUMHS, Jamshoro

No candidate will be allowed to appear in MTE examination without attending the above mentioned workshops

Logbook

The trainee is required to enter all work performed and the academic activities undertaken in the logbook on daily basis. The concerned supervisor is required to verify the entries made by the trainee. This system ensures timely entries by the trainee and prompt verification by the supervisor. It also helps in monitoring the progress of trainees and vigilance of supervisors. At least 200 entries should be entered by trainee to appear in Midterm (MTE) Examination

Research (Synopsis/Dissertation/Thesis) or a paper

One of the training requirements for trainee is a dissertation on a topic related to the field of specialization. For trainees of program in program the synopsis of dissertation must be submitted within six months of training.

Following documents are necessary for Midterm (MTE) Examination

- 1) Two year training certificate
- 2) All 04 workshops certificates
- 3) Evidence of submission of synopsis

- 4) At least 200 log book entries (150 in medicine and 50 in rotation)

**Components of Midterm (MTE) Examination:**

- 1) Written Examination = 100 Marks (100 single Best Questions)
- 2) Clinical including 4 short cases, TOACS/OSCE = 100 Marks ( 10 OSCE stations)

To be declared successful in MTE Examination the candidate must secure at least 60% marks

## FINAL EXAMINATION

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At the end of 5<sup>th</sup> year of M.D. Cardiology Program

### **Eligibility Criteria:**

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

- i) the result of passing Intermediate Examination.
- ii) the certificate of completion of training, issued by the Supervisor will be mandatory.
- iii) a cumulative score of 75% in Continuous Internal assessments of all training years.
- iv) To have got the thesis acceptance letter or paper will be published in X category Examination.
- v) To have submitted no dues certificate from all relevant departments including library, hostel, cashier etc.
- vi) To have submitted evidence of submission of examination fee.

### **Final Examination Schedule and Fee**

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

### **Components of Final Examination**

|                             |                 |
|-----------------------------|-----------------|
| Final Examination           | Total marks 400 |
| Clinical, TOACS/OSCE & ORAL | Total marks 200 |
|                             | Total marks 200 |
|                             | Total marks 400 |

### **Part of Final Examination**

There will be two SBQs papers which will cover the whole syllabus of the specialty of training with total marks of 200.

The candidates scoring a score of 50% marks in multiple choice questions will be eligible to appear in the clinical and TOACS & CLINICAL consist of 200. 50 marks for long case ,50 marks short cases and 100 for TOCAS.

The pass THEORY result will be valid for three consecutive attempts for appearing in the Clinical of the Final Examination. After three attempts, the candidate will appear in theory again.

## CLINICAL, TOACS/OSCE & ORAL:

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- a) The Clinical and Oral Examination will consist of 04 short cases, 01 long case and Toacs/OSCE & Oral with 01 station for a pair of Internal and External Examiner Each short case will be of 07 minutes duration, 05 minutes will be for examining the patient and 02 minutes for discussion. The Oral Examination will consist of laboratory data assessment, interpretation of Radiology images, ECG and others.
- b) The Total Marks of Clinical, TOACS/OSCE & ORAL will be 500 and to be divided as follows:

Short Cases                      Total Marks = 50

Long Case                      Total Marks = 50

TOACS/OSCE      &      ORAL                      Total      Marks      =      100

- c) A panel of four examiners will be appointed by the Vice Chancellor , all these will be the external examiners. The chairman of cardiology will act as a coordinator.
- d) The internal examiners will not examine the candidates for whom they have acted as Supervisor and will be substituted by other internal examiner.
- e) The candidates scoring 60% marks in each component of the Clinical & Oral Examination will pass this part of the Final Examination.

## **DECLARATION OF RESULT**

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### **For the declaration of result:**

The candidate must get his/her Thesis accepted.

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

### **Submission / Evaluation of Synopsis**

1. The candidates shall prepare their synopsis as per guidelines provided by the Advanced Studies & Research Board, available on university website.
2. Synopsis of research project shall be submitted by the end of the 2<sup>nd</sup> year

of MD program. The synopsis after review by an Institutional Review Committee shall be submitted to the University for Consideration by the Advanced Studies & Research Board, through the Principal / Dean /Head of the institution.

### **Submission of Thesis/Paper**

Thesis shall be submitted by the candidate duly recommended by the Supervisor.

The minimum duration between approval of synopsis and submission of thesis shall be one year, but the thesis cannot be submitted later than 7 years of enrolment.

- i. The research thesis must be compiled and bound in accordance with the Thesis Format Guidelines approved by the University and available on website.
- iv. The research thesis will be submitted along with the fee prescribed by the University

### **Thesis Examination**

The candidate will submit his/her thesis at least 06 months prior to completion of training.

The Thesis along with a certificate of approval from the supervisory will be submitted to the Registrar's office, who would record the date / time etc. and get received from the Controller of Examinations within 05 working days of receiving.

The Controller of Examinations will submit a panel of eight examiners within 07 days for selection of four examiners by the Vice Chancellor. The Vice Chancellor shall return the final panel within 05 working days to the Controller of Examinations for processing and assessment. In case of any delay the Controller of Examinations would bring the case personally to the Vice Chancellor. The Supervisor shall not act as an examiner of the candidate and will not take part in evaluation of thesis.

The Controller of Examinations will make sure that the Thesis is submitted to examiners in appropriate fashion and a reminder is sent after every ten days.

The thesis will be evaluated by the examiners within a period of 06 weeks.

In case the examiners fail to complete the task within 06 weeks with 02 fortnightly reminders by the Controller of Examinations, the Controller of Examinations will bring it to the notice of Vice Chancellor in person.

In case of difficulty in find an internal examiner for thesis evaluation, the Vice Chancellor would, in consultation with the concerned Deans, appoint any relevant person as examiner in supersession of the relevant Clause of the University Regulations.

There will be three external examiners

The thesis will be considered accepted, if the cumulative score of all the examiners is 60%.

## **DEGREE AWARD OF MD CARDIOLOGY**

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

# CONTENT OUTLINE

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## MD Cardiology

### **1. 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 in 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.

Flow, pressure and resistance in blood vessels

Vasomotor system and control of blood vessels

Characters of arterial pulse and venous pulse

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

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

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

## **2.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

Haematologic disorder

### **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

### **3. 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

## **MD CARDIOLOGY**

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### **Basic Principles of Internal Medicine**

After the induction period of 6 months, the resident will undertake Internal Medicine training for next 18 months. 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:**

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- **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
- **Dermatology;**
- *Common and / or Important Problems:*
- Cellulitis
- Cutaneous drug reactions
- Psoriasis and eczema
- Skin failure: e.g. erythroderma, 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
- **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
- **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

- **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
- **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
- **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

- **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

- **Immunology**
- *Common or Important Problems:*
- Anaphylaxis (see also ‘Allergy’)
- *Clinical Science:*
- Innate and adaptive immune responses

- Principles of Hypersensitivity and transplantation
- **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

- **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
- **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
- **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)
- **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)
- **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

- **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)

- **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**

- .
- *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)
- **Specialty Training in Cardiology**

## **SPECIFIC PROGRAM CONTENT**

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### **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 Arteriosus (PDA), Atrioseptal Defects (ASD)}

- Coarctation of the aorta
- Transposition of great vessels
- Status post fontan patients
- Ebstein anomaly
- Pulmonary stenosis
- Eisenmenger 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
- Principles of basic electrophysiology including determinants of the normal action potential and normal cardiac rhythm and conduction.
- Genesis of cardiac arrhythmias, including congenital and acquired arrhythmias syndromes and 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-purkinje system, ventricular arrhythmias, as well as ablation therapy for tachyarrhythmias.
- Basic pharmacokinetics and pharmacodynamics of drugs used in electrophysiology.
- Technique of electrical cardioversion and the sedation procedures that accompany this technique
- Indications and basic methods of placing pacemakers and automatic defibrillators.
- Evaluation of patients for syncope and assessment of risks for sudden cardiac death in certain high risk populations
- **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 B/IIIa 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 patterns 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 3<sup>rd</sup> 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 3<sup>rd</sup> & 4<sup>th</sup> 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**

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### **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 LUMHS, Jamshoro.

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

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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**

| S No. | Name of patient, Sex & Admissions | Age | Diagnosis | Procedure performed | Supervisor's Signature |
|-------|-----------------------------------|-----|-----------|---------------------|------------------------|
| 1     |                                   |     |           |                     |                        |
| 2     |                                   |     |           |                     |                        |
| 3     |                                   |     |           |                     |                        |
| 4     |                                   |     |           |                     |                        |

**Cardiac Emergencies Handled**

| S No. | Name of patient, Sex & Admissions | Age | Diagnosis | Procedure performed | Supervisor's Signature |
|-------|-----------------------------------|-----|-----------|---------------------|------------------------|
| 1     |                                   |     |           |                     |                        |
| 2     |                                   |     |           |                     |                        |
| 3     |                                   |     |           |                     |                        |
| 4     |                                   |     |           |                     |                        |

**Case Presented**

| S No. | Name of patient, Sex & Admissions | Age | Case Presented | Case presented | Supervisor's Signature |
|-------|-----------------------------------|-----|----------------|----------------|------------------------|
| 1     |                                   |     |                |                |                        |
| 2     |                                   |     |                |                |                        |
| 3     |                                   |     |                |                |                        |
| 4     |                                   |     |                |                |                        |

**Seminars / Journal Club Presentation**

| <b>S No.</b> | <b>Topic</b> | <b>Case Presented</b> | <b>Supervisor's Signature</b> |
|--------------|--------------|-----------------------|-------------------------------|
| 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.

| <b>S No.</b> | <b>Method of Evaluation<br/>(Oral, Practical, Theory)</b> | <b>Rating</b> | <b>Supervisor's Signature</b> |
|--------------|-----------------------------------------------------------|---------------|-------------------------------|
| 1            |                                                           |               |                               |
| 2            |                                                           |               |                               |
| 3            |                                                           |               |                               |
| 4            |                                                           |               |                               |

## **COURSE AND TRAINING**

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### **CLINICAL TRAINING**

1. The period of training shall be for five years.
2. Candidates shall attend 75% of all clinical and or class room activity prescribed for him, else she will not be eligible for final examination.
3. Enrollment with university after submission within 3 months.
4. Registration as a research scholar. The postgraduate students required as research and write a synopsis on the topic within 06 months of admission.

### **ROTATIONS:**

|                                |                  |
|--------------------------------|------------------|
| <b>Cardiac Ward</b>            | <b>14 Months</b> |
| <b>CCU</b>                     | 6 Months         |
| <b>ER (Cardiac Emergency)</b>  | 8 Months         |
| <b>OPD</b>                     | 6 months         |
| <b>Echocardiography</b>        | 4 Months         |
| <b>ETT / Thallium Scanning</b> | 2 Months         |
| <b>Cardiac Cath Lab</b>        | 6 Months         |
| <b>Pediatrics Cardiology</b>   | 4 Months         |
| <b>Cardiac Surgery</b>         | 3 Monhs          |
| <b>Electrophysiology (EP)</b>  | 1 Month          |
| <b>General Medicine</b>        | 3 Months         |
| <b>Pulmonology</b>             | 1 Month          |
| <b>Nephrology</b>              | 1 Month          |
| <b>Psychiatry</b>              | 1 Month          |

**TABLE OF SPECIFICATION OF MTE- MD CARDIOLOGY**

| Area                       | Topic                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Sub- Theme (Objective) |          |                  |            |           |            |                               |           |                |                | Weight<br>Age<br>% |
|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|----------|------------------|------------|-----------|------------|-------------------------------|-----------|----------------|----------------|--------------------|
|                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Epidemiology           | Etiology | Clinical Feature | Assessment | Diagnosis | Management | Complications with management | Prognosis | Rehabilitation | Recent Advance |                    |
| 1. Coronary Artery Disease | <b>Angina Pectoris:</b><br>Unstable angina<br>Vasospastic angina<br>Angina equivalent<br>Exerional Angina<br>Angina with microvascular disease                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 01                     | 02       | 01               | 02         | 02        | 05         | 04                            | 01        | 01             | 01             | 20                 |
|                            | <b>Chronic Ischemic Heart Disease:</b><br>Coronary atherosclerosis<br>Remote myocardial infarction<br>Aneurysm of the heart<br>Coronary Artery aneurysm<br>Silent myocardial Ischemia<br><b>Acute Myocardial Infarction:</b> STEMI of the anterior wall STEMI of the inferior wall / right ventricular Involvement<br>STEMI of the lateral wall<br>STEMI of the posterior wall (including inferoposterior wall)<br>Type I Non-STEMI<br>Type II myocardial infarction<br>Spontaneous coronary artery dissection<br>STEMI, other<br><b>Early complications following acute myocardial infarction</b><br>Ventricular septal rupture<br>Rupture of the cardiac wall<br>Rupture of papillary muscle<br>Postinfarction angina<br>Postinfarction arrhythmias<br>Left ventricular pseudoaneurysm<br>Dynamic left ventricular outflow tract obstruction<br>Postinfarction systolic heart failure<br><b>Atypical angina or non cardiac chest pain</b> |                        |          |                  |            |           |            |                               |           |                |                |                    |

| Area                                                     | Topic                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Sub- Theme (Objective) |          |                         |                |           |                |                                     |           |                    |                       | Weight<br>Age<br>% |
|----------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|----------|-------------------------|----------------|-----------|----------------|-------------------------------------|-----------|--------------------|-----------------------|--------------------|
|                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Epidem<br>i ology      | Etiology | Clinical<br>Featur<br>e | Assessm<br>ent | Diagnosis | Manag<br>m ent | Complications<br>with<br>management | Prognosis | Rehabili<br>tation | Recent<br>Advanc<br>e |                    |
| <b>2.Heart<br/>Failure and<br/>Cardiomyop<br/>athies</b> | <b>Heart failure</b><br>Acute decompensated ventricular failure.<br>Systolic heart failure (heart failure with reduced ejection fraction). Diastolic heart failure (heart failure with preserved ejection fraction).<br>Heart failure with improved ejection fraction.<br>Cardiogenic shock.                                                                                                                                                                                | 01                     | 02       | 01                      | 02             | 01        | 04             | 03                                  | 01        | 01                 | 00                    | 16                 |
|                                                          | <b>Cardiomyopathies</b><br>Dilated Cardiomyopathies.<br>Hypertrophic Cardiomyopathies.<br>Restrictive and infiltrative Cardiomyopathies.<br>Chemotherapy-related cardiomyopathy.<br>Stress-induced cardiomyopathy (Takotsubo syndrome).<br>Myocarditis.<br>Noncompaction cardiomyopathy.<br>Arrhythmogenic right ventricular dysplasia.<br><b>Transplanted heart</b><br><b>Mechanical circulatory support</b>                                                               |                        |          |                         |                |           |                |                                     |           |                    |                       |                    |
| <b>3.Valvular<br/>Heart<br/>Disease</b>                  | <b>Mitral valve disorders</b><br>Mitral valve regurgitation, native. Mitral valve stenosis, native.<br>Mitral valve prolapse, native. Prosthetic mitral valve.<br>Systolic anterior motion<br><b>Aortic valve disorders</b><br>Aortic valve regurgitation, native. Aortic valve stenosis, native. Prosthetic aortic valve.<br><b>Tricuspid valve disorders</b><br>Tricuspid valve regurgitation, native.<br>Tricuspid valve stenosis, native.<br>Prosthetic tricuspid valve | 01                     | 01       | 02                      | 02             | 01        | 04             | 02                                  | 01        | 00                 | 01                    | 15                 |

| Area                 | Topic                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Sub- Theme (Objective) |          |                     |            |           |            |                                     |           |                |                   | Weight<br>Age<br>% |
|----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|----------|---------------------|------------|-----------|------------|-------------------------------------|-----------|----------------|-------------------|--------------------|
|                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Epidemiology           | Etiology | Clinical<br>Feature | Assessment | Diagnosis | Management | Complications<br>with<br>management | Prognosis | Rehabilitation | Recent<br>Advance |                    |
|                      | <b>Pulmonary valve disorders</b><br>Pulmonary valve regurgitation, native.<br>Pulmonary valve stenosis, native.<br>Prosthetic pulmonary valve.<br><b>Endocarditis</b><br><b>Cardiac murmurs and other cardiac sounds</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                        |          |                     |            |           |            |                                     |           |                |                   |                    |
| <b>4.Arrhythmias</b> | <b>Atrioventricular conduction disease</b> Atrioventricular block, 1st degree. Atrioventricular block, 2nd degree. Atrioventricular block, complete Left bundle branch block. Right bundle branch block<br>Left anterior fascicular block<br>Left posterior fascicular block<br><b>Sinus node dysfunction</b><br>Sinus bradycardia<br>Sinus pauses.<br>Bradycardia-tachycardia syndrome.<br><b>Supraventricular arrhythmias</b><br>Atrioventricular nodal reentrant tachycardia.<br>Pre-excitation syndromes (including Wolff-Parkinson-White).<br>Atrioventricular reciprocating tachycardia.<br><b>Ventricular arrhythmias</b><br>Ventricular tachycardia, monomorphic.<br>Ventricular tachycardia, polymorphic.<br>With prolonged Q-T interval.<br>Without prolonged Q-T interval.<br>Ventricular fibrillation (including idiopathic and non-idiopathic varieties).<br>Premature ventricular complexes<br><b>Atrial arrhythmias</b><br>Atrial fibrillation<br>Atrial flutter<br>Atrial tachycardia<br>Ectopic atrial rhythms<br>Premature atrial contractions<br><b>Channelopathies</b> | 00                     | 02       | 01                  | 01         | 02        | 03         | 02                                  | 01        | 00             | 00                | 12                 |

| Area                                                                              | Topic                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Sub- Theme (Objective) |          |                  |            |           |            |                               |           |                |                | Weight<br>Age<br>% |
|-----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|----------|------------------|------------|-----------|------------|-------------------------------|-----------|----------------|----------------|--------------------|
|                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Epidemiology           | Etiology | Clinical Feature | Assessment | Diagnosis | Management | Complications with management | Prognosis | Rehabilitation | Recent Advance |                    |
|                                                                                   | Long Q-T, congenital or acquired.<br>Brugada syndrome.<br>Early repolarization.<br><b>Sudden cardiac death</b><br>Syncope<br>Pacemaker and ICD function.<br>Antiarrhythmic drug effects                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                        |          |                  |            |           |            |                               |           |                |                |                    |
| <b>5.<br/>Systemic<br/>Disorders<br/>Affecting<br/>the<br/>Circulatory System</b> | <b>Musculoskeletal and connective tissue</b> Systemic lupus erythematosus. Systemic sclerosis.<br><b>Endocrine, nutritional, metabolic, and hematologic disorders</b><br>Dyslipidemias.<br>Diabetes.<br>Obesity.<br>Electrolyte and endocrine abnormalities Hematologic disorders<br><b>Renal disorders</b><br><b>Injury and poisoning</b><br>Toxic effects of alcohol.<br>Toxic effects of tobacco and nicotine. Toxic effects of drugs other than alcohol and tobacco.<br>Anaphylactic shock.<br>Angioedema.<br><b>Cardio-Oncology</b><br>Cardiovascular effects of pharmacological cancer therapy.<br>Cardiovascular effects of radiation therapy.<br>Neoplasms. | 00                     | 00       | 00               | 01         | 01        | 01         | 01                            | 00        | 00             | 00             | 04                 |

| Area                               | Topic                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Sub- Theme (Objective) |          |                  |            |           |            |                               |           |                |                | Weight<br>Age<br>% |
|------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|----------|------------------|------------|-----------|------------|-------------------------------|-----------|----------------|----------------|--------------------|
|                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Epidemiology           | Etiology | Clinical Feature | Assessment | Diagnosis | Management | Complications with management | Prognosis | Rehabilitation | Recent Advance |                    |
|                                    | Malignant neoplasm of the heart and pericardium.<br>Benign neoplasms (including myxoma, fibroma, and fibroelastoma).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                        |          |                  |            |           |            |                               |           |                |                |                    |
| <b>6. Congenital Heart Disease</b> | <b>Congenital malformations of cardiac chambers and connections</b><br>Complete transposition of the great vessels<br>Corrected transposition of the great vessels<br>Tricuspid atresia.<br>Anomalous origin or course of coronary artery.<br>Tetralogy of Fallot.<br><b>Congenital malformations of cardiac septa</b> Ventricular septal defect. Atrial septal defect.<br>Patent foramen ovale.<br>Atrioventricular septal defect.<br><b>Congenital malformations of pulmonary and tricuspid valves</b><br>Congenital pulmonary valve stenosis<br>Ebstein anomaly.<br><b>Congenital malformations of aortic and mitral valves</b><br><b>Other congenital malformations of the heart</b><br>Dextrocardia.<br>Congenital heart block.<br><b>Congenital malformations of the great arteries</b><br>Patent ductus arteriosus.<br>Coarctation of the aorta.<br>Aneurysm of the sinus of Valsalva.<br>Congenital malformation of the aortic arch<br>Pulmonary artery malformation.<br><b>Congenital malformations of the great veins</b><br>Persistent left superior vena cava.<br>Anomalous pulmonary venous | 00                     | 00       | 01               | 00         | 01        | 01         | 01                            | 00        | 00             | 01             | 05                 |

| Area                              | Topic                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Sub- Theme (Objective) |          |                         |                |           |                |                                     |           |                    |                       | Weight<br>Age<br>% |
|-----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|----------|-------------------------|----------------|-----------|----------------|-------------------------------------|-----------|--------------------|-----------------------|--------------------|
|                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Epidem<br>i ology      | Etiology | Clinical<br>Featur<br>e | Assessm<br>ent | Diagnosis | Manag<br>m ent | Complications<br>with<br>management | Prognosis | Rehabili<br>tation | Recent<br>Advanc<br>e |                    |
|                                   | connections. <b>Congenital disorders with cardiovascular implications</b><br><b>Eisenmenger syndrome</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                        |          |                         |                |           |                |                                     |           |                    |                       |                    |
| <b>7.Pericardi<br/>al Disease</b> | <b>Acute pericarditis</b><br><b>Chronic pericarditis (including relapsing)</b> Pericardial<br><b>constriction and effusion</b><br>Pericardial effusion.<br>Cardiac tamponade.<br>Constrictive pericarditis.<br>Effusive-constrictive pericarditis.<br><b>Abnormalities of the pericardium</b>                                                                                                                                                                                                                                                                                                                                                                                      | 00                     | 01       | 00                      | 00             | 01        | 01             | 01                                  | 00        | 00                 | 00                    | 04                 |
| <b>8.Vascular<br/>Diseases</b>    | <b>Cerebrovascular diseases</b><br>Cerebral infarction, including cardiovascular manifestations.<br>Extracranial cervical (carotid and vertebral). Subclavian steal syndrome with vertebral artery steal.<br>Carotid artery dissection.<br><b>Diseases of the arteries, arterioles, and capillaries</b><br>Peripheral atherosclerosis.<br>Aortic aneurysm and dissection.<br>Raynaud's phenomenon.<br>Thromboangiitis obliterans (Buerger's disease).<br>Claudication.<br>Acute limb ischemia.<br>Critical limb ischemia.<br>Atheroembolism.<br>Septic arterial embolism.<br>Polyarteritis nodosa.<br>Mucocutaneous lymph node syndrome (Kawasaki disease).<br>Takayasu arteritis. | 00                     | 00       | 00                      | 01             | 01        | 02             | 00                                  | 00        | 00                 | 00                    | 04                 |

| Area                                           | Topic                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Sub- Theme (Objective) |          |                     |            |           |            |                                  |           |                |                   | Weight<br>Age<br>% |
|------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|----------|---------------------|------------|-----------|------------|----------------------------------|-----------|----------------|-------------------|--------------------|
|                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Epidemiology           | Etiology | Clinical<br>Feature | Assessment | Diagnosis | Management | Complications with<br>management | Prognosis | Rehabilitation | Recent<br>Advance |                    |
|                                                | Giant cell arteritis with polymyalgia rheumatic.<br>Mesenteric arterial insufficiency.<br>Subclavian steal syndrome with internal mammary artery steal.<br>Fibromuscular dysplasia.<br><b>Diseases of the veins, lymphatic vessels, and lymph nodes</b><br>Deep vein thrombosis.<br>Portal vein thrombosis.<br>Iliac vein compression syndrome (May-Thurner syndrome).<br>Varicose veins of the lower extremities Chronic venous insufficiency.<br>Chronic idiopathic venous hypertension. Lymphedema. |                        |          |                     |            |           |            |                                  |           |                |                   |                    |
| <b>9.Systemic Hypertension and Hypotension</b> | <b>Hypertensive diseases</b><br>Essential (primary) hypertension.<br>Hypertensive heart disease.<br>Hypertensive chronic kidney disease.<br>Severe or resistant hypertension.<br>Urgent/emergent hypertension.<br>Secondary hypertension.<br>Hypertension in pregnancy.<br><b>Hypotensive diseases</b><br>Hypotensive syndrome.<br>Drug-induced hypotension.                                                                                                                                           | 01                     | 01       | 00                  | 00         | 01        | 03         | 01                               | 00        | 00             | 00                | 07                 |

| Area                                                                    | Topic                                                                                                                                                                                                                                                                                                                                | Sub- Theme (Objective) |          |                         |                |           |                |                                     |           |                    |                       | Weight<br>Age<br>% |
|-------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|----------|-------------------------|----------------|-----------|----------------|-------------------------------------|-----------|--------------------|-----------------------|--------------------|
|                                                                         |                                                                                                                                                                                                                                                                                                                                      | Epidem<br>i ology      | Etiology | Clinical<br>Featur<br>e | Assessm<br>ent | Diagnosis | Manag<br>m ent | Complications<br>with<br>management | Prognosis | Rehabili<br>tation | Recent<br>Advanc<br>e |                    |
| <b>10.Pulmonary<br/>Circulation<br/>Disorders</b>                       | <b>Pulmonary embolism</b><br>Pulmonary embolism with acute cor<br>pulmonale.<br>Pulmonary embolism without acute<br>cor pulmonale.<br>Chronic pulmonary embolism.<br><b>Pulmonary hypertension</b><br>Pulmonary arterial hypertension<br>(WHO Group 1) Pulmonary<br>hypertension associated with other<br>diseases (WHO Groups 2–5). | 00                     | 01       | 00                      | 00             | 01        | 01             | 00                                  | 00        | 00                 | 00                    | 03                 |
| <b>11.Normal<br/>Cardiovascul<br/>ar Anatomy<br/>and<br/>Physiology</b> |                                                                                                                                                                                                                                                                                                                                      | 00                     | 00       | 01                      | 01             | 00        | 00             | 00                                  | 00        | 00                 | 00                    | 02                 |
| <b>12. Non-<br/>Invasive<br/>Assessment</b>                             | <b>Exercise ECG Testing</b><br><b>Nuclear Cardiac</b><br><b>Imaging</b><br><b>Echocardiography</b>                                                                                                                                                                                                                                   | 00                     | 00       | 00                      | 03             | 00        | 00             | 00                                  | 00        | 00                 | 01                    | 04                 |
| <b>13.Cardiovas<br/>cular Disease<br/>in Specific<br/>Population</b>    | <b>Heart Disease in Woman.</b><br><b>Heart Disease &amp;</b><br><b>Pregnancy. Perioperative</b><br><b>Cardiovascular</b><br><b>Management for Non-</b><br><b>Cardiac Surgery.</b><br><b>The Athlete's Heart</b>                                                                                                                      | 00                     | 01       | 00                      | 01             | 01        | 01             | 00                                  | 00        | 00                 | 00                    | 04                 |