



COMPETENCY BASED POSTGRDUATE CURRICULUM

DEPARTMENT OF CARDIOLOGY



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Department of Cardiology

Post- Graduate Program

Preamble:

The purpose of PG education is to create specialists who would provide high quality health care and advance the cause of science through research & training. The purpose of DM Cardiology is to standardize teaching at Post Graduate level throughout the country so that it will benefit in achieving uniformity in undergraduate teaching as well and resultantly creating competent cardiologist with appropriate expertise. The purpose of this document is to provide teachers and learners illustrative guidelines to achieve defined outcomes through learning and assessment. This document was prepared by subject-content specialists. The Reconciliation Board of Academic Council has attempted to render uniformity without compromise to purpose and content of the document. Compromise in purity of syntax has been made in order to preserve the purpose and content. This has necessitated retention of “domains of learning” under the heading “competencies”.

Program Educational Objectives (PEO):

- **PEO1:** Specialist who can provide comprehensive care related to cardiology over and above the physician of first contact.
- **PEO2:** Leader and team member who understands health care system and act to provide safe patient care with accountability and responsibility.
- **PEO3:** Communicator possessing adequate communication skill to convey required information in an appropriate manner in various health care setting.

- **PEO4:** Lifelong learner keen on updating oneself regarding the advancement in the health care field and able to perform the role of researcher and teacher
- **PEO5:** Professional who understands and follows the principle of bio-ethics / ethics related to health care system.

Program Outcome (PO):

After three years of residency program postgraduate should be able to

- **PO1:** To perform clinical examination and arrive at comprehensive diagnosis(C1,C2)
- **PO2:** Perform and interpret basic cardiac investigations such as Electrocardiogram, Echocardiogram, Holter and Treadmill test(C1.C2,C3)
- **PO3:** Perform and interpret diagnostic coronary angiogram and catheterisation (C1, C2, C3).
- **PO4:** Exercise empathy and a caring attitude and maintain professional integrity, honesty and high ethical standards(C1,C2)
- **PO 5:** Plan and deliver comprehensive treatment using the principles of rational drug therapy (C1.C2, C4).
- **PO6:** Plan and advise measures for the prevention and rehabilitation of patients belonging to his specialty(C1,C2)
- **PO7:** Perform invasive lifesaving cardiac procedures like Temporary pacemaker insertion, pericardiocentesis(C1,C3)
- **PO8:** Demonstrate competence in basic concepts of research methodology and clinical epidemiology; and preventive aspects of various disease states(C2,C4)
- **PO9:** Be a motivated 'teacher' - defined as one keen to share knowledge and skills with a colleague or a junior or any learner(C1,C2,C3.C4)
- **PO10:** Undertake audit, use information technology tools and carry out research - both basic and clinical, with the aim of publishing the work and presenting the work at scientific forums(C2,C3, C4)

Course with Course objective

Course 1 (C1): Applied basic medical science

Objectives: At the end of three years post graduate student should have

CO 1. 1. Applied knowledge on anatomy, physiology & biochemical functions of cardiovascular system & correlation with disease pathogenesis.

CO 1.2. Applied knowledge on pathological changes in cardiovascular system associated with diseases and their correlation with clinical signs; understanding various pathogenic processes and possible therapeutic interventions possible at various levels to reverse or arrest the progress of diseases

CO 1.3. Applied knowledge about pharmacokinetics and pharmaco-dynamics of the drugs used for the management of cardiac disorders.

Course 2 (C2): Clinical Cardiology including Paediatric cardiology.

Objectives: At the end of three years post graduate student should have

CO 2.1. Provide quality care in diagnosis, management & prevention of complications of non communicable diseases like Hypertension and coronary heart disease.

CO 2.2. Approach a patient with symptoms & clinical signs arrive at a possible available investigations & come to a diagnosis .

CO 2.3 Manage emergencies & critically ill patients in providing utmost care with ethical treatment for better outcome of the patients.

CO 2.4. To understand the pathophysiology behind heart failure, evaluation of its etiology, diagnosis and its management.

CO 2.5. To diagnose acute rheumatic fever, various valvular disorders and grade its severity along with formulating a clear treatment strategy.

CO 2.6. Able to identify and classify various types of cardiomyopathy.

CO 2.7. To do comprehensive perioperative evaluation both in patients with/without cardiac disease.

CO 2.8. To perform paediatric echocardiogram, diagnose all types of paediatric diseases and in depth knowledge of management options.

CO 2.9. Knowledge about mechanism of cardiac arrhythmias and conduction disturbances, their clinical assessment, diagnosis and management.

Course 3 (C3): DIAGNOSTIC AND INTERVENTIONAL CARDIOLOGY INCLUDING CARDIAC INSTRUMENTATION.

Objectives: At the end of three years post graduate student should have

CO 3.1. Diagnostic Cardiology: interpretation of Electrocardiogram, Echo cardiogram (basic & advanced), Treadmill test, Holter. Perform and interpret diagnostic angiogram (coronary and peripheral). Understand the basic interpretation of nuclear cardiology, cardiac CT and cardiac MRI.

CO 3.2. Interventional Cardiology: To have thorough knowledge about the procedural details, complications and management of those complications associated with Percutaneous coronary intervention, balloon valvuloplasty (mitral, aortic, pulmonary), peripheral arterial and venous interventions. Ability to perform Type A coronary interventions under supervision.

CO 3.3. Cardiac devices: pre procedural assessment of cardiac anatomy in structural heart diseases (ASD, VSD, PDA, RSOV), choosing appropriate intervention, knowledge about various devices and their application, procedural details for these interventions. Knowledge about cardiac pacing (types of pacemakers, implantation techniques, interrogation and optimisation).

Course 4 (C4): RECENT ADVANCES IN CARDIOLOGY, PREVENTIVE

CARDIOLOGY AND CARDIAC SURGERY.

CO 4.1. Updating knowledge about newer drugs for cardiac diseases, advanced cardiac interventions.

CO 4.2. Knowledge about risk stratification and strategies in preventing various cardiac diseases.

CO 4.3. Preoperative assessment of patients for cardiac surgery and post-operative follow up.

Mapping of PEO, PO and CO

	PEO1				PEO2		PEO 3	PEO4		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
C1	Y	Y	Y	Y	Y		Y		Y	
C2	Y	Y	Y	Y	Y	Y		Y	Y	Y
C3		Y	Y				Y	Y	Y	Y
C4					Y	Y			Y	

1. GOALS & OBJECTIVES

1.1 GOAL :

The goal of DM course is to produce a competent cardiologist who :

- Recognizes the health needs of patients and carries out professional obligations, keeping in view the principles of National Health policy and professional ethics
- Has acquired the competencies pertaining to Cardiology that are required to be practised in the community and at all levels of health care system
- Has acquired skills in effectively communicating with the patients, family and the community
- Is aware of the contemporary advances and developments in medical sciences
- Acquires a spirit of scientific enquiry and is oriented to principles of research methodology
- Has acquired skills in educating medical and paramedical professionals

1.2 LEARNING OBJECTIVES

- In general, the course is designed to train post graduates (MD) in Internal Medicine & Paediatrics, in major areas of Cardiology like clinical Cardiology, Coronary care, Paediatric Cardiology, Electrophysiology, Invasive diagnostic and Therapeutic Cardiac procedures and various non- invasive diagnostic techniques and research activities.
- The aim of the course is to impart, thorough comprehensive approach, training to the candidate in the various aspects of cardiology so that at the end of the course he / she shall be able to perform the following:-

1.2.1 Cognitive Domain :

- 1) To diagnose cardiovascular diseases based on clinical methods.
- 2) To interpret relevant laboratory, radiological and cardiological investigations for the purpose of diagnosis
- 3) To arrive at treatment plans / modalities based on 1 & 2 and discuss the pros and cons with the patient and his / her family
- 4) Be able to carry out efficient management of all types of cardiovascular emergencies, following a rapid assessment of the patient and synthesizing available clinical and investigational information. To keep abreast of the current knowledge and recent advances in the field by self learning and /or participating in continuing Medical Education programmes.
- 5) To render preventive and rehabilitative care.
- 6) To organize and manage administrative responsibilities for routine day to day work as well as emergency /urgent situations
- 7) To understand the functional principles of various biomedical equipments used in invasive and non invasive cardiology.
- 8) To carry out research leading to publications in the field
- 9) To teach the medical and other paramedical students/staff and develop learning resource materials for them

1.2.2 SKILLS :

1.2.2.1 Non-invasive techniques

The candidate would be given adequate training during the course so that he/she will be able to perform and interpret various non invasive techniques including:

- a. Electrocardiography

- b. Stress testing –ECG tread mill test, stress echocardiography
- c. Holter monitoring for arrhythmias and ischemic disorders
- d. Echocardiography – M-mode, Two dimensional, 3D Doppler (Including tissue Doppler), Colour flow imaging, contrast echo, strain and strain rate imaging, speckle tracking, trans oesophageal echocardiography and echo directed hemodynamic studies.

The candidate would be given adequate exposure in choosing other Non invasive cardiac investigatory techniques including Cardiac CT, MRI & Nuclear Cardiology appropriate to the situation.

1.2.2 .2 Invasive cardiology

The candidate would be given adequate training so that he/she will be able

1. To perform temporary pacemaker insertion, pericardiocentesis , central venous line insertions
2. To perform right and left heart catheterization and coronary angiography procedures in adults and Children
3. To perform different diagnostic peripheral angiograms.
4. To assist in various interventions including Coronary and Peripheral angioplasty and valvuloplasty
5. To observe and assist device closure of ASD, VSD, PDA etc.
6. To observe and learn doing FFR during angioplasty.
7. To calculate and interpret various hemodynamic parameters
8. To interpret electrophysiological data and assist in electrophysiology procedures, permanent pacemaker implantation, AICD implantation.

1.2.3 Affective Domain :

- 1) To adopt ethical practices in dealing with patients, colleagues, subordinates

superiors and health care workers.

- 2) To promote cordial interpersonal relations
- 3) To perform as a team
- 4) To learn to be a leader when the need arises.
- 5) To learn to order investigations and prescribe drugs rationally.
- 6) To be aware of ethical issues in human and animal research.

7). To take rational decisions in the face of ethical dilemmas in cardiac diseases, demonstrate empathy & Human approach towards patients & their families & exhibit interpersonal behaviour in accordance with social norms & expectations.

2. SYLLABUS

2.1 Basic sciences related to Cardiology

2.1.1 Cardiac Anatomy

The cardiac anatomy with special emphasis on the development of heart and blood vessels, foetal circulation and its changes in post natal life; coronary circulation; venous drainage of heart ; The heart and pericardium and its relation to neighbouring structures; anatomy of cardiac chambers and valves; arteries and veins; histology of heart and blood vessels. Functional anatomy of the heart, orientation of the heart within the Thorax, Methods used to study cardiac anatomy, correlative anatomy, New

developments and future challenges, Quantum computing, Ultrastructure of the heart, Cardiac Embryology and Histology.

2.1.2 Cardiac Physiology

Cardiac Physiology will cover all the physiological changes in the heart during its normal function with special reference to cardiac cycle; myocardial contractility; pressure changes in the cardiac chambers; cardiac output; factors controlling blood flow; regulation of cardiac function; cardiac reflexes; coronary blood flow; exercise physiology; physiology of blood pressure regulation; normal influence on cardiovascular system; preload; after-load; assessment of ventricular function; regulation of cardiac contraction; action potentials; the cellular basis of cardiac contraction, Integration of the cardiovascular system and the response to dynamic exercise, etc.

2.1.3 Cardiac Molecular Biology

Principles of molecular biology including Gene Structure, Expression and regulation;

Recombinant DNA Technology; PCR Techniques, Molecular basis of cellular growth, Molecular and cellular biology of the normal, hypertrophied and failing heart including cardiac growth and hypertrophy, Molecular and Cellular biology of the blood vessels including endothelial cell, vascular smooth muscle interactions, atherosclerosis etc, The Human Genome and its future implications for cardiology including bioethical implications and genetic counselling, Cardiovascular Tissue modification by genetic approaches including Gene Transfer etc, Molecular Development of the heart including anomalies.

2.1.4 Cardiac Biochemistry

All aspects of normal and abnormal patterns of cardiac biochemistry including cardiac enzymes; lipid profile, cardiac metabolism, electrolytes and their effects on cardiac function etc.

2.1.5 Cardiac Pharmacology

All the drugs used in the treatment of cardiac disorders inclusive of antianginal agents like beta-blocking agents, nitrates and calcium channel blockers, antifailure agents like diuretics, Angiotensin-Converting Enzyme (ACE) Inhibitors, Angiotensin-II Receptor Blocking Drugs (ARBs) and aldosterone antagonism, Digitalis, Acute Inotropes and inotropic Dilators, Antihypertensive Drugs, Antiarrhythmic Drugs, Antithrombotic agents like Platelet Inhibitors, Anticoagulants and Fibrinolytics, Lipid-Lowering and Atherosclerotic Drugs, choice of drugs, Adverse Cardiovascular Drug Interactions and Complications.

2.1.6 Cardiac Pathology

All pathological changes in various cardiac diseases with special reference to clinical correlation included. Special emphasis on pathological changes in the pulmonary vascular system in various cardiac disorders; pathogenesis and pathology of rheumatic fever and rheumatic heart disease; cardiomyopathies -- dilated, hypertrophic and obliterative/restrictive; congenital heart disease-cyanotic and acyanotic; atherosclerosis; coronary artery disease; cardiac involvement in other systemic diseases and storage disorders etc.

2.1.7 Cardiac Microbiology

The various microbiological aspects of cardiac diseases including rheumatic fever, infective endocarditis, myocarditis are included. Cardiac Molecular Biology has been included under a separate head.

2.2 Clinical Cardiology including Paediatric Cardiology.

2.2.1 General Evaluation of the patient

The History, Physical Examination and Cardiac Auscultation including elements of accurate history taking, symptoms associated with cardiovascular disease, The physical examination of adults, children, infants and neonates, syndromes associated with congenital heart disease, measurement of arterial blood pressure, venous pulse, examination of the retina, inspection and palpation of the pericardium, cardiac auscultation.

2.2.2 Heart Failure

Pathophysiology and diagnosis of Heart Failure, Diagnosis and management of heart failure, Cardiac transplantation and mechanical ventricular support.

2.2.3 Rhythm and Conduction Disturbances

Mechanisms of cardiac arrhythmias and conduction disturbances, Recognition, clinical assessment and management of arrhythmias and conduction disturbances, anti arrhythmic drugs, etc

2.2.4 Syncope, Sudden Death and Cardio-pulmonary Resuscitation

Diagnosis and management of syncope, sudden cardiac death, Cardio pulmonary Resuscitation and the subsequent management of the patients etc.

2.2.5 Coronary Heart Disease

Atherogenesis and its determinants, Pathology of coronary atherosclerosis, Coronary blood flow and myocardial ischemia, Dyslipidemia, other risk factors, and the prevention of coronary heart disease, Non atherosclerotic coronary heart disease,

Diagnosis and management of patients with chronic ischemic heart disease, Diagnosis and management of patients with unstable angina, Diagnosis and management of patients with acute myocardial infarction, The electrocardiogram in Acute myocardial infarction, Thrombogenesis, antithrombotic and thrombolytic therapy, rehabilitation of the patient with coronary heart disease etc.

2.2.6 Systemic Arterial Hypertension

Hypertension, epidemiology, pathophysiology, diagnosis and treatment.

2.2.7 Pulmonary Hypertension and Pulmonary Disease

Pulmonary hypertension, Pulmonary embolism, Chronic Cor pulmonale etc.

2.2.8 Valvular Heart Disease

Acute rheumatic fever, Aortic valve disease, Mitral valve disease, Mitral valve prolapse syndrome, tricuspid valve, pulmonary valve and multi valvular disease, Clinical performance of prosthetic heart valves, Antithrombotic therapy for valvular heart disease etc.

2.2.9 Congenital Heart Disease

Cardiovascular disease due to genetic abnormalities, the pathology, patho physiology, recognition and treatment of congenital heart diseases, Congenital heart disease in adults etc.

2.2.10 Cardiomyopathy and Specific Heart Muscle Diseases

Classification of Cardiomyopathies, Dilated Cardiomyopathy, Hypertrophic Cardiomyopathy, Restrictive, obliterative and infiltrative Cardiomyopathies, Myocarditis and specific Cardiomyopathies, Endocrine disease and Alcohol, AIDS and the Cardiovascular system, Effect of non cardiac drugs, Electricity, Poisons and Radiation and the heart etc.

2.2.11 Pericardial Diseases and Endocarditis

Diseases of the pericardium, Infective endocarditis

2.2.12 The Heart, Anaesthesia and Surgery

Perioperative evaluation and management of patients with known or suspected cardio vascular disease who undergo non cardiac surgery, Anaesthesia and patients with cardiovascular disease, etc.

2.2.13 Miscellaneous Diseases and Conditions

The connective tissue diseases and the cardiovascular system, Neoplastic heart disease, Diabetes and cardiovascular disease, traumatic heart disease, effects of mood and

anxiety disorders on the cardiovascular system, Heart disease and pregnancy, The heart and obesity, the heart and kidney disease, exercise and the cardiovascular system, Acute hemodynamics, conditioning, training the athlete's heart and sudden death, Cardiovascular aging in health and therapeutic considerations in older patients with cardiovascular diseases, women and coronary artery disease etc.

2.2.14 Tropical Cardiology

Conditions which are specifically found in the tropics like rheumatic heart disease, Endo myocardial Fibrosis, Eosinophilic Heart Disease, Aorto arteritis etc.

2.2.15 Diseases of the great vessels and peripheral vessels

Diagnosis and treatment of diseases of the aorta, Cerebro vascular disease and neurologic manifestations of heart disease, diagnosis and management of diseases of the peripheral arteries and veins, surgical treatment of peripheral vascular diseases, etc.

2.3 Diagnostic and Interventional Cardiology including Cardiac Instrumentation

2.3.1 Diagnostic Cardiology

The resting Electrocardiogram, The Chest roentgenogram and cardiac fluoroscopy, The Echocardiogram, ECG Exercise Testing, Cardiac Catheterization, Coronary Arteriography, Coronary Blood Flow and Pressure Measurements, Cardiac Ventriculography, Pulmonary Angiography, Angiography of the Aorta and Peripheral Vessels, Nuclear Cardiology, Computed tomography of the Heart, Magnetic resonance Imaging of the heart, Magnetic Resonance imaging of the Vascular System, Positron Emission Tomography for the non invasive study and quantification of blood flow and metabolism in human cardiac disease, long-term continuous electrocardiographic recordings, Signal Averaging techniques and measurement of Late Potentials, Techniques of Electrophysiological evaluation of Brady and tachy arrhythmias, Coronary Intravascular Ultrasound Imaging endo myocardial biopsy etc.

2.3.2 Interventional Cardiology

Percutaneous Coronary Interventions, Coronary Angioplasty, IVUS/OCT Guided coronary intervention and FFR guided coronary interventions, Atherectomy, Athero ablation and Thrombectomy, Coronary Stenting, Balloon Valvuloplasty, Peripheral Intervention, Paediatric interventions, Intra aortic Balloon Counter pulsation and other Circulatory Assist Devices, Interventional Electrophysiology, Cardiac pacemakers, implantable devices for heart failure and for the treatment of cardiac arrhythmias etc.

2.3.3 Cardiac Instrumentation

Principles of cardiac instrumentation, pressure recording, ECG Machines, Cardiac Monitors, Defibrillators, Cath-Lab Equipment, EP Lab Equipment, Gamma Camera,

CT Scan, MRI Equipment, PET Scans, Echocardiography including Stress Echo, Colour Doppler and TEE, Pacemakers temporary and Permanent, ICDs, Triple Chamber Devices, radiofrequency ablation equipment, programmed stimulators, IABP, Holter and Signal Averaging and ABP machines, Treadmill equipments, Hemodynamic recorders, oxymeters, Computers and image processing in Cardiology etc.

2.4 Recent advances in Cardiology, Cardiac epidemiology, Preventive Cardiology including Cardiology related Cardiac surgery

Atherosclerosis and Prevention: Epidemiology of Cardiovascular Diseases Risk factors for atherosclerotic diseases, assessment of cardiac risk

2.4.1 Special Problems in the prevention of cardiovascular disease

- (a) Diabetes mellitus type 2
- (b) Menopausal women
- (c) Non-traditional risk factors for coronary disease

2.4.2 Special problems in Hyperlipidemia therapy

- (a) Child with hypercholesterolemia
- (b) Transplant patient
- (c) Hypercholesterolemia in the elderly
- (d) Elevated lipoprotein fractions.

2.4.3 Non Cardiac Vascular Disease: Special problems in Vascular Disease;

- (a) Compromise of an internal thoracic artery to coronary artery graft by sub clavian artery disease; localised lymphedema

2.4.4 Ischemic Heart Disease: Special Diagnostic issues in Ischemic Heart Disease :

- (a) The patient with chest pain, a positive stress test and normal coronary arteries
- (b) The patient with coronary artery disease and acute and chronic heart failure

2.4.5 Stable Coronary Syndromes: Special problems in myocardial ischemia;

- (a) Management of variant angina breakthrough
- (b) Management of the non-revascularization patient with severe angina

- (c) Treatment of silent ischemia
- (d) Treatment of micro vascular angina
- (e) Sildenafil , sexual activity and the cardiac patient.

2.4.6 Acute Coronary Syndromes :

Special problems in Acute Myocardial Infarction;

- (a) Right ventricular infarction
- (b) Acute myocardial infarction and normal coronary arteries
- (c) Non perfused acute myocardial infarction after thrombolytic therapy.

2.4.7 Non Pharmacological treatment of Ischemic Heart Disease :

Special problems in non pharmacologic therapy :

- (a) Unprotected left main coronary angioplasty
- (b) Chronic total occlusion;
- (c) Saphenous vein graft interventions
- (d) Percutaneous intervention of cardiac allograft vasculopathy
- (e) In-stent restenosis.

2.4.8 Hypertension

Management issues in difficult hypertension like

- (a) Hypertension and ethnicity
- (b) Hypertension in pregnancy pre eclampsia
- (c) Perioperative hypertension
- (d) Ambulatory blood pressure monitoring;
- (e) Diabetes and hypertension

- (f) Resistant hypertension
- (g) Hypertension in the context of acute myocardial infarction or coronary interventions
- (h) Concomitant therapy in hypertension.

2.4.9 Cardiac Arrhythmias

➤ Special problems in cardiac pacing like

- (a) Pacemaker syndrome
- (b) Temporary cardiac pacing
- (c) Diagnostic and surgical procedures in pacemaker patients
- (d) Pacemaker lead extraction
- (e) Biventricular pacing for congestive heart failure.

➤ Special problems in Supra ventricular arrhythmias like

- (a) Syncope in PSVT
- (b) Paroxysmal and Perioperative atrial fibrillation
- (c) Cycle length alternation in supra ventricular tachycardia
- (d) Atrial flutter
- (e) Atrial fibrillation and anticoagulants.

➤ Special problems in ventricular arrhythmias, namely

- (a) Problems of implanted defibrillators
- (b) Syncope in a patient

(c) Palpitations and VT in a young woman.

2.4.10 Heart Failure and Cardiomyopathy :

➤ **Special problems in chronic heart failure, namely**

(a) Mechanisms of exercise intolerance and exercise testing

(b) Cardiac cachexia

(c) Anemia, renal dysfunction and depression in heart failure

(d) Disease management programs.

➤ **Special problems in myocarditis and cardiomyopathy such as**

(a) Peripartum cardiomyopathy

(b) HIV myocarditis and cardiomyopathy

(c) Adriamycin induced Cardiomyopathy

(d) Tachy Cardiomyopathy

(e) Diabetic Cardiomyopathy.

2.4.11 Valvular Heart Disease

➤ **Special problems in valvular heart diseases, namely**

(a) New onset atrial fibrillation in asymptomatic mitral stenosis

(b) Mitral stenosis and pregnancy

(c) Low gradient, low output aortic stenosis

(d) Mild to moderate aortic stenosis in patients undergoing bypass surgery

➤ **Special problems in surgical treatment of valvular diseases**

- (a) Perivalvular leaks
- (b) Pregnancy and anticoagulation
- (c) Postoperative management of valvular dysfunction in valvular surgical treatment.

2.4.12 Congenital Heart Disease

➤ **Special problems in Adult Congenital heart diseases :**

- (a) Pregnancy in a woman with Eisenmenger's syndrome
- (b) Thrombo embolism after Fontan procedure;
- (c) Late systemic RV failure in patients with TGA.

2.4.13 Recent Advances

- a) To update on ACLS protocol
- b) To update on recent guidelines

3. LEARNING RESOURCE MATERIALS

3.1 :Text Books (Indicates latest editions)

RECOMMENDED :

1. Braunwald E. Zipes D. Libby P.: Heart Disease : A Text Book of Cardiovascular Medicine (Saunders/ Elsevier)
2. Fuster V.: Hurst's The Heart (Mc Graw Hill)
3. Topol E. Comprehensive Cardiovascular Medicine (Saunders)
4. Baim DS. GrossmanW: Grossman's Cardiac Catheterization, Angiography and Intervention
5. Feigenbaum H. Echocardiography (Wolters Kluwer)

6. Perloff J: The Clinical Recognition of Congenital Heart Diseases (Saunders/ Elsevier)
7. Marriot HJL: Practical Electrocardiography
8. Paediatric Cardiology – Myung K. Park (Elsevier)
9. ECHO Manual – OH and Tajik
10. Valvular heart disease – Alpert and Halen
11. Congenital Disease of the heart: Abraham M. Rudolph

REFERENCES :

1. Crawford MH. DiMarco JP. Paulus WJ: Cardiology
2. Otto: Text book of Echocardiography (Saunders/ Elsevier)
3. Nadas AS. Paediatric Cardiology
4. Garson A. The Science and Practice of Paediatric Cardiology
5. Moss and Adams: Heart Disease in Infants, Children and Adolescents (Wolters Kluwer)
6. Anderson RH: Paediatric Cardiology
7. Constant J. Bedside Cardiology
8. Opie LH. Drugs for the Heart (Elsevier)
9. Topol E. Text Book of Interventional Cardiology (Saunders)
10. Kern Cardiac Catheterization Hand book (Elsevier)

3.2 Journals_

RECOMMENDED :

1. Indian Heart Journal

2. Journal of the American College of Cardiology
3. JACC Interventions
4. The Heart
5. Circulation
6. Indian Journal of Echocardiography
7. American Journal Of Echocardiography

OPTIONAL :

1. Bulletin of WHO
2. American Heart Journal
3. American Journal of Cardiology.
4. International Journal of Cardiology.
5. The Lancet
6. New England Journal of Medicine.
7. European Heart Journal.
8. Cardiology Clinics of North America.
9. Catheterization, Cardiovascular Diagnosis.
10. PACE
11. Current Problems in Cardiology.

The Student should also be familiarised with Internet browsing for Journals, Special Articles, Review Articles and other recent recommendations of International Societies like the American Heart Association, NASPE, European Cardiac Society etc.

4. TEACHING LEARNING EXPERIENCE

Training period (As per MCI Guidelines)

The period of training for obtaining the degree of D.M. in Cardiology shall be three completed years (including the examination period) after obtaining M.D. degree, or equivalent recognised qualification in the required subject.

➤ Training programme MCI guidelines

1. The training imparted with due care to the post graduate students in the recognised institutions for the award of D.M. Cardiology, shall determine the expertise of the specialist and /or medical teachers produced as a result of the educational programme during the period of stay in the institution.
2. All the candidates joining the D.M. Cardiology training programme shall work as full time residents during the period of training , attending not less than 80%(Eighty percent) of the training during the calendar year, and given full time responsibility, assignments and participation in all facets of the educational processes.
3. D.M. Cardiology students shall maintain an academic portfolio, as per the SBV University norms
4. During training for the D.M. Cardiology, there shall be proper training imparted in basic medical sciences related to cardiology. Emphasis to be laid on preventive and social aspects and emergency care services.
5. The D.M. Cardiology student shall be required to participate in the teaching and training programmes of undergraduate and postgraduate students in the departments of medicine, paediatrics etc.
6. Training in Medical Audit, management, health economics, health information system, basics of statistics, exposure to human behaviour studies, knowledge of pharmaco economics and introduction to non linear mathematics shall be imparted.
7. In - Service training in the management and treatment of patients entrusted to their care: participation in Seminars, Journal Clubs, Group Discussions, Clinical Meetings, Grand Rounds and Clinico-Pathological Conferences, Advanced

Diagnostic, Therapeutic and Laboratory techniques in cardiology.

4. 1 Teaching / Learning Schedule

4.1.1 CLINICAL POSTINGS

Year	Specialization	Duration
I st Year	Ward / OPD	3 Months
	ICCU	3 months
	Non Invasive LAB	3 Months
	Cath Lab	3 Months
II nd Year	Ward / OPD	3 Months
	ICCU	3 months
	Non Invasive LAB	3 Months
	Cath Lab	3 Months
IIIrd Year	Paediatric Cardiology	1 Month
	Cardiac Imaging	1 Month
	CTVS	1 Month
	Cath Lab	3 Months
	Ward / OPD	3 Months
	Non Invasive Lab	2 Months
	Exam	1Month

4.2 WARD / OPD

The candidate would first familiarize himself/herself with the general working of the hospital, the Wards, admission norms, sending of investigations, geography of the hospital, location of the various services, posting of cases for catheterization / intervention, consent forms, blood availability, discharge protocol, medical records section etc. In addition, the candidate would examine all the cardiac cases in the wards

and give consultation to all other departments of the hospital with the help of the consultant.

If there are undergraduate MBBS or Post Graduate MD students from Medicine, Paediatrics or other specialties posted, then he / she would impart relevant clinical examination and diagnostic skills to them.

The candidate would also be working in the OPD and assessing the suitability of the patients for admission, making an OPD diagnosis, planning the relevant investigations etc. In addition, the candidate would manage the special clinics like Post Intervention Clinic and the Pacemaker Clinic of the Department.

The DM candidate would be put on regular 24 hour duties and would take the call from the Casualty and other department of the hospital. He/she would relieve the ICU person for Lunch etc.

4.3 INTENSIVE CARE UNIT

This posting is essential for the candidate to learn all the aspects of Cardiac Intensive

Care like Thrombolytic Therapy in Acute Myocardial Infarction, Hemodynamic Monitoring in Acute Myocardial Infarction using the Swan-Ganz Balloon Floation Thermodilution Catheter with monitoring of Pulmonary Wedge Pressures, Cardiac Output and Resistances, management of Brady arrhythmias with Temporary Cardiac Pacing, management of Tachy arrhythmias with DC Cardio version / DC shock. Management of Acute Coronary Syndromes, all cardiac sick patients with shock states and hemodynamic compromise, post cath and intervention patients who are unstable, insertion of Intra Aortic Balloon Pump, Emergency Non invasive diagnosis like ECHO etc, Pericardiocentesis, Ventilator therapy, all emergency cardiac consultations etc. The candidate should familiarize himself/herself with all the monitoring gadgets in the ICU, namely Monitors, Cardiac Output Recorders, Defibrillators, IABP Machine, Ventilators, ABG machines etc.

The candidate would be on duty in the Intensive Care Unit from 9 A.M to 9 P.M and 24 hours by rotation. He / she would also attend the teaching programmes of the department without disturbing patient care. He/she would be relieved for lunch by the ward resident. The candidate would also be taking calls from the casualty and giving consultations to all department of the hospital.

4.4 NON-INVASIVE LABORATORY

The candidate would be posted in the Non-Invasive Laboratory wherein he/she would receive training and independently perform Computerised ECG Recording and Evaluation, Colour Doppler Echocardiographic Examination, Transesophageal Echocardiographic Examination, Dobutamine Stress Echocardiographic Examination, Holter Monitoring and evaluation, Event Recorder and analysis, Ambulatory Blood Pressure Monitoring. The candidate would learn all aspects of Cardiac Instrumentation such as ECG machines, Treadmill, Echocardiography machines, holter, event recorders etc. In addition, the candidate would also learn Nuclear Cardiology when he/she is posted to a Centre where facility for the same exists. The candidate would also be attending the OPD. During this period, the candidate would also be attending all teaching programs of the department and would be doing emergency duties also in the ICU / taking casualty calls and giving consultations to all departments of the hospital.

4.5 CATH –LAB

The Candidate would be posted in the cath-lab only after he/she is familiar with all aspects of cardiac care including wards, OPD, ICU and all non invasive cardiac diagnosis.

In the First Year of Cath-Lab posting, the candidate would assist in all the diagnostic procedures such as right heart catheterization, left heart catheterization, coronary angiography, peripheral angiography, electrophysiological studies etc. After a certain period, he/she would start assisting in Interventional Procedures like PTCA / STENT implantations, Balloon Valvuloplasties, Peripheral Interventions, PDA coil occlusions,

Radio-Frequency Ablations, Permanent Pacemaker Implantations, ICD Implantations, CRT etc. He/she would familiarize himself / herself with all the cardiac instruments in the cath-lab like X-Ray I/I System, Hemodynamic Cath Lab recorder, EP Recorder, Oximeter etc. The candidate is responsible for all the precath instructions, explaining and counselling to the patients and relatives, preparing the cath list, consent,

checking all the investigations, getting the pre-anesthetic check up done in case of necessity and posting the patients. He / she would give the necessary post cath care, secure hemo- stasis after the procedure, prepare the complete cath report and ensure that all records are maintained correctly and given to the patient etc. He / she should be available for Emergency Cath Procedures like Acute Primary PTCA etc even when not on duty. In routine conditions, the candidate need not attend OPDs, but it is necessary that he/she attends the rounds and does the emergency duties on rotation. The candidate would attend all the teaching programmes of the department and would present the data in the post hemodynamic conference.

In the Second Year of the Cath-Lab posting, the candidate would be permitted to perform independently, but under supervision all the diagnostic procedures. However, he/she would continue to assist in the Interventional Procedures. The rest of the work remains the same. In the Third Year of the Cath-Lab posting, the candidate would be permitted to perform Cardiac Interventions independently but under strict Supervision. The rest of the work remains the same.

The candidate should also be aware of the consumables and the hardware used in diagnostic and interventional cardiac catheterization. He / she should be familiar with interpretation and diagnosing all the hemodynamic and angiographic data.

The candidate must learn all the ethical, legal considerations of the invasive work and learn to use them with wisdom and discretion.

4.6 Departmental Weekly Academic Programmes

4.6.1. Journal Clubs :

Critical analysis of original research articles in Indian and International Journals, Journals from the Internet, recommendations of various committees such as the American Heart Association, American College of Cardiology etc regarding indications of various procedures.- Once a week

4.6.2. Short Reviews :

Short review of the literature on a simple specified topic, based upon the various theory papers in the examination namely Basic Sciences applied to Cardiology, Clini- cal Cardiology including Paediatric's, Diagnostic Cardiology, Intervention and Cardiac Instrumentation and recent advances in cardiology, Preventive cardiology, cardiac epidemiology and cardiac surgery. – Once a week

4.6.3. Bed-Side Clinics :

Both short cases and long cases to be taken by the candidate and presented to the consul- tants in the same pattern as examination. – Once a week

4.6.4. Cath Conference :

Complete work up of each case with ECG, X-Ray, Colour Doppler, TEE and Cardiac Cath and Angio presented to the consultants and reviewed. All diagnostic and interventional cases done in one week reviewed.

4.6.5. Session on any one of the following :

ECHO / TMT / Holter / ECG / X-Ray : - once a week

4.6.6. PG / UG Teaching programme by PG – Once a week.

4.7 POSTING & TRAINING IN OUTSIDE CENTRES

1. Paediatric Cardiology / Cardiac Imaging

The candidate should undergo one month peripheral posting in a Centre of Excellence in the field of Paediatric Cardiology & Cardiac

Imaging. The candidate will be sent to one of the following centres for a period of one month.

- a) Madras Medical mission Chennai.
- b) The Amritha Institute of Medical Sciences at Kochi
- d) Sree Chitra Thirunal Institute of Medical Sciences Trivandrum

2. Electrophysiology

The candidate should undergo one month peripheral posting in a Centre of Excellence in the field of Electrophysiology for which the candidate will be sent to one of the following institutes for the period of one month

- a) JIPMER , Puducherry

3. Cardio-thoracic and Vascular Surgery

One month of Posting in a CTVS Unit should be undertaken by the candidate at MGMCRI, Pondicherry.

Central hospital teaching sessions –

DM residents would present interesting cases in Scientific and academic forum of MGMCRI which shall be conducted once in a month.

Conferences/Workshops/ CMEs and Papers

- 1. A Resident must attend at least one conference/Workshop/CME per year.
- 2. One paper must be presented in at least 3 years.

5. LOG BOOK :

The academic port folio common to MD/MS/Super specialities as per SBVU Norms to be followed.

6. Research Activities

Paper Presentation and Publications as per SBVU Norms

7. EVALUATION :

The purpose of continuous course evaluation is mainly

- 1. To ensure the habits of regularity, punctuality and disciplined working amongst PG students.
- 2. To give periodic feedback regarding their performance during the medical course & to enable them to take corrective steps to enhance their learning in various areas mentioned. eg. Patient care, research, teaching, administration etc.

3. To monitor attainment of clinical and technical skills to ensure adequacy of training.
4. To make it available to the internal examiner at the time of final examination to discount the possibility of a single adverse performance influencing the pass or fail situation of the candidate. This would give an idea of the continued performance of the candidate during the three years of training to the external examiners, so that candidates who have otherwise been rated as satisfactory in their internal evaluation can be given more chances in the final examinations and overcome the adverse effects of doing badly in any one case.

7.1 Formative evaluation assessment will be carried out over following activities of the P.G. resident.

- Ward work.
- Case presentation
- P.G. Lecture
- Journal club
- General assessment of affective function attitude by medical & paramedical staff.

7.2 Summative Evaluation

Candidates are eligible to appear for theory examination only if they have atleast 80% attendance

Summative evaluation consists of three parts :

1. Theory
2. Clinics
3. Viva-voce
4. Dissertation

7.2.1 Theory

1. There are 4 theory papers of each 100 marks.

The components of theory is as follows

Paper I : Applied basic science – 10 Short essay questions of each 10 marks

Paper II : Clinical cardiology including Paediatric Cardiology - 10 Short essay questions of each 10 marks

Paper III: Diagnostic and Interventional Cardiology -10 Short essay questions of each 10 marks

Paper IV : Recent Advances in Cardiology - 10 Short essay questions of each 10 marks

Candidates should secure a minimum of 40 % marks in each paper with an overall average of 50%.

7.2.2 Clinics

1. Clinical examinations would consist of one long case for 100 marks and two short cases for 50 marks each and ward rounds (4 cases) for 100 marks
2. Candidate should get 50% overall for passing clinical examination

Long Case :

The candidate would have one hour time to carefully take a detailed history, and do a complete clinical examination. If there is any language problem he / she would be provided with an interpreter for the same. On the basis of the history and examination, the candidate is expected to come to a reasonable provisional diagnosis. He / she would then present the case to the examiners and after the provisional diagnosis is assessed, the candidate would be given the ECG and the X-Ray. After this he/she may be asked

to perform an echocardiographic examination of the patient or a recorded Video-Tape/ CD of the ECHO of the patient would be played and the candidate asked to interpret. In case, a cardiac catheterization and angiocardiology has been performed on the patient, the hemodynamic, oximetry and angiograms would be shown to the candidate and then asked to make a complete confirmed diagnosis. He / she would then be questioned on the management strategies and related matters.

Partial List of Long cases kept for the examination

1. Rheumatic Multivalvular Diseases.
2. Coronary Artery Disease with complications such as Ventricular aneurysm, ischemic Cardio myopathy, papillary muscle dysfunction with MR etc.
3. Congenital Cyanotic Heart Disease.

4. Congenital acyanotic Heart Disease with additional features such as ASD with MS, ASD with MR, Endocardial Cushion Defects etc.
5. Aorto arteritis with hemiplegia, renal bruits etc.
6. Hypertrophic Obstructive Cardiomyopathy.
7. Any type of heart disease with infective endocarditis.
8. Post surgical patient with complications such as Post CABG with angina, heart failure and valve dysfunction or Post Prosthetic Valve Patient with new valvular lesions etc.
9. Restrictive type of heart disease like Constrictive Pericarditis, Endomyocardial Fibrosis.
10. Coarctation of Aorta with associated abnormalities etc.
11. Ischemic cardiomyopathy

Short cases 2 : The candidate would have to present two short cases. In each, he/she has to take a short history, do a complete clinical examination and come to a reasonable provisional diagnosis. The time allotted is 30 minutes for each short case. The pattern of the examination is the same as that for the long case, except for the fact that the discussion is faster. It is generally the case that the candidate would get different categories of cases for each of the cases he/she is given for the examination. For example, a candidate is usually given one Congenital, One Rheumatic and One Coronary/Myocardial etc as long or short case. However, there is no rigid compartment that a particular case should be given as long or short case and this usually is decided by the External Examiners.

Partial List of Short Cases

1. Simple ASD, VSD, PDA etc.
2. TOF.VSD with PS or PS alone etc.
3. Multivalvular Rheumatic Heart Diseases or isolated AS, AR, MR etc.
4. Eisenmenger's Syndrome or Pulmonary Arterial Hypertension Status.
5. Complete Heart Block and Permanent pacemaker with pacemaker Dysfunction or pacemaker syndrome.
6. Ebsteins anomaly or non hypertensive TR.
7. Tricuspid Valve Disease with Rheumatic Mitral Stenosis.
8. Renovascular Hypertension
9. Cardiac Malpositions like Dextrocardia.
10. Marfan's Syndrome, Noonan's Syndrome with heart disease.
11. Aortic Aneurysms, Stable dissection of aorta.
12. Coronary Artery Disease with Carotid or Peripheral Vascular Diseases.
13. Pregnancy with Congenital or Valvular heart disease.
14. Cardiomyopathy, Atrial Fibrillation, Tachycardiomyopathy etc.
15. Post surgical patient like Post BT Shunt etc.

7.2.3 VIVA-VOCE

Oral/Viva-Voce Examination : (100 marks) The candidate may be shown ECGs, X-Rays, ECHO Pictures, CDs or Video Tapes, Angiograms CDs, Films, Hemodynamic Tracings, EP Tracings, Pacemaker Parameters or ECGs, for spot diagnosis.

This examination shall be comprehensive to test the candidates' overall knowledge of the subject.

(Candidates should secure a minimum of 50 % marks)

7.2.4 Dissertation :

All candidates admitted to D.M. course shall be assigned a topic for dissertation by the Head of the concerned unit and the title of the topic assigned to the candidate be intimated to the Controller of examinations, through the Dean, within six months after joining the course.

The assigned faculty will supervise and see that the dissertations are done properly utilizing the clinical materials of our own department / institution. The student must learn the design and interpretation of research studies, responsible use of informed consent and research methodology and interpretation of data and statistical analysis. The students should seek the help of qualified staff members in the conduct of research. They must learn to use library and computer based research. This training will help them to develop skills in planning, designing and conduct of research studies.

The dissertation should be approved and has to be forwarded to the Controller of examinations six months prior to practical examinations and it will be sent for evaluation by two external examiners.

The Dissertation would be sent for External Evaluation, in strict confidence, through the Office of The Controller of Examinations, Sri Balaji Vidyapeeth. The results of the Final Examination will be declared only following the approval of the Dissertation. In the event of the Dissertation being not approved, the results of the Final Examination would be withheld, until the Dissertation is resubmitted with the suggested corrections and final approval sought from the Examiners.

8.0 MINIMUM PASS MARKS

- 1. Theory :** Minimum of 40 % marks in each paper with an overall average of 50%.
- 2. Clinics :** Minimum 50% overall.

- 1. Viva –Voce :** Minimum of 50 %.

9. MODEL QUESTION PAPER

D.M CARDIOLOGY

PAPER-I

Basic Medical Sciences

Write short essays on the following :-

1. Coronary Collateral Circulation.
2. Hemodynamic parameters of Left Ventricular Function.
3. Gp II b/ III a receptor blocking drugs.
4. Pathology of Sudden Cardiac Death.
5. Culture-Negative Infective Endocarditis.
6. Genetics of Hypertrophic Obstructive Cardiomyopathy.
7. Homocysteine and its relation to coronary atherosclerosis.
8. Cono-Truncal Septation and the anomalies that can arise due to defective development of it.
9. Actions of Betablockers on the cardiovascular system.
10. Immunology in Cardiac Transplantation.

D.M CARDIOLOGY

PAPER-II

Clinical Cardiology including Paediatric Cardiology

Write short essays on the following :-

1. Risk stratification of long QT syndrome
2. Outline the principles and methods of assessment of operability in left to

right shunt with high pulmonary artery pressures.

3. Hypertensive Crisis.
4. Rheumatic prophylaxis.
5. Endomyocardial Fibrosis.
6. Syndrome X
7. Clinical features of acute infective endocarditis.
8. Diagnosis and management of a patient with wide QRS tachycardia.
9. Assessment of viability of myocardium
10. Risk stratification and management of persistent AF.

D.M CARDIOLOGY

PAPER III

Diagnostic and Interventional Cardiology including Cardiac

Instrumentation Time: 3 Hours

All

Questions Carry Equal marks

Max

Marks: 100 **Write short essays on the following :-**

1. Assessment and management of severe PAH in a 32 year old lady.
2. Management of ARVC
3. Myocardial Contrast Echocardiography.
4. Unprotected Left Main Angioplasty.
5. Role of FFR in PCI
6. ECHO-Planar Magnetic Resonance Imaging.

7. Vena Contracta.
8. Heart Rate variability assessment.
9. Bio-absorbable Scaffold
10. Non Surgical management of severe MR.

D.M CARDIOLOGY

PAPER IV

Recent advances in Cardiology, Cardiac Epidemiology, Preventive Cardiology and related Cardiac Surgery

Time: 3 Hours

All Questions carry equal marks

Max Marks:

100

Write short essays on the following:-

1. Cardiac Resynchronisation Therapy.
2. Epidemiology of Coronary Artery Disease in India.
3. Rheumatic Prophylaxis.
4. Arterial Switch operation.
5. Vascular remodelling.
6. Diabetic Dyslipidemia.
7. Pharmacological Defibrillation.
8. Xenotransplantation.
9. Cardiac Interventions in the foetus in utero.
10. Epidemiological Transitions.

10. CONCLUSION

1. The revised syllabus, selection, evaluation are based on the current MCI guidelines for post graduate medical education.
2. This would be subjected to further revision, based on the changes in MCI Guidelines, recommendations of the Board of Studies and compliance with other Rules and regulations as deemed appropriate