REGULATIONS AND CURRICULUM GOVERNING

M.Sc. Cardiac Catheterization & Interventional Technology

Implemented in the Academic Year 2022-23

Name of the Constituent Unit: Yenepoya School of Allied Health Sciences



Deralakatte, Mangalore, Karnataka.

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NOTIFICATION FROM THE UNIVERSITY

Sl. No.	ACM with date	Decisions/Approvals
1.	47TH ACM/ 20.06.2022	Starting of M.Sc. Cardiac Catheterization & interventional technology program under the Faculty of Allied and Healthcare Professions and approval of the Curriculum & Regulations.
2.	43rd ACM/ 07.07.2021	Approved the introduction of the Choice Based Credit System (CBCS) for the M.Sc. Cardiac Catheterization & interventional technology programme.
3.	51st ACM/ 16.05.2023	Approval of CBCS regulations: Form CIA 40% and SEE 60% to CIA 50% and SEE 50%. Minimum pass marks for CIA shall be 50% and SEE shall be 50%
4.	58th ACM/ 13.08.2024	Approved the amendment of the dissertation credit distribution from 6 credits to 12 credits.
5.	63rd ACM/ 13.05.2025	Approved the amendment on Structured continuous internal assessment components of PG dissertation

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CONTENTS

S. No.	Particulars	Page numbers
1.	Preamble	1
2.	Definitions	1
3.	Eligibility for Admission	2-4
4.	Duration of the Program	4
5.	Maximum period for completion of the Program	4
6.	Aim of the program	5
7.	Outcome of the program	5-7
8.	Program Structure	8
9.	Attendance	8
10.	Syllabus/Course Contents	8-82
11.	Teaching - Learning methods	83
12.	Scheme of Examination	84
13.	Eligibility to appear for University Examination	84-88
14.	Criteria for passing	88-90
15.	Carry over provisions	90
16.	Grading and Classification	90
17.	Journals	91

1. Preamble

Health care sector has become one of the largest employment generation sectors in India and abroad. Rapidly changing and expanding horizon of the health care sector demands formal training programs in all its Allied areas. Postgraduate Program in Allied Health sciences specialty often encompasses a wide range of disciplines. The learning during post-graduation is usually heavily research focused. Professionals in the medical field rely heavily on modern technology to successfully treat, diagnose, and care for patients. By doing post-graduation In Allied health disciplines, one will be preparing for a career as an educator, researcher, or technologist. Students may find a variety of options upon completion of post-graduation such as managing the Laboratories, Operation theatres, Radiology suites and Dialysis units. They can also join as teachers in the faculty of Allied and health professionals. They can also do research pursue doctorate in their field of interest. They can also join biomedical equipment manufacturing company and pharmaceutical company as experts in their field.

The post-graduation in CCIT will enable the candidates to develop effective technical skills & evolve into a full trained & qualified Cardiac Cath lab Technologist will be adequately equipped to provide the diagnosis based on Cardiac Catheterization. Graduates will be cognizant and responsive to the cardiovascular care of the community and possess a commitment to continuously improve knowledge and abilities. To match our education system with the international educational pattern all the postgraduate programs are with Choice Based Credit System.

2. Definitions

2.1 Academic Year:

Two consecutive (one odd + one even) semesters constitute one academic year.

2.2 Choice Based Credit System:

The CBCS provides choice for students to select from the prescribed courses (core, elective or minor or soft skill courses).

2.3 Course:

Usually referred to, as 'papers" is a component of a programme. The courses shall define learning objectives and learning outcomes. A course shall comprise lectures/ tutorials /laboratory work /fieldwork /outreach activities / project work/ vocational training/ viva/seminars/ term papers/assignments/ presentations/self-study etc... or a combination of some of these.

2.4 Credits:

Credit defines the quantum of contents/syllabus prescribed for a course and determines the number of hours of instruction required per week. Thus, normally in each of the courses, credits will be assigned on the basis of the number of lectures/tutorial laboratory work and other forms of learning required, to complete the course contents minimum of 15-week schedule: One credit=1hour of lecture per week/two hours of Laboratory or practical/three hours of clinical rotation, field work/posting. All courses need not carry the same credits.

2.5 Programs:

An educational program leading to award of a degree, diploma or certificate.

2.6 Grade Point:

It is a numerical weight allotted to each letter grade on a10 point scale.

2.7 Credit Point:

It is the product of grade point and number of credits for a course.

2.8 Cumulative Grade Point Average (CGPA):

It is a measure of overall cumulative performance of a student over all semesters. The CGPA is the ratio of total credit points secured by a student in various courses in all semesters and the sum of the total credits of all courses in all the semesters. It is expressed up to two decimal places.

2.9 Letter Grade:

It is an index of the performance of students in a said course. Grades are denoted by letters: O+, O, A+, A, B+, P, F.

2.10 Semester Grade Point Average (SGPA):

It is a measure of performance of work done in a semester. It is ratio of total credit points secured by a student in various courses registered in a semester and the total course credits taken during that semester. It shall be expressed up to two decimal places.

2.11 Transcript or Grade Card or Certificate:

Based on the grades earned, a grade certificate shall be issued to all the registered students after every semester. The grade certificate will display the course details (code, title, number of credits, grade secured) along with SGPA of that semester.

Type of Courses

2.1.2 Core course: A course that should compulsorily be studied by a candidate as a core requirement is termed as a core course. This is the core requirement to complete the M.Sc.CCIT.

2.1.3 Skill Enhancement Course: These courses are aimed at improving practical, professional & procedural knowledge requirement for carrying the highly skilled task related to the field of study.

2.1.4 Multidisciplinary Elective: Generally, a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/subject of study or which provides an extended scope or which enables an

exposure to some other discipline or subject or domain or nurtures the candidate's proficiency skill.

2.1.5

2.1.6 A candidate shall have the freedom to choose Multidisciplinary Elective courses during the academic duration of the particular PG Program offered by Yenepoya (deemed to be) University through the PG departments or SWAYAM/MOOC external online platforms or a mix of courses offered by Yenepoya(deemed to be) University and SWAYAM/MOOC as appropriate.

2.1.7

2.1.8 A candidate opting for SWAYAM/MOOC courses shall have the freedom to choose the courses of once own choice and complete such courses before appearing fourth Semester End Examination.

2.1.9 A candidate shall compulsorily submit the pass certificate of each course successfully completed to the controller of examination of Yenepoya (deemed to be) University through the proper channel before appearing the fourth semester end examination.

2.1.10 A candidate opting multidisciplinary elective courses offered by the Yenepoya (deemed to be) University through the PG departments need to take up these courses generally during second and third semesters of the program.

2.1.11 A candidate shall not take the courses offered by the department in which she/he is enrolled.

2.1.12 Registration for the multidisciplinary elective courses offered by the Yenepoya (deemed to be) University shall be at least one week prior to the commencement of the course with the CBCS coordinator. The CBCS unit shall notify the list of courses after being approved by the respective BOS. For SWAYAM/MOOC courses shall be as per the enrollment notification by the respective implementation authorities.

Yenepoya (deemed to be) University shall adapt the regulations of UGC governing SWAYAM/MOOC courses as amended from time to time.

3. Eligibility for admission:

To be eligible for admission a candidate shall have obtained a bachelor's degree in B.Sc. Cardiovascular Technology (CVT) or B.Sc. Cardiac care technology i.e. from a University established under law considered equivalent by there to Yenepoya (Deemed to be University). The candidate should have obtained a minimum of 50% aggregate of marks in all the years of university examination of degree course.

In case of ST/SC/OBC candidates, the minimum marks shall be 45%.

4.Durations of the Programme:

The duration of the programme shall extend over 4 semesters (2 academic years) of 15 weeks or more each with a minimum of 90 actual working days of instructions in each semester and 2 – 3 weeks of examinations. Successful completion will lead to master's degree in CCIT

Semester:

An academic year shall consist of two semesters:

Odd Semester 1st&3rd	September/October to February/March
Even semester 2nd&4th	March/April to August/September

5.Maximum period for completion of the programme:

A Candidate shall complete the four semesters (two years) programme within four years from the date of admission.

6.Aim of the program

The M.Sc. Cardiac Catheterization and Interventional Technology program aims to develop skilled, ethical, and research-oriented professionals with advanced knowledge in diagnostic and interventional cardiovascular procedures. The program prepares graduates to deliver safe, evidence-based, and patient-centred care in the cardiac catheterization laboratory, operate and manage advanced cath lab

technologies, adhere to radiation safety and quality standards, and contribute to clinical research, education, and leadership in cardiovascular healthcare settings.

6. Outcomes of the program:

Upon completion of the Master's program, students will be trained in wide spectrum of knowledge in various procedures in Interventional cardiac catheterization.

In particular they will:

PO 1: Attain core knowledge in cardiac catheterization and interventional techniques and procedures. (K,S)

PO 2: Acquire knowledge in cardiac catheterization technique, instrumentation and hardware's used in routine procedures in cardiac Cath lab. (K,S)

PO 3: Enhances knowledge on various Cardiovascular & systemic diseases that have influence on cardiac structure & function. (K)

PO 4: Foster diagnostic approach to cardiovascular diseases & methods to assisting in imaging of cardiac catheterization.(S,C)

Expected skill to be acquired by the end of the program**:**

PO 5: Knowledge about the basics in cardiac catheterization and intervention, clinical cardiology, biostatistics and research methodology, ethics and pedagogy.(K,S)

PO 6: Enhance the approach in cardiac Cath and intervention in IHD and VHD, cardiovascular medicine.(K,A)

PO 7: Expertise in the cardiac interventional techniques, methods of performing invasive procedures, sterility maintenance, infection control, hardware selection, and handling of a Cath lab.(S, C, A)

PO 8: To understand and interpret hemodynamic assessment, and to acquire comprehensive knowledge in the approach, diagnosis, evaluation, and interpretation of congenital heart diseases using cardiac catheterization, including catheter-based interventions for CHD and heart failure.(K,S,C)

PO 9: Expertise about methodology and interpretation of electrophysiology and

cardiac pacemakers, cardiac Cath and intervention in miscellaneous diseases.(S,C,A)

PO 10: Attain knowledge about cardiovascular surgery and recent advances in cardiac in cardiac Cath and intervention.(K,S)

Program Structure:

	Broad category of course	**Hours per week / Credits**	**Course (Title)**
1.	**Discipline-Specific Courses**		
a)	Theory	**I Semester**	
		60 Hours / 4 Credits	Basics in Cardiac Catheterization and Intervention
		60 Hours / 4 Credits	Clinical Cardiology
		45 Hours / 3 Credits	Biostatistics & Research Methodology
		II Semester	
		45 Hours / 3 Credits	Cardiac cath and intervention in Ischemic and Valvular heart disease
		45 Hours / 3 Credits	Heart Failure
		45 Hours / 3 Credits	Bioethics
		III Semester	
		60 Hours / 4 Credits	Cardiac cath and intervention in congenital heart disease
		45 Hours / 3 Credits	Electrophysiology and Cardiac Pacemakers
		45 Hours / 3 Credits	Health Care Management
		IV Semester	
		45 Hours / 3 Credits	Cardiac Catheterization and intervention in Miscellaneous Diseases
		45 Hours / 3Credits	Recent Advances in Cardiac catheterization and intervention

b)	Practical (SEC)*	-	-
c)	Clinical (SEC)*	300 Hours/ 10 Credits	Cardiac Catheterization Clinical skills - I
		240 Hours/8 Credits	Cardiac Catheterization Clinical skills - II
		300 Hours/ 10 Credits	Cardiac Catheterization Clinical skills - III
		240 Hours/ 8 Credits	Cardiac Catheterization Clinical skills - IV
2.	**Curriculum Enrichment Courses**		
a)	Research Project	12 credits	Dissertation
3.	**Electives**		
a)	Interdisciplinary Courses	90 Hours/6 Credits	Coursera/Swayam
	Total	**90 Credits**	

SEC: Skill Enhancement Course

7. Attendance

8.1 Each course (theory, practical, clinical etc.) shall be treated as an independent unit for the purpose of attendance. Candidates having minimum 80% attendance in each of the Courses can only qualify to appear for the Semester End Examination. Candidates with less than 80% of attendance shall be required to repeat that Course by attending the semester.

8.2 There shall be no provision for condonation of shortage of attendance.

8.3 For SWAYAM/MOOC/NPTEL it shall be as per the regulations governing the courses of implementing authority.

8.4 The HOD/Course Coordinator through the Dean of Faculties shall announce the names of the candidates who will not be eligible to take the Semester End-Examinations (SEE) in the various courses and send a copy of the same to the Controller of Examinations (COE) Office. Registrations of such candidates for those courses shall be treated as cancelled.

8. Syllabus/Course Content

SEMESTER I

Course Title: Basics in Cardiac Catheterization and Intervention

Course: Core

Credits: 4 **No.of Hours: 60**

Course Outcomes:

After completing this course, the students will be able to:

a) To understand the formation, circulation and supply of coronary arteries, cardiac veins and coronary sinus
b) To understand usage of Xray and interpretation of fluoroscopy and cine angiographic interpretation
c) To understand the different hardware used for various cardiovascular procedures
d) To understand the mechanism and interpretation of cardiac hemodynamics
e) Expertise about adjunctive and cardiac support devices
f) To gain knowledge on techniques of various cardiac catheterization diagnostic and interventional procedures
g) To obtain knowledge about various percutaneous approaches assessing the coronaries
h) To understand about radiation safety and protection

Unit	Hrs	Content	Must Know	Good to	Desirable to know	Weightage	Types Of Questions
I	3	**Heart and coronary anatomy for interventional cardiology** 1.1 Coronary artery and coronary sinus anatomy Cardiac chambers and peripheral anatomy	√			4 %	LE,SE
II	4	**Introduction to cardiac cath lab** 2.1 Indications and contraindications of Cardiac Cath 2.2 Complications of Cardiac Cath	√			6 %	LE,SE
III	4	**Cath lab data** 3.1 1 Hemodynamic data 3.2 Cine angiographic data 3.3 Sterile Technique and preparation	√			4 %	LE,SE
IV	4	**Equipment's in the cath lab** 4.1 X ray cine angiographic system 4.2 Physiological recorder 4.3 Digital imaging formats and archiving 4.4 Equipments for PCI 4.5 Emergency equipments	√			6 %	LE,SE

V	7	**Other adjunctive devices** 5.1 Atherectomy Device 5.2 Thrombectomy 5.3 Embolic protection device 5.4 IVUS 5.5 Doppler 5.6 Pressure Wires	√			16 %	LE,SE
VI	2	**Environmental safety in cathlab** 6.1 Blood and body fluids 6.2 Blood born viruses 6.3 Universal and standard precautions 6.4 Environmental assessment 6.5 Method of protection (Skin, Eye, Nose protection) 6.6 Radiation	√			4 %	LE,SE
VII	4	**Cine angiographic imaging, radiation safety /protection and contrast agents** 7.1 Basic X –Ray physics 7.2 Image formation 7.3 The cine fluorographic system 7.4 Image detection, processing and recordings 7.5 Image intensifier 7.6 Flat panel detectors 7.7 Biological effects of radiation 7.8 Intravascular contrast agents	√			6 %	LE,SE

	3 hrs	**Principle and catheterization laboratory equipments** 8.1 X ray cine angiographic system 8.2 Operational radiation management for patient and staff 8.3 General principle of coronary artery brachytherapy 8.4 Cath lab physiological recorders 8.5 Rotational angiography 8.6 CT angiography 8.7 MRI and angiography	√			8 %	LE,SE
IX	5 hrs	**Percutaneous approach including transeptal and apical puncture** 9.1 Catheterization via femoral artery and vein and its approach 9.2 Percutaneous Entry of the Axillary, Brachial, or Radial Arteries and its approach 9.3 Control of the puncture site following sheath removal 9.4 Lumbar Aortic Puncture 9.5 Transseptal Puncture 9.6 Apical Left Ventricular Puncture	√			8 %	LE,SE
X	6 hrs	**Angiographic techniques** 10.1 Coronary angiography 10.2 Cardiac ventriculography 10.3 Pulmonary angiography 10.4 Angiography of the aorta and peripheral artery	√			10 %	LE,SE
XI	7 hrs	**Catheterization hardwares** 11.1 Diagnostic procedures hardware's (catheters) 11.2 Therapeutic procedures hardware's (guide wires, stents and balloons) 11.3 Coronary intervention 11.4 Valvular intervention 11.5 Closure devices 11.6 Pacing devices	√			8 %	LE,SE

XII	2 hrs	**Complication** 12.1 Death 12.2 MI 12.3 Cerebrovascular complications 12.4 Local vascular complications 12.5 Arrhythmias or conduction disturbances 12.6 Perforation of the heart and great vessels 12.7 Infections and pyrogen reactions 12.8 Allergic and anaphylactoid reactions 12.9 CIN/kidney injury 12.10 Other complications	√			4 %	LE,SE
XIII	5 hrs	**Right and left heart catheterization** 13.1 indications and contraindications 13.2 hardwares and materials used 13.3 procedure 13.4 complications	√			8 %	LE,SE
XIV	4 hrs	**Other procedures** 14.1 Pericardiocentesis 14.2 Electrical cardioversion 14.3 Endomyocardial biopsy 14.4 IABP 14.5 FFR	√			8 %	LE,SE

REFERENCE BOOKS:

1. Grossman and Bairn's Cardiac Catheterization, Angiography and Intervention textbook
2. The Interventional Cardiac Catheterization handbook by Morten. J .Kern
3. Interventional Cardiology by Spencer B King

Course Title: Clinical Cardiology

Course: Core

Credits: 4 **Number of Hours: 60**

Course Outcomes:

After completing this course, the students will be able to:

a) Gain knowledge on the clinical examination of cardiac diseases.
b) understand various cardiac and non-cardiac causes of symptoms associated with cardiac diseases.
c) understand cardiovascular system examination
d) Gain knowledge on various cardiovascular drugs
e) Gain knowledge on basic and advanced cardiac life support

Course Content:

Unit	Hrs	Content	Must	Good	Desira	Weightage(%)	Types Of Questions
1	12	**History taking-Cardinal Symptoms** 1.1 Chest pain 1.2 Palpitation 1.3 Dyspnea 1.4 Fatigue 1.5 Syncope 1.6 Other cardiac symptoms -Hemoptysis -Hoarseness of voice -Cyanosis	√			8%	SA

2	4	**Measurement of arterial blood pressure** 2.1 Determinants of arterial blood pressure 2.2 Measurement of arterial blood pressure 2.3 Hypertension	√			**6%**	LE,SA
3	4	**Arterial pulse** 3.1Definition 3.2Genesis of arterial pulse and examination of arterial pulse 3.3Characteristic features of pulse in common clinical condition	√			**6%**	LE,SA
4	3	**Jugular Venous Pulse** 4.1Examination of JVP 4.2Estimation of venous pressure and JVP in disease conditions 4.3Abnormalities of the waves	√			**6%**	LE,SA

5	6	Inspection and Palpation of the Precordium 5.1 General inspection of the patient- Syndromes associated with congenital heart diseases 5.2 Examination of the chest for the shape and distended vessels 5.3 Palpation of the precordium for any tenderness 5.4 Palpation of the cardiovascular sounds, thrills and rubs 5.5 Tracheal Tug 5.6 Kinetic cardiogram	√			**8%**	SA
6	5	**Percussion of the precordium and precordial findings in**	√			**6%**	SA

		common heart diseases 6.1 Method of percussion 6.2 The scheme of percussion 6.3 Precordial findings in common heart diseases					
7	7	**Cardiac auscultation** 7.1 Principles and techniques: Sthethoscope 7.2 The heart sounds: systolic ejection sound. opening snaps, prosthetic heart sounds 7.3 Heart murmurs	√			15%	LA,SA
8	6	**Chest X-ray** 8.1 Chest X ray examination for cardiac anatomy and pulmonary vasculature 8.2 Chest X ray in valvular heart diseases 8.3 Chest X ray in congenital heart diseases	√			8%	LA,SA
9	7	**Cardiovascular Pharmacology** 9.1Mechanism of action, indication, dosage and contraindications of cardiovascular drugs: -Betablockers -Calcium channel blockers -Diuretics -Vasodilators -thrombolytic agents -atropine -Inotropic agents -antiarrhythmic drugs		√		13%	SA

10	5	**Basic life support/ACLS** 10.1 The primary and secondary approach to emergency cardiac care Pulseless VT/VF/Asystole/ Hypotension	√			8%	SA

Reference Books:

1. Braunwald's Heart Disease, A Textbook of cardiovascular medicine,11nth edition, Elsevier, 9 January 2018.
2. B. N. Vijaya Raghava Rao, Clinical examination in cardiology, Second edition,Elsevier.21 march 2017
3. R Alagappan, Manual of Practical Medicine, 6th edition, Jaypee brothers, Jan 2018

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Course Title: Research Methodology & Biostatistics

Course: Core

Credits: 3 **No of Hours: 45**

Research Methodology

Course Outcomes:

After completing this course, the students will be able to:

a) Have knowledge of process involved in Biomedical research from formulation to publication.

b) Draft a research proposal.

Course Content:

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of Question
I	2	**1. Introduction** 1.1 Need for research	✓			10%	**SE**
		1.2 Types of research	✓				
		1.3 Outlining the research process	✓				
2	2	**2. Review of Literature** 2.1 Importance, sources & steps	✓			10%	**SE**
		2.2 Critical appraisal of research article	✓				

3	2	**3. Research Design** 3.1 Types of research – Qualitative & Quantitative	✓			10%	**LE,SE**
		3.2 Experimental & Non Experimental, Survey – advantages & disadvantages	✓				
4	2	**4. Research Process** 4.1 Framing a research question	✓			15%	**LE,SE**
		4.2 Research title	✓				
		4.3 Aim & Objectives, Assumptions, Limitations & Delimitations, Variables	✓				
		4.4 Hypothesis – formation & testing	✓				
5	2	**5. Data collection & analysis** 5.1 Data sources, technique of data collection, tools	✓			20%	**LE,SE**
		5.2 Reliability & validity	✓				
		5.3 Process of data collection	✓				
		5.4 Pilot study – method, need	✓				
6	2	6. **Interpretation& presentation of data**	✓			15%	**LE,SE**
		6.1 Qualitative & quantitative analysis					
		6.2 Graphical representation of data	✓				
		6.3 Conclusion & discussion	✓				
7	**2**	Discussion, Conclusion and References	✓			10%	**SE**
8	**2**	Essentials of writing a research paper along with process of publication	✓			10%	**LE**

Biostatistics

Course Outcomes:

After completing this course, the students will be able to:

a. Understand Statistical Terms.

b. Possess Knowledge and Skill in the use of Basic Statistical and Research Methodology.

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of Question
1	6	**1. Introduction** 1.1 Introduction to biostatistics &research methodology, types of variables &	✓			5%	**LE,SE**
		scales of measurements, measure of central tendency & dispersion, rate, ratio, proportion, incidence & prevalence					

2	3	2. **Sampling** 2.1 Population & Sample, Sampling and non-sampling errors and methods of minimizing these errors, Random and non-random sampling, different sampling techniques – simple random, stratified, systematic, cluster& multistage.	✓			10%	**LE,SE**
3	3	3. **Sampling distributions** 3.1 Parameter and Statistic. Standard error. Basic probability distributions - Normal, poison, binomial distributions with their applications in biological sciences.	✓			5%	**SE**
4	6	**4. Tests of significance** 4.1 Basics if testing of hypothesis – Null & Alternative hypothesis, type 1 and type II errors, level of significance (parametric) & power of the tests, p value, Confidence interval. Tests of significance – T test	✓			15%	**LE,SE**

		(paired &UN paired), Chi square test & Test of proportion, One way analysis of variance. Repeated measures analysis of variance. Tests of significance (non-parametric) – Mann – Whitney U Test, Wilcoxon Test, Kruskal – Wallis Analysis of variance, Friedmann's Analysis of variance					
5	3	**5. Correlation and regression** 5.1 Linear correlation by Karl Pearson and rank order correlation due to Spearman, Testing the significance of correlation co efficient, simple linear regression – estimation & testing, residual plots, multiple linear regression.	✓			**15%**	**LE**
6	2	**6.** Sample size determination **6.1** General concept. Sample size for estimating means and proportion, testing of difference in means and proportions of two groups.	✓			**5%**	**SE**

7	2	**7. Study designs** 7.1 Epidemiological methods – case series analysis and prevalence studies. Analytical epidemiological methods – case control and cohort studies. Clinical trials / intervention studies, odds ratio and relative risk, stratified analysis	✓			**10%**	**SE**
8	2	**8. Multivariate analysis** 8.1 Concept of multivariate analysis, introduction to logistic regression and survival analysis	✓			**15%**	**LE,SE**
9	1	**9. Reliability and validity of diagnostic tests** 9.1 Sensitivity, Specificity, Positive Predictive Value (PPV), Negative Predictive Value (NPV), ROC curve.	✓			**10%**	**LE,SE**

10	1	**10. Format of scientific documentations** 10.1 Structure of research protocols, structure of thesis/research report, formats of reporting in scientific journals. Systematic review and meta-analysis.	✓			**10%**	**LE,SE**

Reference Books:

1. Rao NSN: Applied statistics in health sciences, JP publishers
2. Mahajan B.K: Methods of biostatistics, Kothari book depot, A.D Marg, Bombay
3. Potti L.R: A text book of statistics, Yamuna publications, Sreekanteshwaram,
4. Trivandrum.
5. Lancaster H.O: Introduction to medical statistics, Johnwiley & sons, New York.
6. Leius A.E: Biostatistics, Reinhold publishing Co, New York.
7. Cotton T: Statistics in medicine, Little Brown & Co, Boston.
8. Hill A.B: Principles of medical statistics, Oxford University press, New York

Course Title: Cardiac catheterization Clinical Skills Paper I

Course: SEC

Credits: 10 **No. of Hours: 300**

Course Outcomes:

- To advance in cardiac catheterization technique, instrumentation and hardware's used in routine
- procedure in Cath lab
- Clinical findings of various cardiovascular diseases and the different imaging modalities used to diagnose and treat the conditions.

Course Content:

Unit	Hrs	Content	Must Know	Good to know	Desirable to know	Weightage	Type of questions
I	50	**Introduction to cardiac Cath lab** 1.1 Coronary artery and coronary sinus anatomy 1.2 Cardiac chambers and peripheral anatomy 1.3Indications, contraindication and Complications of cardiac Cath 1.4 Hemodynamic and cine angiographic data 1.5 X ray system and digital imaging formats 1.6 Sterile techniques and preparation 1.7 Image detection, processing and recordings 1.8 Radiation protection	√			**16%**	
II	50	**Complications of cardiac catheterization** 2.1 Death 2.2 MI 2.3 Cerebrovascular complications 2.4 Local vascular complications 2.5 Arrhythmias or conduction disturbances 2.6 Perforation of the heart and great vessels 2.7 Infections and pyrogen reactions 2.8 Allergic and anaphylactoid reactions 2.9 CIN/kidney injury 2.10 Other complications	√			**16%**	
III	50	**Percutaneous approach techniques** 3.1 Catheterization via femoral artery and vein and its approach 3.2 Percutaneous Entry of the Axillary, Brachial, or Radial Arteries and its approach 3.3 Control of the puncture site	√			**16%**	

		following sheath removal 3.4 Lumbar Aortic Puncture					
		3.5 Transseptal Puncture Apical Left Ventricular Puncture					
I V	50	**Angiographic techniques** 4.1 Coronary angiography 4.2 Cardiac ventriculography 4.3 Pulmonary angiography 4.4 Aortic angiography of the aorta 4.5 Peripheral angiography 4.6 Right heart catheterization 4.7 left heart catheterization	√			**16%**	
V	50	**Catheterization hardwares for various interventions** 5.1 diagnostic hardwares (sheath, wires, catheters) 5.2 therapeutic hardwares (wires, catheters, balloons and stents) 5.3 Coronary intervention hardwares 5.4 Valvular intervention hardwares 5.5 Hardwares for closure and pacing devices	√			**16%**	
V I	50	**Other adjunctive devices and procedures** 6.1 Atherectomy Device 6.2 Thrombectomy 6.3 Embolic protection device 6.4 IVUS 6.5 FFR 6.6 Pressure Wires 6.7 Pericardiocentesis 6.8 Electrical cardioversion 6.9 Endomyocardial biopsy 6.10 IABP	√			**16%**	

SEMESTER II

Course Title: Cardiac Catheterization and Intervention in IHD and VHD

Course: Core

Credits: 3 **No of Hours: 45**

Course Outcomes:

a) After completing this course students will be able to:

b) Acquire knowledge in the following aspects:

c) Gain knowledge on detection of coronary artery disease

d) To understand the various complications of myocardial infarction

e) To understand the etiology and pathophysiology of each Valvular heart disease

f) To understand relevant screening and / or diagnostic tests with clinical findings appropriate for cardiovascular risk stratification

g) To understand the importance of myocardial viability in patients who require cardiac revascularization

Course Content:

Unit	Hrs	Content	Must Know	Good to	Desirable to	Weightage	Types Of Questions
I	1hrs	**Understanding coronary circulation** 1.1 Pathogenesis of atherosclerotic plaques 1.2 Abnormalities of coronary perfusion 1.3 Anomalies of the Coronary circulation	√			4 %	LE,SE

II	1 hrs	**Angiographic technique during PCI** 2.1 Femoral and radial or brachial approach 2.2 Adverse effect of coronary angioplasty	√			4 %	LE,SE
III	1 hrs	**ACUTE MYOCARDIAL INFARCTION** 3.1 Pathophysiology and definition 3.2 Differential diagnosis 3.3 Diagnostic testing	√			4%	LE,SE
IV	3 hrs	**Coronary angiogram and angioplasty interpretation** 4.1 Wall motion scoring 4.2 Global ventricular function 4.3 Views and quantification of stenosis 4.4 Coronary collaterals 4.5 Coronary vasospasm 4.6 Myocardial bridge 4.7 Common angiographic views for coronary angioplasty 4.8 Angiographic TIMI classification of blood flow 4.9 Angiographic classification of collaterals flow 4.10 Assessment of coronary stenosis 4.11 Myocardial blush grades 4.12 Coronary lesion description for angioplasty 4.13 Problem and solution in the interpretation of coronary angiogram	√			10%	LE,SE
V	3 hrs	**Complications of MI** 5.1 Mechanical Complications 5.2 VSR 5.3 MR 5.4 Cardiac rupture 5.5 Pseudoaneurysm 5.6 LV pump failure and cardiogenic shock 5.7 RV failure 5.8 Ventricular aneurysm	√			8%	LE,SE

		5.9 Dynamic LVOT obstruction 5.10 Complications of arrhythmias 5.11 Ischemic complications 5.12 Embolic complications 5.13 Pericarditis					
VI	3 hrs	**Complications of pci** 6.1 MI during PCI 6.2 Abrupt vessel closure after PCI 6.3 Intracoronary thrombus 6.4 Dissection 6.5 Hypotension 6.6 Arrythmia 6.7 Peripheral vascular complication 6.8 No flow/slow flow 6.9 No Reflow phenomena 6.10 Stent thrombosis 6.11 Complication related to radiographic contrast media	√			8%	**LE,SE**
VII	2 hrs	**Post mi risk stratification and management** 7.1 Risk stratification 7.2 Therapy after MI 7.3 CABG after MI 7.4 Secondary prevention 7.5 Prevention of SCD after MI 7.6 Therapy and prevention after hospital treatment	√			4%	**LE,SE**
VIII	4 hrs	**Non-balloon pci devices** 8.1 Rotational ablation catheters 8.2 Directional coronary atherectomy 8.3 Thrombus aspiration system 8.4 Embolic protection devices 8.5 Cutting balloons 8.6 Restenosis and Brachytherapy	√			8%	**LE,SE**

IX	4 hrs	**Difficult situation in pci and strategies** 9.1 Side branch and bi-furcation stenosis and approach 9.2 Eccentric stenosis 9.3 Severe calcific stenosis 9.4 Ostial lesions 9.5 Total coronary occlusion 9.6 Multivessel PCI 9.7 IMA PCI 9.8 PCI for bypass graft 9.9 PCI for unstable angina and acute MI 9.10 PCI for cardiogenic shock	√			8%	**LE,SE**
X	2 hrs	**HIGH RISK PCI** 10.1 Identifying the high-risk PCI patient 10.2 ACC/AHA lesion classification 10.3 Patient related and clinical risk factors 10.4 Risk reduction and support of the high-risk PCI 10.5 Management of complication	√			8%	**LE,SE**
XI	2 hrs	**Pathogenesis, pathology of VHD and rheumatic fever** 11.1 Classification of VHD 11.2 AV Valves 11.3 Semilunar valves 11.4 Endocarditis 11.5 Myocarditis 11.6 Pericarditis 11.7 Diagnosis, Pathogenesis and pathology	√			6%	**LE,SE**

Unit XII	6 hrs	**Mitral and aortic valve stenosis and regurgitation** 12.1 Normal mitral valve and pathological features 12.2 Findings in ECG, X-ray 12.3 Symptoms and complications in MS, MR, AS, AR 12.4 Angiographic assessment and hemodynamic findings 12.5 Differential diagnosis 12.6 Chronic and acute MR, AR 12.7 Mitral valve prolapse and its role in cardiac Cath	√			16%	**LE,SE**
Unit XIII	3 hrs	**Pulmonic and tricuspid valve disease** 13.1 Normal pulmonary valve and pathological features 13.2 Findings in ECG, X-ray 13.3 Symptoms and complications in PS, TS 13.4 Cardiac Cath and selective angiography 13.5 Angiographic assessment	√			6%	**LE,SE**
Unit XIV	4 hrs	**Calculation of stenotic valve orifice area, hemodynamics in valvular heart diseases and angiography in prosthetic valves** 14.1 The Gorlin formula 14.2 Calculation of mitral valve area and its pitfalls 14.3 Calculation of aortic valve area and its pitfalls 14.4 Valve resistance 14.5 Alternatives to Gorlin formula 14.6 Pressure tracings 14.7 Pullback techniques and its pressure tracing interpretation 14.8 Angiography in prosthetic valves	√			6%	**LE,SE**

Unit XV	6 Hrs	**Balloon mitral, aortic, pulmonary and tricuspid valvuloplasty** 15.1 Indications 15.2 Contraindications 15.3 Complications and management 15.4 Patient selection and procedure 15.5 Balloon selection and technique	√			8%	**LE,SE**

Reference Books:

- Grossman & Bairn's Cardiac Catheterization, Angiography, and Intervention textbook
- The interventional cardiac catheterisation handbook by Morten. J. kern
- Interventional cardiology by Spencer B king

YENEPOYA
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Course Title: Heart Failure

Course: Core

Credits: 3 **Number of Hours: 45**

- **Course Outcomes:**

At the end of the course, students will be able to:

a) Understand the pathophysiology of heart failure
b) Possess Knowledge on clinical assessment of heart failure
c) Understand the various etiologies of heart failure
d) Understand the management of heart failure.

- **COURSE CONTENT:**

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Types Of Questions
1	5hrs	**Mechanisms of cardiac contraction and relaxation** 1.1 The cardiac cycle 1.2 Contractility versus loading conditions 1.3 Starling's law of the heart 1.4 Wall stress 1.5 Heart rate and force-frequency relastionship 1.6 Myocardial oxygen uptake 1.7 Measurement of contractile function 1.8 LV,RV and atrial function		√		9%	SA
2	9hrs	**Pathophysiology and Clinical assessment of heart failure** 2.1 Pathogenesis 2.2 HF as a progressive model 2.3LV remodeling 2.4 HF definition 2.5 clinical assessment of HF 2.6 the medical history and physical examination	√			20%	LE,SA

		2.7 Routine assessment 2.8 Risk score for prognosis 2.9 Right heart catheterization 2.10 Endomyocardial biopsy 2.11 Cradiopulmonary exercise testing 2.12 Imaging modality in diagnosis and management					
3	7hrs	**ETILOGY OF HEART FAILURE** 3.1 Ischemic heart diseases 3.2 Valvular heart diseases 3.3 Hypertensive heart diseases 3.4Cardiomyopathies- DCM, HCM, RCM 3.5 Congenital Heart Diseases	√			15%	LE,SA
4	4hrs	**HEART FAILURE IN INFANTS** 4.1 Etiology 4.2 Pathophysiology 4.3 Clinical evaluation 4.4 Diagnosis 4.5 Management	√			7%	LE,SA
5	4hrs	**DIAGNOSIS AND MANAGEMENT OF ACUTE HEART FAILURE** 5.1 Epidemiology 5.2 Pathophysiology 5.3 Evaluation 5.4Managemnet		√		7%	SA
6	9hrs	**HEART FAILURE WITH REDUCED EJECTION FRACTION** 6.1 Epidemiology 6.2 Etiology 6.3 pathophysiology 6.4 Prognosis 6.5 Approach and management	√			20%	LE,SA

7	4hrs	**HEART FAILURE WITH PRESERVED EJECTION FRACTION**	√			7%	LE,SA
		7.1 Epidemiology 7.2 Etiology 7.3 pathophysiology 7.4 Prognosis 7.5 Approach and management					
8	8hrs	**MANAGEMENT OF HEART FAILURE** 8.1 Devices for monitoring and managing heart failure - ventricular dyssynchrony - Device therapy(CRT, ICD) 8.2 Surgical management of heart failure - LV reconstruction - Cardiac transplantation 8.3 Mechanical circulatory support - Indications - Patient selection	√			15%	LE,SA

Recommended Books:

- Braunwald's Heart Disease, A Textbook of cardiovascular medicine,11nth edition, Elsevier,9 January 2018
- Brain Griffin, Manual of cardiovascular medicine, 9th edition

Course Title: Bioethics

Course: Core

Credits: 3 **Number of Hours: 45**

Course Outcomes:

a) Locate the importance of bioethics in health care and research
b) Understand the ethical principles and theories
c) Identify ethical issues in healthcare setting and their possible solutions
d) Analyse the ethical issues in specific clinical settings
e) Apply ethical principles in clinical research
f) Locate the importance of healthcare provider- patient relationship

- **Course Content:**

Unit	Hrs	Content	Must Know	Good to	Desirable to Know	Weightage (%)	Type of Questions
I	5	**Introduction to bioethics** 1.1 Definition and scope of bioethics	√			10	LE, SE
		1.2 History of bioethics		√			
		1.3 Codes of ethics	√				
II	5	**Ethical principles and theories** 2.1 The ethical principles	√			30	LE, SE
		2.2 Ethical theories and their	√				

		2.3 Application of ethical theories and principles in healthcare	√				
III	10	**Ethics in healthcare** 3.1 Consent	√			20	LE, SE
		3.2 Risk: benefit analysis	√				
		3.3 Distributive justice		√			
		3.4 Privacy and confidentiality	√				
		3.5 Stigma and discrimination		√			
		3.6 Health technology assessment			√		
		3.7 Public health ethics			√		
IV	15	**Specific ethical issues in healthcare** 4.1 End of life care and euthanasia	√			10	SE
		4.2 Artificial reproductive techniques			√		
		4.3 Medical termination of pregnancy		√			
		4.4 Pre-natal sex determination		√			
		4.5 Organ donation		√			
		4.6 Medical errors and truth telling	√				
		4.7 Medical negligence and malpractice	√				
V	10	**Research ethics** 5.1. Research ethics principles	√			30	LE, SE
		5.2. Informed consent	√				
		5.3. Vulnerability in research	√				
		5.4. Responsible conduct of research	√				
		5.5. Publication ethics	√				

Reference Books:

- English DC. Bioethics a Clinical Guide for Medical Students.
- Tayaoe M.C. Textbook of Medical Bioethics, Attitude and Communication for Medical Students; 2016 Feb 28
- Princy Louis Palatty. A Textbook of Bioethics for Healthcare Professionals 1st Edition; 2018

Course Title: Cardiac catheterization Clinical Skills

Paper II

Course: SEC

Credits: 8 **Number of Hours: 240**

Course Outcomes:

- Evaluation of patients with IHD/VHD
- Evaluation and severity assessment of valvular lesion and interventions

Course Content:

Unit	Hrs	Content	Must Know	Good to	Desirable to	Weightage	Types Of Questions
I	26	**ANGIOGRAPHIC TECHNIQUE DURING ACUTE MI** 1.1 Femoral and radial or brachial approach 1.2 Adverse effect of coronary angioplasty 1.3 Differential diagnosis and Diagnostic testing	√			**11%**	

II	26	**CORONARY ANGIOGRAM AND ANGIOPLASTY INTERPRETATION** 2.1 Wall motion scoring and Global ventricular function 2.2 Views and quantification of stenosis 2.3 Coronary collaterals and Angiographic classification of collaterals flow 2.4 Myocardial bridge and coronary vasospasm 2.5 Angiographic TIMI classification of blood flow 2.6 Assessment of coronary stenosis and Coronary lesion for angioplasty 2.7 Myocardial blush grades	√			**11%**	
III	26	**COMPLICATIONS OF MI** 3.1 Mechanical Complications, VSR, MR, Cardiac rupture, Pseudoaneurysm, RV failure, LV pump failure and cardiogenic shock, Ventricular aneurysm, Dynamic LVOT obstruction, Complications of arrhythmias, Ischemic complications, Embolic complications, Pericarditis	√			**11%**	
IV	26	**COMPLICATIONS OF PCI** 4.1 MI during PCI, Abrupt vessel closure after PCI, Intracoronary thrombus, Dissection, Hypotension, Arrythmia, Peripheral vascular complication, no flow/slow flow, No reflow phenomena, stent thrombosis and complications related to radiographic contrast media	√			**11%**	

V	26	**NON-BALLOON PCI DEVICES** 5.1 Rotational ablation catheters, Directional coronary atherectomy, Thrombus aspiration system, Embolic protection devices, Cutting balloons, Restenosis and Brachytherapy	√			**11%**	
VI	26	**DIFFICULT SITUATION IN PCI AND STRATEGIES** 6.1 Side branch and bifurcation stenosis and approach, Eccentric stenosis, Severe calcific stenosis, Ostial lesions, Total coronary occlusion, Multivessel PCI, IMA PCI, PCI for bypass graft, unstable angina, acute MI and cardiogenic shock.	√			**11%**	
VII	26	**ASSESSMENT AND TREATMENT OF VHD** 7.1 Angiographic assessment, differential diagnosis and hemodynamic findings of MS, MR, AS, AR, TS, PS	√			**11%**	
VIII	26	**CALCULATION OF STENOTIC VALVE ORIFICE AREA, HEMODYNAMICS IN VALVULAR HEART DISEASES** 8.1 The Gorlin formula, Calculation of mitral and aortic valve area and its pitfalls, Valve resistance, Pressure tracings, Pullback techniques and its pressure tracing interpretation, Angiography in prosthetic valves	√			**11%**	
IX	32	**BALLOON MITRAL, AORTIC, PULMONARY AND TRICUSPID VALVULOPLASTY** 9.1 Indications, Contraindications, Complications and management, Patient selection and procedure, Balloon selection and technique	√			**12%**	

SEMESTER III

Course Title: Cardiac Catheterization and Intervention in Congenital Heart Diseases

Course: Core

Credits: 4 **Number of Hours: 60**

Course Outcomes:

After completing this course students will be able to:

a) Describe the approach to imaging of congenital heart disease

b) Explain the hemodynamics of each acyanotic congenital heart disease

c) Explain the hemodynamics of each cyanotic congenital heart disease

d) Describe the diagnosis of congenital heart diseases and its therapeutic treatment and intervention in cardiac Cath lab.

Course Content:

Unit	Hrs	Content	Must Know	Good to	Desirable to	Weightage	Types Of Questions
Unit I	4	**GENERAL PRINCIPLE IN THE CATHETERISATION OF PATIENTS WITH CHD** 1.1 Vascular access/vessel and chamber entry 1.2 Intracardiac catheter manipulation 1.3 Pressure measurements and oximetry 1.4 Angiographic projections in CHD	√			4%	LE,SE

II	5	**Special circumstances** 2.1 Pregnancy 2.2 Pulmonary Ventricular Failure and 2.3 Pulmonary Vascular Disease 2.4 Down Syndrome 2.5 Right Ventricular Outflow Failure 2.6 Cyanosis 2.7 Systemic Ventricular Heart Failure 2.8 Coronary Artery Disease	√			4%	LE,SE
III	5	**Pressure measurements** 3.1 Definitions of Terms Relevant to the Pressure measurement 3.2 Pressure measuring devices 3.3 The electrical strain gauges 3.4 Pressure transducer system in Cath lab 3.5 Physiological characteristics of pressure waveform 3.6 Normal counters of pressure waveforms 3.7 Sources of error and artifacts 3.8 Micromanometers	√			8%	LE,SE
IV	3	**Blood flow measurement: cardiac output and vascular resistance** 4.1 Cardiac output 4.2 Techniques for determining of cardiac output 4.3 Clinical measurements of vascular resistance	√			8%	LE,SE
V	5	**SHUNT DETECTION AND QUANTIFICATION** 5.1 Detection of left to right intracardiac shunts 5.2 Oximetry run 5.3 Step-up and step-down of oxygen saturation 5.4 Calculation of pulmonary blood flow and resistance (QP and PVR) 5.5 Calculation of systemic blood	√			8%	LE,SE

		flow and resistance (QS and SVR) 5.6 Flow ratio 5.7 Calculation of bidirectional shunt 5.8 limitations of oximetry method 5.9 Detection of right to left intracardiac shunts				6%	
VI	3	**Indications for CHD** 6.1 Guidelines for diagnostic cardiac cath in CHD 6.2 Angiography in CHD	√			6%	**LE,SE**
VII	5	**Septal defects** 7.1 Atrial septal defects 7.2 Atrioventricular septal defects 7.3 Ventricular septal defects	√			8%	**LE,SE**
VIII	5	**Arterial abnormalities** 8.1 Patent ductus arteriosus 8.2 AP window 8.3 Anomalies of the coronary vessels and the aortic root 8.4 Vascular anomalies 8.5 Aortic arch anomalies	√			8%	**LE,SE**
IX	4	**Venous abnormalities** 9.1 Anomalies of pulmonary veins 9.2 Abnormal systemic venous connection	√			6%	**LE,SE**

X	6	**RV and pulmonary outflow abnormalities** 10.1 Pulmonary atresia and intact ventricular septum 10.2 Pulmonary atresia and VSD 10.3 TOF 10.4 Truncus arteriosus 10.5 Tricuspid atresia	√			8%	**LE,SE**
XI	4	**LV outflow abnormalities** 11.1 CoA 11.2 HLHS	√			8%	**LE,SE**
XII	4	**TGA AND CCTGA** 12.1 Morphology and types 12.2 indications and contraindications 12.3 Diagnostic cath and hardwares 12.4 procedure 12.5 complications	√			6%	**LE,SE**
XIII	4	**DORV and DOLV** 13.1 Morphology and types 13.2 indications and contraindications 13.3 Diagnostic cath and hardwares 13.4 procedure 13.5 complications	√			6%	**LE,SE**
XIV	5	**Univentricular atrioventricular connection** 14.1 Morphology and types 14.2 indications and contraindications 14.3 Diagnostic cath and hardwares 14.4 procedure 14.5 complications	√			6%	**LE,SE**

Reference Books:

1. Moss and Adams. Heart Disease in Infants & children 9th edition
2. Myung K Park. Park's Pediatric Cardiology for practitioners. Elsevier India published in2014
3. Text book of interventional cardiology by TOPAL
4. Manual of cardiovascular medicine by Brian P Griffin.

Electrophysiology and Cardiac Pacemakers

Course: Core

Credits: 3 **Number of Hours: 45**

Course Outcomes:

At the end of the course, student would gain knowledge and understand about :

a) The technical aspect of cardiac pacemakers.
b) Various diagnostic modalities used to detect arrhythmias.
c) The technical aspects of ICD.
d) The technical aspect of CRT.
e) The post procedural programming and analysis of pacemakers, ICD and CRT on follow-up.

Course Content:

Unit	Hrs	Content	Must Know	Good to	Desirable	Weightage	Types Of Questions
I	7	**Unit 1**: Diagnosis of cardiac arrhythmias 1.1 Holter 1.2 Exercise stress test 1.3 HR variability 1.4 QT depression and SAECG 1.5 Head up tilt test		√		20%	LE,SE

II	10	ELECTROPHYSIOLOGY STUDIES 2.1 Introduction 2.2 Indications 2.3 Equipment and setting 2.4 Techniques and procedures 2.5 Atrial stimulation 2.6 Ventricular stimulation 2.7 Induction of ventricular fibrillation 2.8 Use of cardioactive drugs during Ep's 2.9 Ablation therapy and mapping 2.10 INTERPRETATION OF FINDINGS IN EP 2.10.1 Bradyarrhythmia evaluation 2.10.2 SVT evaluation 2.10.3 Evaluation of accessory pathways 2.10.4 Ventricular tachycardia evaluation	√			20%	LA.SE
III	10	Unit – 3: Cardiac Pacing 3.1 Basic components of cardiac pacemakers 3.2 Pacemaker classification 3.3 Indications for pacemaker implantation(guidelines) 3.4 Physiology of cardiac pacing 3.5 Pacemaker timing cycles and intervals	√			20%	
		3.6 Rate adaptive pacing 3.7 Automatic mode switching 3.8 Basic pacing modes 3.9Biventricular pacing 3.10 PPI- pertinent issues for the physician 3.11 Common pacemaker problem 3.12 Pacemaker system malfunction 3.13 Common issues for the patient with PPI 3.14 Evolving indications for pacemakers and future directions					LA,SE

IV	10	Unit -4 Anti-tachycardia devices 4.1 ICD components 4.2 Indications and contraindications (guidelines) 4.3 Implantation procedure 4.4 Device replacement 4.5 Tachycardia detection and therapy 4.6 Bradycardia detection and therapy 4.7 Magnet function 4.8 Device-device interaction	√			20%	LA, SE
V	8	Unit -5 Cardiac Resynchronization therapy 5.1 Introduction 5.2 Mechanism of LV dyssynchrony 5.3 Types of LV dyssynchrony 5.4 Role of CRT 5.5 Current guidelines 5.6 Implantation procedure	√			20%	LA

Recommended Books:

- Brain Griffin, Manual of cardiovascular medicine, 9th edition
- Eric J. Topal, Textbook of Cardiovascular medicine, 5th edition

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Course Title: Health Care Management

Course: Core

Credits: 3 **Number of Hours: 45**

Course Outcome:

- Concepts of Hospitals The student will gain knowledge about hospital administration & planning.
- Workflow in hospitals - Enumerate and identify various Clinical Services like OPD, IPD, ward Management, OT, Emergency, disaster Management and ICU.
- Organizational Structures - To learn to meet special challenges posed by human behavior in workplace of 21st century
- Quality management - To create an awareness about the process of applying for and implementing various accreditation process in healthcare facilities.

Course Content:

Unit	Hrs	Content	Must Know	Good to	Desirable to Know	Weightage	Type of Questions
I	4	**Hospital Structure** 1.1. Introduction to Hospitals, Healthcare & Medical Care, Rationale of Hospital Administration	√			5	SE
		1.2. History of Hospitals, Public Health Delivery system in India, Types of Hospitals, Voluntary Health Organizations			√		
II	8	**Management of Healthcare Organizations** 2.1 Introduction to Management	√			20	LE, SE

		2.2 Evolution & Theories of Management		√			
		2.3 Management Funcions: Planning	√				
		2.4 Organizing	√				
		2.5 Controlling	√				
		2.6 Decision Making	√				
		2.7 Staffing	√				
		2.8 Techniques in Management	√				
III	7	**Organizational Behavior** 3.1 The Importance of Interpersonal Skills, Scope & Process of OB Structure & theories	√			15	LE, SE

		3.2 Motivation - Abraham Maslow's hierarchy of needs theory, Theory X & Y. Contemporary theories of motivation.	√				
		3.3 Foundations of Group Behavior – Formal Vs Informal, Social Identity Theory		√			
		3.4 Organizational Culture		√			
		3.5 Communications in an Organization	√				
IV	7	**Management and Health Economics** 4.1 Demand & Supply	√			20	LE, SE
		4.2 Nature of Costs	√				
		4.3 Marginal cost and breakeven analysis	√				
		4.4 Market structure: Business & Government, Role of Government	√				
V	7	**Accounting for Hospital Management** 5.1 Budgeting & Budgetary control - Classification of budget, P & L, Balance Sheets	√			20	LE, SE
		5.2 Types of Accounts, Debit & Credit	√				
		5.3 Financial Statement Analysis	√				
VI	7	**Concept of Hospital** 6.1 Departmentation in Hospital	√			10	SE
		6.2 Outpatient, Inpatient Services	√				
		6.3 Intensive Care Unit, Emergency Services	√				
		6.4 Laboratory, Radiology	√				

		6.5 Organizing of support services, Utility Services	√				
		6.6 Evaluation of Hospital services – Hospital Statistics	√				
		6.7 Hospital Information Systems - Issues related to Healthcare technology, Planning, Infrastructure	√				
VII	5	**Evolution of Quality management** 7.1 Quality Management Tools & methods	√			10	SE
		7.2 Quality certification & Accreditation – NABH, NABL	√				

Recommended Books:

- Prasad LM. Principles and practice of management. Sultan Chand & Sons; 2020 Oct 1.
- Robbins SP, Judge TA, Vohra N. Organizational behaviour by Pearson 18e. Pearson Education India; 2019.
- Sakharkar B. M. Hospital planning & administration. Jaypee Brothers Medical Publishers Pvt. Limited, 2008 Dec 1.
- Francis CM, De Souza MC. Hospital administration. Jaypee Brothers Medical Publishers; 2000.
- Kulkarni GR, Satyashanker P, Anil Gomes L. Financial management for hospital administration. Jaypee Brothers Medical Publishers Pvt. Limited, 2009

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Course Title: Cardiac catheterization Clinical Skills

Paper III

Course: SEC **Course Code: AH02CC3P1**

Credits: 10 **Number of Hours: 300**

Course Outcome:

- Understand the approach to imaging of congenital heart disease
- Understand the hemodynamics of each acyanotic congenital heart disease
- Gain knowledge on the hemodynamics of each Cyanotic congenital heart disease
- To understand the diagnosis of congenital heart diseases and its therapeutic treatment and intervention in cardiac Cath Lab
- Students will be allowed to assist in intervention associated with ASD, VSD, PDA device closure, CoA stenting, Balloon aortic valvuloplasty and balloon pulmonary valvuloplasty independently under the supervision of the faculty to develop the skill and experience.
- Students will be posted in the cardiac catheterization laboratory for the observation and to develop practice in assisting the diagnostic investigation and therapeutic procedures in various congenital heart disease by cardiac catheterization.

Course Content:

Unit	Hrs	Content	Must Know	Good to	Desirable to	Weightage	Types Of Questions

I	20	GENERAL PRINCIPLE IN THE CATHETERISATION OF PATIENTS WITH CHD 1.1 Vascular access/vessel and chamber entry 1.2 Intracardiac catheter manipulation 1.3 Pressure measurements and oximetry 1.4 Angiographic projections in CHD	√			6%	
II	20	PRESSURE MEASUREMENTS 2.1 Pressure measuring devices 2.2 The electrical strain gauges 2.3Pressure transducer system in Cath lab 2.4 Physiological characteristics of pressure waveform 2.5 Normal counters of pressure waveforms 2.6 Sources of error and artifacts 2.7 Micromanometers	√			6%	
III	20	BLOOD FLOW MEASUREMENT: CARDIAC OUTPUT AND VASCULAR RESISTANCE 3.1 Cardiac output 3.2 Techniques for determining of cardiac output 3.3 Clinical measurements of vascular resistance	√			6%	

IV	20	SHUNT DETECTION AND QUANTIFICATION 4.1 Detection of left to right intracardiac shunts 4.2 Oximetry run 4.3 Step-up and step-down of oxygen saturation 4.4 Calculation of pulmonary blood flow and resistance (QP and PVR) 4.5 Calculation of systemic blood flow and resistance (QS and SVR) 4.6 Flow ratio 4.7 Calculation of bidirectional shunt 4.8 limitations of oximetry method 4.9 Detection of right to left intracardiac shunts	√			6%	
V	20	SEPTAL DEFECTS 5.1 Atrial septal defects 5.2 Atrioventricular septal defects 5.3 Ventricular septal Defects	√			6%	
VI	20	ARTERIAL ABNORMALITIES 6.1 Patent ductus arteriosus 6.2 AP window 6.3 Anomalies of the coronary vessels and the aortic root 6.4 Vascular anomalies 6.5 Aortic arch anomalies	√			6%	

VII	20	VENOUS ABNORMALITIES 7.1Anomalies of pulmonary veins 7.2Abnormal systemic venous Connection	√			6%	
VIII	20	TRICUSPID ATRESIA	√			6%	
IX	20	RV AND PULMONARY OUTFLOW ABNORMALITIES 9.1 Pulmonary atresia and intact ventricular septum 9.2 Pulmonary atresia and VSD 9.3 TOF 9.4 Truncus arteriosus	√			6%	
Unit X	20	LV OUTFLOW ABNORMALITIES 10.1 CoA 10.2 HLHS	√			6%	
XI	**20**	TGA,CCTGA,DORV,DOLV, UNIVENTRICULAR ATRIOVENTRICULAR CONECTION	√			6%	

XII	20	ELECTROPHYSIOLOGY STUDIES 12.1 Equipment and setting 12.2 Techniques and procedures 12.3 Atrial and ventricular stimulation 12.4 Induction of ventricular fibrillation 12.5 Use of cardioactive drugs during Ep's 12.6 Ablation therapy and mapping 12.7 INTERPRETATION OF FINDINGS IN EP 12.7.1 Bradyarrhythmia evaluation 12.7.2 SVT evaluation 12.7.3 Evaluation of accessory pathways 1.7.4 Ventricular tachycardia evaluation	√			6%	
XIII	20	CARDIAC PACING 13.1 Basic components of cardiac pacemakers 13.2 Pacemaker classification 13.3 Physiology of cardiac pacing 13.4 Pacemaker timing cycles and intervals 13.5 Rate adaptive pacing 13.6 Automatic mode switching 13.7 Basic pacing modes 13.8 Biventricular pacing 13.9 Common pacemaker problem 13.10 Pacemaker system malfunction 13.11 Common issues for the patient with PPI	√			6%	
XIV	20	Anti tachycardia devices 14.1 ICD components 14.2 Implantation procedure 14.3 Device replacement 14.4 Tachycardia detection and	√			6%	

		therapy 14.5 Bradycardia detection and therapy 14.6 Magnet function 14.7 Device device interaction					
XV	20	Cardiac Resynchronization therapy 15.1 Mechanism of LV dyssynchrony 15.2 Types of LV dyssynchrony 15.3 Role of CRT 15.4 Implantation procedure	√			6%	

SEMESTER IV

Course Title: Cardiac Catheterization and intervention in Miscellaneous Diseases

Course: Core

Credits: 10 **Number of Hours: 300**

Course Outcomes:

- To understand the pathophysiology, cardiac catheterization evaluation and management options of various cardiomyopathies
- To gain knowledge on differentiation of ischemic and non-ischemic cardiomyopathy
- To understand the pathophysiology and Cath evaluation of pericardial diseases
- To understand different etiologies, clinical presentations and types associated with disease states including aortic diseases, systemic diseases and cardiac masses.
- To develop theoretical and practical skills to how to approach aortic diseases, systemic diseases and cardiac masses by cardiac catheterization.

Course Content:

Unit	Hrs	Content	Must Know	Good to	Desirable to	Weightage	Types Of Questions
I	5	**HYPERTROPHIC CARDIOMYOPATHY** 1.1 Morphological variants 1.2 Diagnosis 1.3 hemodynamic assessing gradients 1.4 evaluation of therapy 1.5 pre and post procedural evaluation 1.6 PTSMA methodology and complications	√			10%	LE,SE

II	4	**IDIOPATHIC DILATED CARDIOMYOPATHY** 2.1 Diagnosis and differentiation from other disorders 2.2 Myocardial biopsy	√			10%	LE,SE
III	3	**Restrictive cardiomyopathy** 3.1 Diagnosis 3.2 Hemodynamics	√			10%	LE,SE
IV	5	**DISEASE OF THE PERICARDIUM** 4.1 Pericardial effusion Detection 4.2 Quantitation of fluid Cardiac tamponade 4.3 Pericardial aspiration techniques 4.4 Constrictive pericarditis Differentiation from Restrictive cardiomyopathy	√			12%	LE,SE
V	6	**AORTIC DISEASE** 5.1 Aortic dilation and aneurysm 5.2 Aortic dissection 5.3 diagnosis and classification 5.4 False aneurysm 5.5 RSOV aneurysm 5.6 Intervention in aortic aneurysm 5.7 Aorto-LV tunnel 5.8 Atherosclerosis	√			12%	LE,SE
VI	6	**VASCULAR INTERVENTION** 6.1 Mesenteric artery intervention 6.2 Celiac artery intervention 6.3 Iliac artery intervention	√			10%	LE,SE

VII	5	**CAROTID AND CEREBROVASCULAR INTERVENTION** 7.1 Aortic arch classification 7.2 Intervention and complications 7.3 CoA intervention	√			8%	LE,SE
VIII	4	**UPPER AND LOWER EXTREMITY**	√			10%	LE,SE
		8.1 indications and contraindications 8.2 Diagnostic cath and hardwares 8.3 procedure 8.4 Intervention and complications					
IX	3	**RENAL ARTERY INTERVENTION** 9.1 indications and contraindications 9.2 Diagnostic cath and hardwares 9.3 procedure 9.4 Intervention and complications	√			8%	LE,SE
X	4	**VENOUS INTERVENTION** 10.1 IVC filter 10.2 Bud Cheri intervention 10.3 CS intervention	√			10%	LE,SE

Reference Books:

- Manual of cardiovascular medicine by Brian P Griffin
- Textbook of interventional cardiology by TOPA
- Interventional cardiology by Spencer B king

YENEPOYA
(DEEMED TO BE UNIVERSITY)

Course Title: Recent Advances in Cardiac catheterization and intervention

Course: Core

Credits: 3 **Number of Hours: 45**

Course Outcomes:

- Develop an understanding of the multi-disciplinary applications of advanced techniques in clinical practice of cardiac catheterization
- To understand the technique, analysis and applications of percutaneous valve implantations.
- To gain knowledge in recent advancing techniques and treatment options, clinical trials and skill to handle new equipments
- gain knowledge about cardiac assist and adjunct devices.

- To understand the extent of coronary blood flow, intracoronary pressure and measurement.

Course Content:

Unit	Hrs	Content	Must Know	Good to	Desirable to	Weightage	Types Of Questions
I	3	**PERCUTANEOUS MITRAL VALVE REPAIR** 1.1 Indications and contraindications 1.2 Procedure 1.3 Complications	√			10%	LE,SE

II	3	**MITRAL CLIP** 2.1 Indications and contraindications 2.2 Procedure 2.3 Complications	√			10%	LE,SE
III	4	**PERCUTANEOUS AORTIC VALVULAR APPROACH** 3.1 Indications and contraindications 3.2 Procedure 3.3 Complications	√			10%	LE,SE
IV	5	**PULMONARY AND TRICUSPID VALVE IMPLANTATION** 4.1 Indications and contraindications 4.2 Procedure 4.3 Complications	√			8%	LE,SE
V	3	**PERCUTANEOUS BALLON PERICARDIOTOMY FOR PATIENT WITH PERICARDIAL EFFUSION AND TAMPONADE** 5.1 Indications and contraindications 5.2 Procedure 5.3 Complications	√			10%	LE,SE
VI	3	**THE LAA INTERVENTION** 6.1 Indications and contraindications 6.2 Procedure 6.3 Complications	√			8%	LE,SE

VII	3	**PTSMA** 7.1 Indications and contraindications 7.2 Procedure 7.3 Complications	√			10%	LE,SE
	4	**SUPPORT & ADJUNCT DEVICES**	√			6%	LE,SE
VIII		8.1 Support devices for High risk percutaneous coronary intervions. 8.2 Cutting Balloon 8.3 Thrombectomy 8.4 Laser, Ultrasound & Atherectomy					
IX	3	**CARDIAC ASSIST DEVICES** 9.1 Impeller 9.2 ECMO	√			4%	LE,SE
X	5	**INTRACORONARY PRESSURE & FLOW MEASUREMENT** 10.1 IVUS 10.2 OCT 10.3 Functional Flow Reserve (FFR)	√			6%	LE,SE
XI	3	**PRECLINICAL AND CLINICAL TRIALS**	√			6%	LE,SE
XII	3	**CORONARY VEIN DEVICE INSERTION** 12.1 Indications and contraindications 12.2 Procedure 12.3 Complications	√			6%	LE,SE
XIII	3	**DEVICE RETRIEVAL SYSTEM** 13.1 Indications and contraindications 13.2 Procedure 13.3 Complications	√			6%	LE,SE

Reference books:

1. Cardiology update by cardiology society of India
2. Textbook of interventional cardiology by TOPAL
3. Interventional Cardiology by Spencer B king

YENEPOYA
(DEEMED TO BE UNIVERSITY)

Course Title: Cardiac catheterization Clinical Skills
Paper IV

Course: SEC

Credits: 8 **Number of Hours: 240**

Course Outcome:

- To understand the pathophysiology, cardiac catheterization evaluation and management options of various cardiomyopathies
- To gain knowledge on differentiation of ischemic and non-ischemic cardiomyopathy
- To understand the pathophysiology and Cath evaluation of pericardial diseases
- To understand different etiologies, clinical presentations and types associated with disease states including aortic diseases, systemic diseases and cardiac masses.
- To develop theoretical and practical skills to how to approach aortic diseases, systemic diseases and cardiac masses by cardiac catheterization.

Course Content:

Unit	Hrs	Content	Must Know	Good to	Desirable to	Weightage	Types Of Questions
I	12	**HYPERTROPHIC CARDIOMYOPATHY** 1.1 Morphological variants 1.2 Diagnosis 1.3 hemodynamic assessing gradients 1.4 evaluation of therapy 1.5 pre and post procedural evaluation 1.6 PTSMA methodology and complications	√			5%	
II	12	**IDIOPATHIC DILATED CARDIOMYOPATHY** 2.1 Diagnosis and differentiation from other	√			5%	

		disorders 2.2 Myocardial biopsy					
III	12	**RESTRICTIVE CARDIOMYOPATHY** 3.1 Diagnosis 3.2 Hemodynamics	√			5%	
IV	12	**DISEASE OF THE PERICARDIUM** 4.1 Pericardial effusion Detection 4.2 Quantitation of fluid Cardiac tamponade 4.3 Pericardial aspiration techniques 4.4 Constrictive pericarditis Differentiation from Restrictive cardiomyopathy	√			5%	
V	12	**AORTIC DISEASE** 5.1 Aortic dilation and aneurysm 5.2 Aortic dissection 5.3 diagnosis and classification 5.4 False aneurysm 5.5 RSOV aneurysm 5.6 Intervention in aortic aneurysm 5.7 Aorto-LV tunnel 5.8 Atherosclerosis	√			5%	
VI	12	**VASCULAR INTERVENTION** 6.1 Mesenteric artery intervention 6.2 Celiac artery intervention 6.3 Iliac artery intervention	√			5%	
			√				
VII	12	**CAROTID AND CEREBROVASCULAR INTERVENTION** 7.1 Aortic arch classification 7.2 Intervention and complications 7.3 CoA intervention	√			5%	

VIII	12	**UPPER AND LOWER EXTREMITY** 8.1 Intervention and complications	√			5%	
IX	12	**RENAL ARTERY INTERVENTION** 9.1 Intervention and complications	√			5%	
X	12	**VENOUS INTERVENTION** 10.1 IVC filter 10.2 Bud Cheri intervention 10.3 CS intervention	√			5%	
XI	12	**PERCUTANEOUS MITRAL VALVE REPAIR And MITRAL CLIP**	√			5%	
XII	12	**PERCUTANEOUS AORTIC VALVULAR APPROACH**	√			5%	
XIII	12	**PULMONARY AND TRICUSPID VALVE IMPLANTATION**	√			5%	
XIV	12	**PERCUTANEOUS BALLON PERICARDIOTOMY FOR PATIENT WITH PERICARDIAL EFFUSION AND TAMPONADE**	√ √			5%	
XV	12	**THE LAA INTERVENTION**	√			5%	
XVI	12	**PTSMA**	√			5%	
XVII	12	**SUPPORT & ADJUNCT DEVICES** 8.1 Support devices for High risk percutaneous coronary	√			5%	

		interventions. 8.2 Cutting Balloon 8.3 Thrombectomy 8.4 Laser, Ultrasound & Atherectomy					
XVIII	12	**INTRACORONARY PRESSURE & FLOW MEASUREMENT** 10.1 IVUS 10.2 OCT 10.3 Functional Flow Reserve (FFR)	√			5%	
XIX	12	**CORONARY VEIN DEVICE INSERTION**	√			5%	
XX	12	**DEVICE RETRIEVAL SYSTEM**	√			5%	

10. Teaching - Learning methods course-wise

Teaching - Learning method	Courses
Experiential learning	Cardiac Catheterization Clinical Skills I – IV
Integrated/Inter-disciplinary learning	Bioethics, Healthcare Management
Participatory learning	Bioethics, Health Care Management, Basics in Cardiac Cath, Recent Advances in Cardiac Cath.
Problem-solving methodologies	Biostatistics & Research Methodology, Cardiac Catheterization Clinical Skills I–IV
Self-directed learning	Coursera / SWAYAM, Recent Advances in Cardiac Cath, Miscellaneous heart disease in Cardiac Cath
Patient-centric and Evidence-based learning	Cardiac Catheterization Clinical Skills I–IV, Cardiac Cath in IHD & VHD, Cardiac cath in congenital heart disease.
The Humanities	Bioethics
Project-based learning	Dissertation, Biostatistics & Research Methodology.

Teaching - Learning method	Courses
Team-work	Cardiac Cath Clinical Skills I–IV
Role-play	Bioethics, Health Care Management, Heart Failure, Clinical Cardiology

Reflective writing	Cardiac Cath Clinical Skills I–IV, Electrophysiology and cardiac pacemaker

11. Scheme of Examination

11.1. Continuous Internal assessment format (distribution of marks)

Continuous Internal assessment components	**Maximum marks**
Average of two IA tests	20
Case Studies/Seminar/Assignments/Quizzes etc.	30
Total marks	50

11.2. Question Paper Pattern

Subjects having maximum marks = 50				Duration
Type of question	Number of questions	Marks for each question	Total	150 min
Long essay type	02	15	30	
Short essay Type	02	10	20	
Total			50	

11.3. Practical Examination

SI.NO	Components	Marks
1	Spotters	10
2	Case Scenario/OSCE/OSPE	20
3	Viva Voce	20

Total Marks	50

11.4. Particulars of practical, viva-voce & dissertation

11.4.1. Practical examination will be aimed at examination of clinical skills and competence of the candidates for undertaking independent work as a specialist.

11.4.2. Viva-Voce examination shall aim at assessing depth of knowledge, logical reasoning, confidence & oral communication skills.

11.4.3. Special emphasis shall be given to dissertation work during the M. Sc. CCIT 2ndYear examination.

11.4.4. The marks of Viva-Voce examination shall be included in the clinical examination to calculate the percentage and declaration of results.

11.4.5. OSCE/OSPE-shall have minimum of 5 stations.

11.5. Evaluation and Certification of online courses:

11.5.1. Evaluation will be based on predefined norms and parameters and announced in the overview of the Course at the time of offering the course. Formative continuous online assessments and end of course proctored exams shall be completed by the student.

11.5.2. The certificate obtained shall be submitted to the college office which will be communicated to the office of the Controller of Examinations of Yenepoya (Deemed to be University).

11.5.3. The Yenepoya (Deemed to be) University will give the equivalent credit weightage to the students for the credits earned through online learning courses through MOOCS/Coursera as per the credit plan of the program.

11.6. Credit Mobility of Online Courses:

11.6.1. The Yenepoya (Deemed to be University) will give the equivalent credit weightage to the students for the credits earned through online learning courses as per the credit plan of the program.

11.6.2. In case a student fails to complete the online course he/ she may be allowed to complete the course requirements by registering for another online course in subsequent semester or opt for a course offered at Yenepoya (Deemed to be University), provided such a course is offered during that semester.

11.6.3. The elective course offered by the Yenepoya (Deemed to be University) shall be restricted to a maximum of 3 credits.

11.6.4. A candidate shall compulsorily complete total 6 Credits of Multidisciplinary courses.

11.6.5. These courses shall be selected either from the Generic Electives offered by the Yenepoya (Deemed to be) university or from the SWAYAM/Coursera courses. A Candidate shall have freedom to choose the courses of once own choice and learn at their own pace but, require to complete minimum 3 credits before second semester and 6 credits before third semester SEE.

11.6.6. A candidate who wishes to earn additional credits may be permitted to do so during the academic duration. The additional credits earned shall be for enrichment purposes only and shall not be reflected in the marks card and shall not be considered for grade calculation, credit requirements, or the awarding of grades.

11.7. Continuous Internal Assessment Components of PG Dissertation

<table>
<tr><th>Sl. No</th><th>Parameters</th><th></th><th>Marks</th></tr>
<tr><td>1.</td><td colspan="2">Maintaining the timeline</td><td>10</td></tr>
<tr><td>2.</td><td colspan="2">Presentation a Conference /CME/Publication (student can choose any of the criteria to avail 40 marks)</td><td>40</td></tr>
<tr><td></td><td>Criteria</td><td>Marks Allocated</td><td></td></tr>
<tr><td></td><td>Online Oral/Online Poster/Offline Poster presentation/Conference proceeding publications in Scopus/WoS indexed
journals/Publication of Copyright</td><td>20</td><td></td></tr>
<tr><td></td><td>Offline oral presentation at National/International Conference/Patents/Publication of Review Paper/Pilot Study/Study
Protocol in Indexed Journal</td><td>40</td><td></td></tr>
<tr><td>3.</td><td colspan="2">Manuscript submission (Based on the dissertation) to the Indexed journals (SCOPUS/WoS) along with submission
of final dissertation</td><td>50</td></tr>
<tr><td></td><td colspan="2">Total</td><td>100</td></tr>
</table>

11.8. Assessment of Research project

A declaration by the candidate that the work was done by him/her shall be included. The guide, Head of the Department and Head of the Institution shall certify the bonafide of the project.

Total 200 marks shall be awarded for the research project and the marks distribution as follows:

- 100 marks – Dissertation evaluation by Internal and External examiners
- 100 marks – Continuous Internal Assessment

11.9. Evaluation of Dissertation

11.9.1. Dissertation shall be evaluated by two examiners, one external & one Internal for 100 marks from the panel of examiners approved by the Board of Studies and by the University.

11.9.2The criteria for the evaluation shall be as prescribed by the Board of Studies.

11.9.3Acceptance of the dissertation is a pre-requisite for a candidate to be eligible to appear in the final examination.

11.10. Guide:

11.10.l. The academic qualification and teaching experience required for recognition of guide shall be as given under:

11.10.2. DM in Cardiology with 2 years of teaching experience after MD/DM programme or Ph.D in CCIT or M.Sc. CCIT with teaching experience of four years after the Masters programme.

11.10.3. Student guide ratio: A recognized guide shall supervise dissertation work of not more than five students per academic year. The age of the guide shall not exceed 65 years.

11.10.4 Co-Guide may be included provided the work requires substantial contribution from a sister department, another institution recognized for teaching in Yenepoya (Deemed to be University), or any other State level University.

11.11.Change of Guide:

In the event of registered guide leaving the Institute/ college due to any reason or in the event of death or any other valid reasons, guide can be changed with prior permission from the University only.

12. Eligibility to appear for University Examination

12.1. Each course (theory, practical, clinical etc.) shall be treated as an independent unit for the purpose of attendance. Candidates having minimum 80% attendance in each of the Courses can only qualify to appear for the Semester End Examination. The Candidates with less than 80% of attendance shall be required to repeat that Course by attending the semester. There shall be no provision for condonation of shortage of attendance.

12.2. Evaluation of a course shall be done based on continuous internal assessment (CIA) mode followed by semester end university examination (SEE) for each course.

12.3. The components of CIA (Continuous Internal Assessment) may include sessional tests, Seminar/ Journal Club/ Case Studies /Assignment and other activities as determined by the board of studies in the respective departments.

12.4. The CIA:SEE percentage is 50:50 and minimum marks for CIA shall be 50% and SEE shall be 50%.

12.5. The pass marks per course shall be 50% There shall be examinations at the end of each semester ordinarily during February/March for odd semesters and August/September for even semesters

12.6. The SEE duration shall be two and half hours.

13. Criteria for passing

13.1. The CIA:SEE percentage is 50:50 and minimum marks for CIA shall be 50% and SEE shall be 50%.

13.2. The pass marks per course shall be 50%

13.3. A candidate shall be declared to have passed the PG program if he/she secures atleast CGPA of 5.0 (Course Alpha-Sign Grade P) in the aggregate of both internal assessment and semester end examination marks.

13.4. The candidates who pass all the semester examinations in the first attempts in Two years are eligible for ranks provided they secure at least a CGPA of 8.0 (atleast Alpha-Sign Grade A).

13.5. The results of the candidates who have passed the fourth semester examination but not passed the lower semester examinations shall be declared as NCL (Not Completed Lower

semester examinations). Such candidates shall be eligible for the degree only after completion of all the lower semester examinations.

13.6. A candidate who passes the semester examinations in parts is eligible for only CGPA and Alpha-Sign Grade but not for ranking.

13.7. There shall be no minimum marks with respect to internal assessment and viva-voce marks.

13.8. A candidate who fails in any of the project work/project report/dissertation shall reappear for the same and pass the examination subsequently within the nearest semester and examination schedule.

14. Carry over provisions

Carry over shall be allowed to the candidates up to IV semesters.

15. Grading and Classification

The results of successful candidates at the end of each semester shall be declared in terms of Grade Point Average (GPA) and Alpha-Sign Grade. The results at the end of the sixth semester shall be classified on the basis of the Cumulative Grade Point Average (CGPA) obtained in all the four semesters and the corresponding overall alpha sign grade.

a. Letter Grades and Grade Points:

Letter Grade	Grade Point	Range of Marks
O+(Outstanding)	10	90–100
O(Excellent)	9	80–89.99
A+(Very Good)	8	70–79.99
A(Good)	7	60–69.99
B+(Average)	6	55–59.99
P(Pass)	5	50–54.99
F(Fail)	<5	<50

b. Cumulative Grade Point Average(CGPA):

The results at the end of the fourth semester shall be classified on the basis of CGPA obtained in the four semesters and the corresponding overall letter grade. The letter grade as described below shall be adopted.

Letter Grade	CGPA Range
O+(Outstanding)	9.0–10.0
O(Excellent)	8.0–8.99
A+(Very Good)	7.0–7.99
A(Good)	6.0–6.99
B+(Average)	5.5–5.99
P(Pass)	5.0–5.49
F(Fail)	<5.0

16. Journals

List of recommended Journals

1.American Heart Journal
2.JACC: Cardiovascular Interventions.
3.Journal of Interventional cardiac electrophysiology - by springer nature (ISSN no: 15728595)
4.Pacing and Clinical Electrophysiology
5.Journal of Interventional Cardiology

Annexures:

Annexure I - Question Paper layout for theory examinations

Annexure II – Logbook template

Annexure III – Journal Club evaluation checklist

Annexure IV – Assignment guideline

Annexure V - Seminar Assessment Rubric Template