YENEPOYA
(DEEMED TO BE UNIVERSITY)

REGULATIONS AND CURRICULUM GOVERNING

M.Sc. Echocardiography

Implemented in 2022-23

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



YENEPOYA
(DEEMED TO BE UNIVERSITY)

Deralakatte, Mangalore, Karnataka.

YENEPOYA
(DEEMED TO BE UNIVERSITY)

NOTIFICATION FROM THE UNIVERSITY

Sl. No.	ACM with date	Decisions/Approvals
1.	47th ACM 20/06/2022	Starting of M.Sc. Echocardiography program under the Faculty of Allied and Healthcare Professions
2.	49th ACM/ 13/12/2022	Approval of Curriculum of M.Sc. Echocardiography
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

YENEPOYA
(DEEMED TO BE UNIVERSITY)

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 Echocardiography will enable the candidate's to develop effective technical skills & evolve into a full trained & qualified Echocardiographer/Cardiac Sonographer& will be adequately equipped to provide the diagnosis based on Echocardiography. 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. Definition

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-pointscale.

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.

Types of Courses

2.12 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. Echocardiography.

2.13 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.

a. **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 thecandidate's proficiency skill.

A candidate shall have the freedom to choose Multidisciplinary Elective courses during the academic duration of the particular PG programme 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.

i. 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.

ii. 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.

iii. 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 programme.

iv. A candidate shall not take the courses offered by the department in which she/heis enrolled.

v. 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. The successful completion will lead to Master's degree in Echocardiography

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 aim of the programme is to develop competent and ethically grounded echocardiography professionals with strong scientific knowledge and practical skills in cardiovascular imaging. The programme focuses on building a thorough understanding of basic and applied sciences relevant to echocardiography, enhancing knowledge of cardiovascular and systemic diseases affecting cardiac structure and function, and fostering a systematic diagnostic approach to cardiovascular disorders. It aims to equip learners with

proficiency in performing non-invasive transthoracic, transesophageal, and stress echocardiography, along with a solid understanding of ultrasound technology, echocardiographic equipment, and Doppler-based hemodynamic assessment. The programme also emphasizes accurate evaluation of congenital heart diseases, promote. s continuous professional development in teaching and clinical practice, and instills strong ethical principles essential for high-quality patient care.

7.Outcomes of the Program

Upon completion of the Masters' program student will be trained in wide spectrum of knowledge in non-interventional cardiovascular diagnostic Echocardiography

In particular they will: (S, C, A)

PO 1: Practice Echocardiography effectively, backed by scientific knowledge & skills(K, S)

PO 2: Demonstrate understanding of basic sciences relevant to respective branches(K)

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 perform routine Echocardiography(K,S)

Expected skill to be acquired by the end of the programme:

PO 5 : Performing various cardiovascular diseases by means of non-invasive Trans Thoracic, Trans-esophageal & stress Echocardiography(K,S,A)

PO 6: Develop knowledge on technical aspect of an ultrasound equipment & echocardiographic machine (K,S,A)

PO 7: Understand the hemodynamic assessment using Doppler Principles(K,S)

PO 8: Knowledge to approach, diagnose congenital heart diseases & its evaluation using echocardiography(K,S,A)

PO 9: Continue to reveal keen interest in professional development whether in teaching or practice & imbibe ethical principles.(K,A,C)

Program Structure

	Broad category of course	**Hours/Credits**	**Course (Title + Course Code)**
1.	**Discipline-Specific Courses**		
a)	Theory	**I Semester**	
		60 Hours / 4 Credits	Cardiac Embryology
		60 Hours / 4 Credits	Clinical Cardiology
		45 Hours / 3 Credits	Biostatistics & Research Methodology
		II Semester	
		45 Hours / 3 Credits	Ischemic and Valvular heart disease
		45 Hours / 3 Credits	Heart Failure
		45 Hours / 3 Credits	Ultrasound, Doppler principles
		45 Hours / 3 Credits	Bioethics
		III Semester	
		45 Hours / 3 Credits	Congenital heart disease
		45 Hours / 3 Credits	Cardiac Pacemaker
		45 Hours / 3 Credits	Health Care Management
		IV Semester	
		45 Hours / 3 Credits	Miscellaneous Diseases of the heart

		45 Hours / 3 Credits	Recent Advances in echocardiography

	Broad category of course	**Hours/Credits**	**Course (Title)**
1.	**Discipline-Specific Courses**		
b)	Practical (SEC)*	-	
c)	Clinical (SEC)*	**I Semester**	
		300 hours/10 credits	Echocardiographic Clinical Skills I
		II Semester	
		240 hours/8 credits	Echocardiographic Clinical Skills II
		III Semester	
		300 hours/10 credits	Echocardiographic Clinical Skills III
		IV Semester	
		240 hours/8 credits	Echocardiographic 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	**92 Credits**	

SEC: Skill Enhancement Course

8. 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 (SEE). The Candidates with less

than 80% of attendance shall be required to repeat that Course by attending the semester.

8.2 here shall be no provision for condo nation 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 COE Office. Registrations of such candidates for those courses shall be treated as cancelled.

9. Syllabus/Course Contents

SEMESTER I

Course Title: Cardiac Embryology

Course: Core

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

Course Outcomes:

After completing this course the students will be able to:

a. To describe the embryological development of various cardiac structures

b. To understand fetal circulation and developmental changes relative to definitive cardiac structure

c. To understand the mechanism of cardiac looping

d. To understand the formation of coronary arteries

e. To gain knowledge on the development of pericardium and conduction system

- **COURSE CONTENT:**

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

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Types Of Questions
Unit 1	12	**Unit 1**: Early development of Embryo 1.1 Mitosis 1.2 Meiosis 1.3 Oogenesis 1.4 Spermatogenesis 1.5 Fertilization 1.6 Formation of Germ layers	√			10%	LE
Unit 2	6	**Unit – 2:** Development of the heart 2.1 Formation of the heart tube 2.2 Mechanism of cardiac looping	√			15%	LE
Unit 3	15	**Unit-3** Development of cardiac chambers and valves 3.1 Development of sinus venosus 3.2 Development of Right atrium 3.3 Development of left	√			15%	LE

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Types Of Questions
		atrium 3.4 Formation of Inter-atrial septum 3.5 Right ventricle and left ventricle formation 3.6 Formation of Inter-ventricular septum 3.7 Atrioventricular valves 3.8 Semilunar valves					
Unit 4	8	**Unit – 4:** Formation of great arteries and systemic veins 4.1 Fate of truncus arteriosus 4.2 Formation of pharyngeal arch arteries and their fate 4.3 Cardinal veins 4.4Vitelline veins 4.5Umbilical veins	√			15%	LE
Unit 5	10	**Unit -5** Development of conduction system of the heart, Pericardium and coronary arteries 5.1 Formation of Sino-atrial	√			15%	

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Types Of Questions
		node 5.2 Formation of Atrioventricular node 5.3 Formation of fibrous pericardium 5.4 Formation of Serous pericardium 5.5 Early development of coronary arteries					SE
Unit 6	4	**Unit 6:** Congenital Heart disease 6.1 Primary genetic factors 6.2 Chromosomal causes		√		15%	SE
Unit 7	5	**Unit 7**: Fetal and Neonatal Circulation 7.1 Fetal Circulation 7.2 Transitional and neonatal Circulation	√			15%	SE

Reference Books:

1. Inder Bir Singh. Human Embryology. Jaypee brother's medical publishers. 10th Edition

2. Sadler T.Langman's Medical Embryology.Wolters Kluwer publishers. 14th Edition

Clinical Cardiology

Course: Core

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

Course Outcomes:

After completing this course the students will be able to:

a. To gain knowledge on the clinical examination of cardiac diseases

b. To understand various cardiac and non-cardiac causes of symptoms associated with cardiac diseases

c. To understand cardiovascular system examination

d. To gain knowledge on various cardiovascular drugs

e. To gain knowledge on basic and advanced cardiac life support

COURSE CONTENT:

Unit	**Hrs**	**Content**	**Must Know**	**Good to Know**	**Desirable to Know**	**Weightage(%)**	**Types Of Questions**
Unit 1	10	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%	LE.SE

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage(%)	Types Of Questions
Unit 2	5	Measurement of arterial blood pressure 2.1 Determinants of arterial blood pressure 2.2 Measurement of arterial blood pressure 2.3 Hypertension	√			6%	LE,SE
Unit 3	5	Arterial pulse 3.1 Definition 3.2 Genesis of arterial pulse and examination of arterial pulse 3.3 Characteristic features of pulse in common clinical condition	√			6%	LE,SE
Unit 4	5	Jugular Venous Pulse 4.1 Examination of JVP 4.2 Estimation of venous pressure and JVP in disease conditions 4.3 Abnormalities of the waves	√			6%	LE,SE
Unit 5	6	Inspection and Palpation of the Precordium 5.1 General inspection of the patient-Syndromes associated with	√			8%	SE

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage(%)	Types Of Questions
		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 cardiovascularpulsations ,palpable sounds,thrills and rubs 5.5 Tracheal Tug 5.6 Kinetic cardiogram					
Unit 6	4	Percussion of the precordium and precordial findings in common heart diseases 6.1 Method of percussion 6.2 The scheme of percussion 6.3 Precordial findings in common heart diseases	√			6%	SE
Unit 7	8	Cardiac auscultation 7.1 Principles and techniques: Stethoscope	√			15%	LE,SE

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage(%)	Types Of Questions
		7.2 The heart sounds: systolic ejection sound. opening snaps, prosthetic heart sounds 7.3 Heart murmurs					
Unit 8	5	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%	LE,SE
Unit 9	7	Cardiovascular Pharmacology 9.1 Mechanism of action, indication, dosage and contraindications of cardiovascular drugs: -Beta blockers -Calcium channel blockers -Diuretics -Vasodilators		√		13%	SE

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage(%)	Types Of Questions
		-thrombolytic agents -atropine -Inotropic agents -antiarrhythmic drugs					
Unit 10	5	Basic life support/ACLS 10.1 The primary and secondary approach to emergency cardiac care pulseless VT/VF/Asystole/Hypotension	√			8%	SE

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

Course Title: Biostatistics & Research Methodology

Course: Core

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

Research Methodology

Course Outcomes:

After completing this course the students will be able to:

a. To describe the types, need and process of research

b. To outline the process and purpose of literature review

c. To explain various biomedical research designs with advantages and disadvantages.

d. To outline the process involved in data collection and analysis

e. To explain the components of research paper and process of publication.

Course Content

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of Question
Unit 1	**2**	**1. Introduction** 1.1 Need for research	✓			10%	**SE**

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of Question
		1.2 Types of research	✓				
		1.3 Outlining the research process	✓				
Unit 2	**2**	**2. Review of Literature** 2.1 Importance, sources & steps	✓			10%	**SE**
		2.2 Critical appraisal of research article	✓				
Unit 3	**2**	**3. Research Design** 3.1 Types of research – Qualitative & Quantitative	✓			10%	**LE,SE**
		3.2 Experimental & Non Experimental, Survey – advantages & disadvantages	✓				
Unit 4	**2**	**4. Research Process** 4.1 Framing a research question	✓			15%	**LE,SE**
		4.2 Research title	✓				
		4.3 Aim & Objectives, Assumptions,	✓				

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of Question
		Limitations & Delimitations, Variables					
		4.4 Hypothesis – formation & testing	✓				
Unit 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	✓				
Unit 6	**2**	6. **Interpretation & presentation of data** 6.1 Qualitative & quantitative analysis	✓			15%	**LE,SE**
		6.2 Graphical	✓				

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of Question
		representation of data					
		6.3 Conclusion & discussion	✓				
Unit 7	**2**	7. **Discussion, Conclusion and References**	✓			10%	**SE**
Unit 8	**2**	8. **Essentials of writing a research paper along with process of publication**	✓			10%	**LE**

Course Outcome:

At the end of the Course, the students will

- have knowledge of process involved in Biomedical research from formulation to publication.
- be able to draft a research proposal.

Biostatistics

Course Outcomes:

After completing this course the students will be able to:

a. To Understand the Statistical Terms.
b. To Possess Knowledge and Skill in the use of Basic Statistical and Research Methodology.

Course Content:

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of Question
Unit 1	**6**	**1. Introduction** 1.1 Introduction to biostatistics &research methodology, types of variables & scales of measurements, measure of central tendency & dispersion, rate, ratio, proportion, incidence & prevalence	✓			5%	**LE,SE**
Unit 2	**3**	2. **Sampling** 2.1 Population & Sample, Sampling and non-sampling errors and methods	✓			10%	**LE,SE**

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of Question
		of minimizing these errors, Random and non-random sampling, different sampling techniques – simple random, stratified, systematic, cluster& multistage.					
Unit 3	**3**	3. **Sampling distributions** 3.1 Parameter and Statistic. Standard error. Basic probability distributions - Normal, poisson, binomial distributions with their applications in biological sciences.	✓			5%	**SE**
Unit 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	✓			15%	**LE,SE**

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of Question
		(parametric) & power of the tests, p value, Confidence interval. Tests of significance – T test (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					
Unit 5	**3**	**5. Correlation and regression** 5.1 Linear correlation by Karl Pearson and rank order correlation due to	✓			15%	**LE**

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of Question
		Spearman, Testing the significance of correlation co efficient, simple linear regression – estimation & testing, residual plots, multiple linear regression.					
Unit 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**
Unit 7	**2**	**7. Study designs** 7.1 Epidemiological methods – case series analysis and prevalence studies. Analytical epidemiological methods – case control and cohort studies. Clinical	✓			10%	**SE**

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of Question
		trials / intervention studies, odds ratio and relative risk, stratified analysis					
Unit 8	**2**	**8. Multivariate analysis** 8.1 Concept of multivariate analysis, introduction to logistic regression and survival analysis	✓			15%	**LE,SE**
Unit 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**
Unit 10	**1**	**10. Format of scientific documentations** 10.1 Structure of	✓			10%	**LE,SE**

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of Question
		research protocols, structure of thesis/research report, formats of reporting in scientific journals. Systematic review and meta-analysis.					

Reference Books:

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

Course Title: Echocardiographic Clinical Skills Paper I

Course: SEC

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

Course Outcomes:

After completing this course the students will be able to:

a. Routine echocardiographic examination

b. Clinical findings of various cardiovascular diseases

Course Content:

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of Question
Unit 1	100	**Echo examination** 1.1 A segmental approach to anatomy 1.2 Cardiac situs 1.3 Ventricular morphology 1.4 Great artery connections ,Transducer selection ,Reduction of artifacts 1.5 Obtaining optimal gray scale images Gain and depth controls 1.6 Use of M-mode for temporal analysis of cardiac events and obtaining measurements 1.7 Use of modalities to optimize color flow such as color maps, gain and scale 1.8 Adjustments related to Doppler such as scale, PRF, sweep, angle	✓			33%	-

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of Question
		correction 1.9 Use of specialized techniques such as Tissue Doppler					
Unit 2	100	**Doppler Echocardiography** 2.1 To perform calculations such as left ventricular mass and cardiac output, Calculation of cardiac mass 2.2 Doppler equations, stroke distance, converting velocity to flow, flow to volumes, cardiac output, shunt ratios, modified Bernoulli equation and intra-vascular pressures, assessment of left ventricular, left atrial, right ventricular, right atrial pressures 2.3 Candidate would be required to store and retrieve studies of diagnostic quality-clinician satisfaction will be taken as a yard stick for performance,Applications of principles to obtaining, storing and retrieving optimal images	✓			33%	-

Unit	Hrs	**Content**	**Must Know**	**Good to Know**	**Desirable to Know**	**Weightage**	**Type of Question**
Unit 3	100	Clinical examination: 3.1 Clinical examinations of cardiac diseases 3.2 Various cardiovascular drugs 3.3 Basic and advanced cardiac life support	✓			33%	

SEMESTER II

Course Title: Ischemic and Valvular heart disease

Course: Core

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

Course Outcomes:

After completing this course the students will be able to:

a. To gain knowledge on detection of coronary artery disease
b. To understand the various complications of myocardial infarction
c. To understand the etiology and pathophysiology of each Valvular heart disease
d. To understand relevant screening and / or diagnostic tests with clinical findings appropriate for cardiovascular risk stratification
e. To understand the importance of myocardial viability in patients who require cardiac revascularization

Unit	Hrs	Content	Must Know	Good to Know	e to Know	Weightage(%)	Types Of Questions
Unit 1	8	Echocardiography in coronary artery disease 1.1 Understanding coronary circulation 1.2 Pathophysiology of coronary artery syndrome 1.3 Wall motion scoring 1.4 Detection and quantification of RWMA 1.5 Global ventricular function 1.6 Myocardial infarction 1.7 Echo assessment of coronary arteries -Morphology of coronary flow reserve in TTE and TEE				17%	LE,SE

		-Visualization of coronary arteries -Kawasaki disease -Coronary slow flow/syndrome X					
Unit 2	5	Chronic coronary artery disease 2.1 LV aneurysm 2.2 Pseudoaneurysm 2.3 Mural thrombus 2.4 Ischemic cardiomyopathy 2.5 Complications of MI				11%	LE,SE
Unit 3	6	Stress echocardiography 3.1 Types of stress echo 3.2 Protocol of stress echo 3.3 Interpretation of stress echo 3.4 Myocardial perfusion echocardiography -PET -SPECT				13%	LE,SE
Unit 4	4	Rheumatic fever and Infective endocarditis 4.1 Pathogenesis 4.2 Clinical features 4.3 Diagnosis 4.4 Management				8%	SE

Unit 5	8	Mitral valve diseases 5.1 Mitral stenosis -Pathogenesis -Clinical features -Diagnosis -Management -BMV 5.2 Chronic MR and acute MR -Etiology and mechanisms of chronic and acute MR -Pathogenesis of chronic and acute MR -Clinical features of chronic and acute MR -Physical examination of chronic and acute MR -Diagnosis of chronic and acute MR -Severity of chronic and acute MR -Management of chronic and acute MR				17%	LE,SE

		5.3 Mitral valve prolapse -Etiology and pathology -Clinical features and physical examination -Diagnosis -Management					
Unit 6	6	Aortic valve diseases 6.1 Aortic stenosis -Etiology -Pathophysiology -Clinical Presentation -Diagnosis -Management 6.2 Acute and chronic aortic regurgitation -Causes of acute and chronic aortic regurgitation -Pathophysiology -Clinical and physical examination -Diagnosis -Management				13%	LE,SE

Unit 7	4	Pulmonic valve disease and Tricuspid valve disease 7.1 Pulmonary stenosis 7.2 Pulmonary regurgitation 7.3 Idiopathic dilation of PA 7.4 Syndrome of absent pulmonary valve 7.5 Tricuspid stenosis 7.6 Tricuspid regurgitation				8%	SE
Unit 8	4	Prosthetic heart valves 8.1 Types of prosthetic heart valves 8.2 Methods of evaluation of prosthetic valve 8.3 Clinical evaluation 8.4 Echocardiographic evaluation of prosthetic valve 8.5 TEE vs. TTE 8.6 Prosthetic valve stenosis 8.7 Prosthetic valve regurgitation				8%	SE

Recommended Books:

- Braunwald's Heart Disease, A Textbook of cardiovascular medicine,11nth edition, Elsevier,9 January 2018
- Armstrong W, Ryan T and Harvey Feigenbaum's (2010). Feigenbaum's echocardiography(7th edition)

- Catherine M Otto, Textbook of Clinical Echocardiography,5th edition
- Brain Griffin, Manual of cardiovascular medicine, 9th edition

Course Title: Heart Failure

Course: Core

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

Course Outcomes:

After completing this course the students will be able to:

a.

Understand the pathophysiology of heart failure

b. To 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

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Types Of Questions
Unit 1	5	**Unit 1: 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 relationship 1.6 Myocardial oxygen uptake 1.7 Measurement of contractile function 1.8 LV, RV and atrial function		√		9%	SE
Unit 2	9	**Unit – 2: Pathophysiology and Clinical assessment of heart failure** 2.1 Pathogenesis 2.2 HF as a progressive model	√			20%	

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Types Of Questions
		2.3LV remodeling 2.4 HF definition 2.5 clinical assessment of HF 2.6 the medical history and physical examination 2.7Routine assessment 2.8 Risk score for prognosis 2.9 Right heart catheterization 2.10 Endomyocardial biopsy 2.11 Cardiopulmonary exercise testing 2.12 Imaging modality in diagnosis and management					LE,SE
Unit 3	7	**Unit– 3: Etiology Of Heart Failure** 3.1 Ischemic heart diseases 3.2 Valvular heart diseases 3.3 Hypertensive heart diseases 3.4 Cardiomyopathies- DCM,	√			15%	LE,SE

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Types Of Questions
		HCM, RCM 3.5 Congenital Heart Diseases					
Unit 4	4	**Unit – 4: Heart Failure In Infants** 4.1 Etiology 4.2 Pathophysiology 4.3 Clinical evaluation 4.4 Diagnosis 4.5 Management	√			7%	LE,SE
Unit 5	4	**Unit 5: Diagnosis And Management Of Acute Heart Failure** 5.1 Epidemiology 5.2 Pathophysiology 5.3 Evaluation 5.4Managemnet		√		7%	SE
Unit 6	9	**Unit 6: Heart Failure With Reduced Ejection Fraction**	√			20%	LE,SA

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Types Of Questions
		6.1 Epidemiology 6.2 Etiology 6.3 pathophysiology 6.4 Prognosis 6.5 Approach and management					
Unit 7	4	**Unit7: Heart Failure With Preserved Ejection Fraction** 7.1 Epidemiology 7.2 Etiology 7.3 pathophysiology 7.4 Prognosis 7.5 Approach and management	√			7%	LE,SE
Unit 8	8	**UNIT 8: Management Of Heart Failure** 8.1 Devices for monitoring and managing heart failure - ventricular dyssynchrony - Device therapy (CRT, ICD) 8.2 Surgical management of		√		15%	SE

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Types Of Questions
		heart failure - LV reconstruction - Cardiac transplantation 8.3 Mechanical circulatory support - Indications - Patient selection					

- **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: Ultrasound, Doppler principles

Course: Core

Credits: 3 Number of Hours: 45

Course Outcomes: Course Outcomes:

After completing this course the students will be able to:

a. To understand basic concepts of ultrasound physics and its applications to patient care.

b. To understand the application of 2D and Doppler principles in image Acquisition
c. To understand core concepts of Hemodynamic using Doppler calculations.
d. To gain knowledge on the specialized techniques used in echocardiography
e. To understand the mechanism and ECG findings of cardiac arrhythmias

COURSE CONTENT:

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

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Types Of Questions
Unit 1	4	**Physical properties of Ultrasound** 1.1 Properties of Sound 1.2 Properties of Ultrasound 1.3 Specular and Scattered echoes 1.4 Interaction between Ultrasound and tissue	√			**9%**	SE
Unit 2	4	**Transducer and production of Ultrasound beams** 2.1 Piezoelectric crystals 2.2 Transducer designs 2.3 Fresnel and Fraunhofer zone 2.4 Artifacts in echocardiographic imaging	√			10%	LE,SE
Unit 3	4	**Creating an image** 3.1 Display options: A-mode, B-mode, M-mode 3.2 Resolution 3.3 Tissue Harmonic Imaging	√			9%	SE

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Types Of Questions
Unit 4	5	**Principles of Doppler echocardiography** 4.1 Doppler shift and its medical applications 4.2 Determination of blood flow velocity and gradients, angle corrections 4.3 ulsed wave Doppler 4.4 ontinuous wave Doppler 4.5 yquist limit, Aliasing Technical limitations of Doppler flow imaging	√			12%	LE,SE
Unit 5	4	**Color flow imaging** **5.1 Manipulating sector** **5.2 olor gains and color maps** **5.3** Assessing severity of regurgitation **5.4** Limitations of color flow-Billiard ball effect, Coanda effect	√			8%	SE
Unit 6	6	**Hemodynamic assessment by Doppler** **6.1 Stroke volume/cardiac output** **6.2 ernoulli's principle** **6.3 ontinuity equation** **6.4**	√			13%	LE,SE

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Types Of Questions
		ISA method					
Unit 7	4	**Contrast echocardiography** **7.1 Source of echo** **7.2 Microbubbles as echo-contrast agents** 7.3 Source of microbubbles in injected solutions 7.4 Contrast solutions 7.5 Injection technique 7.6 Left sided contrast following right sided injection 7.7 Analysis of contrast echocardiogram	√			9%	LE,SE
Unit 8	8	**Specialized techniques in Echocardiography-Technical aspects** 8.1 issue Doppler Imaging 8.2 Trans-esophageal echocardiography and probes 8.3 Intra-vascular Ultrasound 8.4 3D principles and acquisition of images		√		17	SE
Unit 9	6	**Advanced ECG** 9.1 Mechanism of cardiac arrhythmias 9.2 Sinus nodal disturbances and arrhythmias: - SA exit block	√			13%	LE,SE

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Types Of Questions
		- Sick sinus syndrome 9.3 AV junctional arrhythmias - AVNRT - AVRT 9.4 Pre-excitation syndrome - Concealed accessory pathways - WPW 9.5 Ventricular arrhythmias -Ventricular tachycardia - Ventricular flutter -Ventricular fibrillation -SVT with aberrancy					

- **Recommended Books:**

1. Harvey Feigenbaum. Feigenbaum's Echocardiography, Wolters Kluwer India .6th Edition ,2010
2. Jae K OH Tajik. Echo Manual 3rd Edition, 2006
3. Catherine M Otto, Textbook of clinical Echocardiography, Elsevier, 6th Edition 2018
4. Arthur Weyman, Principles and practices of Echocardiography.
5. Leo Schamroth ,Introduction to electrocardiography, Wiley publisher 8th edition 2018

Course Title: Bioethics

Course: Core

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

Course Outcomes:

After completing this course the students will be able to:

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. CLO 4: Analyze 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 Know	Desirable to	Weightage (%)	Type of Questions
Unit 1	5	**Introduction to bioethics** 1.1 Definition and scope of bioethics	√			10	LE, SE
		1.2 History of bioethics		√			
		1.3 Codes of ethics	√				
Unit 2	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	√				
Unit 3	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			√		

Unit	Hrs	Content	Must Know	Good to Know	Desirable to	Weightage (%)	Type of Questions
		3.7 Public health ethics			√		
Unit 4	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	√				
Unit 5	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	√				

Unit	Hrs	Content	Must Know	Good to Know	Desirable to	Weightage (%)	Type of Questions
		5.5. Publication ethics	√				

Reference Books:

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

Course Title: Echocardiographic Clinical Skills Paper II

Course: SEC

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

Course Outcomes:

After completing this course the students will be able to:

a. Evaluation of patients with IHD

b. Evaluation and severity assessment of valvular lesion

Course Content:

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of Question
Unit 1	**80**	1.1 Ischemic heart disease Evaluation 1.2 Follow up assessment 1.3 Complication of acute MI assessment Clinical correlation of symptoms 1.4 Understanding coronary circulation: Coronary anatomy and physiology, pathogenesis of atherosclerotic plaques, abnormalities of coronary perfusion, wall thickening 1.5 Wall motion scoring: Regional left ventricular function, relationship to vascular supply, use of tissue Doppler where indicated, Segmental analysis for wall motion defects, coronary artery territories, detection and quantization of Ischemic muscle-wall motion scoring, 1.6 Global ventricular function: Linear measurements: indirect M-Mode markers of left ventricular function; Assessing global LV function 1.7 Assessment of overall performance of the Ischemic	✓			33%	-

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of Question
		left ventricle-systolic and diastolic function, estimating volumes rule of disks 1.8 Myocardial infarction: Detecting and assessing MI, co- relation with coronary anatomy, prognostication following MI.					
Unit 2	**80**	2.1 Echo examination in valvular heart disease and Heart failure 2.2 Hemodynamic information derived from echocardiography: Aortic flow, pulmonary flow, mitral flow, left atrial flow, tricuspid valve flow, cardiac output, regurgitant fraction shunt ratios 2.3 Echocardiographic detection of stagnant blood flow, modified Bernoulli equation and intravascular pressures, echocardiographic findings with elevated left ventricular diastolic pressure, elevated left atrial pressures, pulmonary hypertension, right ventricular pressure, right atrial pressure.	✓			33%	-

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of Question
Unit 3	**80**	3.1 Basic concepts of ultrasound physics and its applications to patient care. 3.2 Application of 2D and Doppler principles in image Acquisition 3.3 Hemodynamic using Doppler calculations. 3.4 Specialized techniques used in echocardiography	✓			33%	

SEMESTER III
Course Title: Congenital heart disease

Course: Core

Credits: 3 Number of Hours: 45

Course Outcomes:

After completing this course the students will be able to:

a. Understand the segmental approach to imaging of congenital heart disease

b. Understand the hemodynamics of each acyanotic congenital heart disease

c. Gain knowledge on the hemodynamics of each Cyanotic congenital heart disease

d. Understand Cono-truncal anomalies in detail

e. Gain knowledge on echocardiographic examination during and after CHD repair

COURSE CONTENT:

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage(%)	Types Of Questions
1	2	Fetal cardiac imaging 1.1 Fetal physiology 1.2 Indications for fetal echocardiography		√		4	SE
2	3	Echo examination 2.1 Segmental approach to anatomy 2.2 Cardiac situs 2.3 Ventricular morphology 2.4 Great artery connection	√			6	SE
3	3	Abnormalities of cardiac septation 3.1 Atrial septal defect 3.2 Ventricular septal defect 3.3 Endocardial cushion defect	√			6	LE,SE
4	8	Abnormalities of RV inflow and LV inflow	√			17	LE,SE

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage(%)	Types Of Questions
		4.1 Abnormalities of RV inflow -Ebstein's anomaly -Tricuspid stenosis -Tricuspid atresia 4.2 Abnormalities of LV inflow -Abnormal pulmonary venous connection-TAPVC, PAPVC, Cor-triatriatum -Supra valvular mitral ring -Double orifice mitral ring -Hypoplastic left heart syndrome					
5	2	Anomalous systemic venous connection 5.1 Anomalies of SVC 5.2 Anomalies of	√			4	SE

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage(%)	Types Of Questions
		IVC					
6	5	Abnormalities of RV outflow and LV outflow 6.1 Abnormalities of RV outflow - Pulmonary stenosis -Pulmonary atresia with intact ventricular septum 6.2 Abnormalities of RV outflow -Subvalvular, Valvular and supravalvular AS -Co-arctation of aorta	√			11	LE,SE
7	5	Abnormal vascular connections and structures 7.1 Patent ductus arteriosus 7.2 Coronary artery anomalies	√			11	SE

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage(%)	Types Of Questions
		7.3 Vascular anomalies 7.4 Interrupted aortic arch					
8	8	Cono- truncal Abnormalities 8.1 Tetralogy of fallot 8.2 TOF with pulmonary atresia 8.3 TOF with absent pulmonary valve 8.4 Transposition of the great arteries 8.5 Complete TGA 8.6 Congenitally corrected TGA 8.7 Double outlet right ventricle 8.8 Truncus arteriosus	√			17	LE,SE
9	6	Complex Congenital heart diseases 9.2 Single ventricle 9.3 Common atrium 9.4 Heterotaxy syndrome	√			13	LE,SE

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage(%)	Types Of Questions
10	3	Echo evaluation during and after surgery 10.1 Systemic artery to pulmonary artery shunts 10.2 Pulmonary artery bands 10.3 Fontan procedure 10.4 Right ventricle to pulmonary artery conduits	√	√		6	SE

Recommended Books:

- Moss and Adams. Heart Disease in Infants & children 9th edition
- Myung K Park. Park's Pediatric Cardiology for practitioners. Elsevier India published in 2014
- J K Perloff. Congenital Heart Disease in Adults. Sonders 3rd edition.

Course Title: Cardiac Pacemaker

Course: Core

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

Course Outcomes:

After completing this course the students will be able to:

a. To understand the technical aspects of cardiac pacemakers

b. To gain knowledge on various diagnostic modalities to detect arrhythmias

c. To understand the technical aspects of ICD

d. To understand the technical aspects of CRT

e. To understand the post procedural programming and analysis of pacemakers, ICD and CRT on follow up

COURSE CONTENT:

Unit	Hrs	Content	Must Know	Good to Know	e to Know	Weightage	Types Of Questions
Unit 1	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		√		15%	LE,SE
Unit 2	8	**Unit – 2**: Cardiac Pacing 2.1Basic components of cardiac pacemakers 2.2 Pacemaker classification	√			20%	

Unit	Hrs	Content	Must Know	Good to Know	e to Know	Weightage	Types Of Questions
		2.3 Indications for pacemaker implantation(guidelines) 2.4 Physiology of cardiac pacing 2.5 Pacemaker timing cycles and intervals 2.6 Rate adaptive pacing 2.7 Automatic mode switching 2.8 Basic pacing modes					LA.SE
Unit 3	8	**Unit-3** Biventricular pacing 3.1 PPI- pertinent issues for the physician 3.2 Common pacemaker problem 3.3 Pacemaker system malfunction 3.4 Common issues for the patient with PPI 3.5 Evolving indications for pacemakers and future directions	√			20%	LA,SE

Unit	Hrs	Content	Must Know	Good to Know	e to Know	Weightage	Types Of Questions
Unit 4	9	**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
Unit 5	10	**Unit -5** Cardiac Resynchronization therapy 5.1 Introduction 5.2 Mechanism of LV dyssynchrony 5.3 Types of LV	√			25%	

Unit	Hrs	Content	Must Know	Good to Know	e to Know	Weightage	Types Of Questions
		dyssynchrony 5.4 Role of CRT 5.5 Current guidelines 5.6 Implantation procedure					LA

- **Recommended Books:**

1. Brain Griffin, Manual of cardiovascular medicine, 9th edition
2. Eric J. Topol, Textbook of Cardiovascular medicine, 5th edition

Course Title: Health Care Management

Course: Core

Credits: 3 Number of Hours: 45

Course Outcomes:

After completing this course the students will be able to:

a. Concepts of Hospitals –The student will gain knowledge about hospital administration & planning.

b. Workflow in hospitals - Enumerate and identify various Clinical Services like OPD,IPD, ward Management, OT, Emergency, disaster Management and ICU.

c. Organizational Structures - To learn to meet special challenges posed by humanbehavior in workplace of 21st century

d. Quality management - To create an awareness about the process of applying for andimplementing various accreditation process in healthcare facilities.

Course Content:

Unit	Hrs	Content	Must Know	Good to ...	Desirable to ...	Weightage	Type of Questions
1	4	**Hospital Structure** 1.1. Introduction to Hospitals,	√			5	SE

Unit	Hrs	Content	Must Know	Good to ...	Desirable to ...	Weightage	Type of Questions
		Healthcare & Medical Care, Rationale of Hospital Administration					
		1.2. History of Hospitals, Public Health Delivery system in India, Types of Hospitals, Voluntary Health Organizations			√		
2	8	**Management of Healthcare Organizations** 2.1 Introduction to Management	√			20	LE, SE
		2.2 Evolution & Theories of Management		√			
		2.3 Management Functions: Planning	√				
		2.4 Organizing	√				
		2.5 Controlling	√				
		2.6 Decision Making	√				
		2.7 Staffing	√				
		2.8 Techniques in Management	√				

Unit	Hrs	Content	Must Know	Good to ...	Desirable to ...	Weightage	Type of Questions
3	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	√				
4	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	√				

Unit	Hrs	Content	Must Know	Good to ...	Desirable to ...	Weightage	Type of Questions
		Government					
5	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	√				
6	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	√				

Unit	Hrs	Content	Must Know	Good to ...	Desirable to ...	Weightage	Type of Questions
		6.7 Hospital Information Systems - Issues related to Healthcare technology, Planning, Infrastructure	√				
7	5	**Evolution of Quality management** 7.1 Quality Management Tools & methods	√			10	SE
		7.2 Quality certification & Accreditation – NABH, NABL	√				

Reference Books:

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

Course Title: Echocardiographic Clinical Skills Paper III

Course: SEC

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

Course Outcomes:

After completing this course the students will be able to:

a. Approach to pediatric echocardiography
b. Diagnose and evaluate of congenital heart diseases
c. Diagnose Cardiomyopathies types and evaluation

Course Content:

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of Question
1	**150**	**Echo examination** 1.1 A segmental approach to congenital heart disease Hemodynamics evaluation 1.2 Lesion assessment with respect to timing of palliative/corrective	✓			50%	--

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of Question
		surgery 1.3 Pediatric echocardiography: Segmental approach, Assessing visceral and cardiac situs,veno-atrialconnection,atrio-ventricularandventriculo-greatarteryrelation, Ventricular loop, Great artery position, Aortic arch visualization. 1.4 Abnormalities of right& left ventricular inflow & outflow tracts					
2	**150**	Assessment of various types of cardiomyopathies and various heart failure stages				50%	-

SEMESTER IV

Course Title: Miscellaneous diseases of the heart

Course: Core

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

Course Outcomes:

After completing this course the students will be able to:

a. To understand the pathophysiology, echocardiographic evaluation and management options of various cardiomyopathies

b. To gain knowledge on echocardiographic differentiation of ischemic and non-ischemic cardiomyopathy

c. To understand the pathophysiology, echocardiographic evaluation of pericardial diseases

d. To understand different etiologies, clinical presentations and types associated with disease states including aortic diseases, systemic diseases and cardiac masses.

e. To develop theoretical and practical skills to how to approach aortic diseases, systemic diseases and cardiac masses by echocardiography

COURSE CONTENT:

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

Unit	Hrs	Content	Must Know	Good to Know	e to Know	Weightage	Types Of Questions
Unit 1	4	**UNIT 1**: Hypertrophic cardiomyopathy 1.1 Definition and types of hypertrophy 1.2 Pathophysiology 1.3 Clinical evaluation 1.4 Diagnosis 1.5 Prognosis 1.6 Management		√		10%	LE,SE
Unit 2	4	**UNIT 2**: Dilated cardiomyopathy 2.1 Secondary findings in DCM 2.2 Etiology of DCM 2.3 Doppler evaluation of systolic and diastolic function 2.4 Therapeutic decision	√			15%	LE.SE

Unit	Hrs	Content	Must Know	Good to Know	e to Know	Weightage	Types Of Questions
Unit 3	7	**UNIT 3**: Infiltrative and Restrictive cardiomyopathy 3.1 Pathophysiology 3.2 Types of RCM 3.3 Echo evaluation of RCM 3.4 Endocardial fibroelastosis and hyper-eosinophilic syndrome 3.5 Constrictive versus restrictive heart disease	√			20%	LE,SE
Unit 4	3	**UNIT 4** : Peri-partum cardiomyopathy 4.1 Definition 4.2 Pathophysiology 4.3 Clinical evaluation 4.4 Diagnosis 4.5 Prognosis 4.6 Management	√			5%	LE, SE
Unit 5	3	**UNIT 5:** Non-compaction LV/RV cardiomyopathy	√			10%	LE

Unit	Hrs	Content	Must Know	Good to Know	e to Know	Weightage	Types Of Questions
		5.1 Definition 5.2 Diagnosis 5.3 Management					
Unit 6	2	**UNIT 6**: Echocardiographic differentiation of ischemic and Non-Ischemic cardiomyopathy 6.1 Echocardiographic assessment of ischemic and non-ischemic cardiomyopathy 6.2 M-mode echocardiography 6.3 2D/3D/Doppler echocardiography 6.4 Distinction between ischemic and non- ischemic dilated cardiomyopathy 6.5 Other non-invasive imaging modalities			√	5%	LE,SE
Unit 7	6	**UNIT -7** Pericardial disease	√			10%	LE,SE

Unit	Hrs	Content	Must Know	Good to Know	e to Know	Weightage	Types Of Questions
		7.1Acute pericarditis 7.2 Pericardial effusion 7.3 M-Mode and 2D echocardiography 7.4 Pericardial tamponade 7.5 Constrictive pericarditis 7.6 Congenital anomalies					
Unit 8	7	**Unit-8:** Diseases of the Aorta 8.1 Aortic dilatation and aneurysm 8.2 Marfan's syndrome 8.3 Valsalva sinus aneurysm 8.4 Aortic dissection 8.5 Acute aortic syndrome 8.6 Infections of the aorta 8.7 Takayasu arteritis	√			10%	LE,SE
Unit 9	8	**Unit -9**: Echocardiography in systemic disease, nutritional and metabolic disorder 9.1 Echocardiography in		√		10%	LE,SE

Unit	Hrs	Content	Must Know	Good to Know	e to Know	Weightage	Types Of Questions
		systemic disease - Hypertension - Diabetes mellitus - Connective tissue /autoimmune disease - Chronic liver disease -COPD - Pulmonary hypertension 9.2 Echo in nutritional and metabolic disorder Endocrine diseases Pregnancy and heart disease					
Unit 10	2	Unit -10 Echocardiographic assessment of Cardiac Tumors and Masses 10.1 Echocardiographic assessment of cardiac tumors and masses 10.2 Primary Benign cardiac tumors		√		5%	SE

Unit	Hrs	Content	Must Know	Good to Know	e to Know	Weightage	Types Of Questions
		10.3 Malignant primary cardiac tumors					

- **Recommended Books:**

1.Armstrong W, Ryan T and Harvey Feigenbaum's (2010). Feigenbaum's echocardiography (7th edition)

2.Braunwald's Heart Disease, A Textbook of cardiovascular medicine,11th edition, Elsevier,9 January 2018

3.Brain Griffin, Manual of Cardiovascular medicine, 9th edition

Course title: Recent Advances in Echocardiography

Course: Core

Credits: 3 Number of Hours: 45

Course Outcomes:

After completing this course the students will be able to:

a. Develop an understanding of the multi-disciplinary applications of advanced techniques in clinical practice over conventional 2D imaging and its role as a vital procedural adjunct

b. To understand the technique, analysis and applications of contrast echocardiography

c. To gain knowledge on the technique and clinical applications of 3D TTE and TEE

d. To understand the role and clinical applications of speckle tracking strain echocardiography

e. To understand clinical applications of cardiac MRI

COURSE CONTENT:

Unit	Hrs	Content	Must Know	Good to Know	e to Know	Weightage	Types Of Questions
Unit1	3	**Unit 1: Monitoring ventricular function in the operating room** 6.2 Global systolic function ,regional wall motion abnormality 6.3 Use of TEE in operating room to monitor cardiac function in specific cardiac entities	√			6%	LE,SE
Unit 2	4	**Unit – 2: Contrast ultrasound imaging, method, analysis and application** 2.1 Ultrasonography contrast agent' 2.2 ultrasonographic imaging technique	√			8%	LE,SE

Unit	Hrs	Content	Must Know	Good to Know	e to Know	Weightage	Types Of Questions
		2.3 method of analysis clinical applications of ultrasonographic contrast 2.4 Myocardial contrast echocardiography 2.5 Indications for use of ultrasound contrast 2.6 Safety of ultrasound contrast					
Unit 3	3	**Unit– 3: Endothelial Dysfunction** 3.1 Endothelial functions and dysfunction 3.2 Role of acetylcholine 3.3Shear stress and flow mediated dilatation 3.4 NO release 3.5 Methodology for assessing endothelial function 3.6 Factors affecting the flow mediated dilatation 3.7 Limitations		√		6%	LE, SE

Unit	Hrs	Content	Must Know	Good to Know	e to Know	Weightage	Types Of Questions
		3.8 Other non-invasive methods to assess endothelial function					
Unit 4	10	**Unit – 4: 3D-Transthoracic and TEE echo examination and performing** 4.1 3D TEE Technology 4.2 performing 3D TEE evaluation 4.3 Specific uses of 3D TEE 4.4 Advanced non-invasive quantification technique in echocardiography -clinical applications of advanced 3D echo - RV quantification 4.5 3D TEE to evaluate valvular heart diseases -3D echo image optimization - 3D echo of the mitral valve	√			22%	LA, SE

Unit	Hrs	Content	Must Know	Good to Know	e to Know	Weightage	Types Of Questions
		- 3D echo of the aortic valve -3D echo of the pulmonic valve -3D echo of the tricuspid valve					
Unit 5	7	**Unit 5: 3D TEE in operating room and 3D guidance of percutaneous procedures** **3D TEE in operating room** - Mitral valve disease - Aortic valve diseases - Tricupsid valve disease - Native valve endocarditis - Prosthetic valve dysfunction 5.1 3D guidance of percutaneous procedures - Fluoroscopy versus echocardiography in		√		15%	LE,SE

Unit	Hrs	Content	Must Know	Good to Know	e to Know	Weightage	Types Of Questions
		guiding percutaneous interventions - Trans-septal puncture - device closure of cardiac shunts - occlusion of the LAA - guidance for EP procedures - Miscellaneous procedures					
Unit 6	3	**Unit 6: Speckle tracking echocardiography, clinical usefulness** 6.1 Cardiac muscular anatomy 6.2 Definition of strain 6.3 2D speckle tracking echocardiography 6.4 Image acquisition and processing 6.5 Clinical applications of 2DSTE 6.6 3D speckle tracking echocardiography, clinical	√			6%	LE,SE

Unit	Hrs	Content	Must Know	Good to Know	e to Know	Weightage	Types Of Questions
		applications of 3DSTE 6.7 Limitations					
Unit 7	3	**Unit7: Intracardiac Echocardiography** 7.1 Equipments and the catheters 7.2 imaging specifications 7.3 clinical applications 7.4 Intracardiac echocardiography during EP intervention	√			6%	LE,SE
Unit 8	3	**UNIT 8: Echo for the electrophysiologist** 8.1 Echocardiography in SVT 8.2 Left atrium, atrial septum, pulmonary veins and vena cava 8.3 echocardiography in VT 8.4 Echocardiography in cardiac implantable electronic devices	√			6%	SE
Unit	6	**UNIT 9: Echo in life**		√		13%	LE,SE

Unit	Hrs	Content	Must Know	Good to Know	e to Know	Weightage	Types Of Questions
9		**threatening condition** 9.1 Chest trauma 9.2 Pulmonary thromboembolism disease 9.3Air embolism 9.4 Hypovolemia 9.5 Large intracardiac thrombus 9.6 Aortic dissection					
Unit 10	5	**Unit 10: A Primer on cardiac MRI for the echocardiographer** 10.1 Quantitative left and right ventricular assessment 10.2 Strain assessment 10.3 LV structure 10.4 Myocarditis and sarcoidosis 10.5 Cardiomyopathies 10.6 Velocity mapping, flow and shunt assessment 10.7Valvular heart diseases		√		12%	SE

Unit	Hrs	Content	Must Know	Good to Know	e to Know	Weightage	Types Of Questions
		and prosthetic valves					

- **Recommended Books:**

- Armstrong W, Ryan T and Harvey Feigenbaum's (2010). Feigenbaum's echocardiography(7th edition)
- Navin C Nanda, Comprehensive Textbook of Echocardiography(2nd edition)

Course Title: Echocardiographic Clinical Skills Paper IV

Course: SEC

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

Course Outcomes:

After completing this course the students will be able to:

a. Echocardiographic examination of myocardial, pericardial, aortic diseases

b. Evaluation of patient's pre and post cardiac surgeries

c. Analysis of tissue deformation using speckle tracking echocardiography 3D Echocardiography

Course Content:

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of Question
1	48hrs	Echocardiographic examination of miscellaneous diseases 1.1HypertrophicCardiomyopathy: 1.2 Idiopathic dilated cardiomyopathy: 1.3 Restrictive Cardiomyopathy 1.4 Diseases of the pericardium	✓			20%	--
2	48hrs	Diseases of the aorta	✓			20%	-

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of Question
3	48hrs	Echocardiography in systemic disorders	✓			20%	-
4	48hrs	Assessment of cardiac dyssynchrony and its application	✓			20%	-
5	48hrs	Advanced Echo	✓			20%	-

10.Teaching - Learning methods course-wise

Teaching - Learning method	Courses

Experiential learning	Echocardiographic Clinical Skills I-IV
Integrated/Inter-disciplinary learning	Bioethics, Healthcare Management
Participatory learning	Bioethics, Health Care Management, Clinical Cardiology
Problem-solving methodologies	Biostatistics & Research Methodology, Echocardiographic Clinical Skills I-IV Ischemic and valvular heart disease Miscellaneous Diseases of the heart Congenital heart disease
Self-directed learning	Coursera / SWAYAM,
Patient-centric and Evidence-based learning	Echocardiographic Clinical Skills I-IV Ischemic and valvular heart disease Miscellaneous Diseases of the heart Congenital heart disease
The Humanities	Bioethics
Project-based learning	Dissertation, Biostatistics & Research Methodology
Team-work	Echocardiographic Clinical Skills I-IV
Role-play	Bioethics, Health Care Management ,Clinical cardiology
Reflective writing	Echocardiographic Clinical Skills I-IV

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	
LONG ESSAY TYPE	02	15	30	150 minutes
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. Echocardiography 2nd Yearexamination.

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

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

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.

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

11.9.3 Acceptance 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 Cardiology or M.Sc. Echocardiography 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%. The pass marks per course shall be 50%

12.5 There shall be examinations at the end of each semester ordinarily during February/March for odd semesters and August/September for even semester

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

- Journal European society of echocardiography
- Journal of Indian Academy of echocardiography
- Journal of American society of echocardiography

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

Annexure VI – OSPE/OSCE checklist