VELS

INSTITUTE OF SCIENCE, TECHNOLOGY & ADVANCED STUDIES (VISTAS)
(Deemed to be University Estd. u/s 3 of the UGC Act, 1956)
PALLAVARAM - CHENNAI
ACCREDITED BY NAAC WITH 'A' GRADE
Marching Beyond 30 Years Successfully



M.Sc. Echocardoigraphy & Cardiovascular Imaging Technology

Curriculum and Syllabus - 2024 Regulation

(Based on Choice Based Credit System (CBCS)

And

Outcome Based Education (OBE)

Effective from the Academic year 2024-2025

School of Allied Health Sciences

1. SHORT TITLE AND COMMENCEMENT:

These regulations shall be called "Specific Regulations for the M.Sc Echocardiography & Cardiovascular Imaging Technology course of Vels Institute of Science Technology and Advanced Studies,Deemed to be University u/s3 of UGC act 1956. These Regulations are applicable to the students who are admitted to the M.Sc Echocardiography & Cardiovascular Imaging Technology in this University.

As per the decision of the Academic Council of this University, these regulations have beenprepared by adopting the regulations of the VISTAS.

2. AIMS

To provide holistic knowledge about clinical care, communication, membership of a multidisciplinary health care team, which is committed to professional excellence, social accountability, leadership quality about lifelong learning.

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3. OBJECTIVES

On completion of the four years M.Sc Echocardiography & Cardiovascular Imaging Technology Programme the graduates will be:

1. Evolve into a full trained, qualified cardiovascular technologist capable of working independently.
2. Become well-versed in techniques such as cardiac catheterization, Electrocardiography, Echocardiography and ultrasound instrumentation.
3. Integrate knowledge and skills of cardiovascular technology to provide healthcare solutions for the benefit of the society.
4. Become well-prepared for working in a team associated with assisting cardiac surgeons and cardiologists in a high-pressure hospital environments.
5. Be cognizant and responsive to the cardiovascular care of the community and possess a commitment to continuously improve knowledge and abilities.
6. Demonstrate leadership qualities and entrepreneur skills by working and communicating effectively in interdisciplinary environment, either independently or in a team.

4. ELIGIBILITY FOR ADMISSION

A Candidate desiring to join the M.Sc Echocardiography & Cardiovascular Imaging Technology should have completed M.Sc.Cardiac Care Technology/Cardiac Perfusion from any recognized university.

No upper age limit for Admission

- Selection of the candidates would be based on the merit of the entrance examination held by VISTAS.

5. DURATIONOF THE COURSE:

The duration of the M.Sc Echocardiography & Cardiovascular Imaging Technology Degree course shall be 2 Years full-time programme comprising 4 Semesters including internship under Choice based Credit System.

6. MEDIUM OF INSTRUCTION:

English shall be the medium of instruction for all subjects of study and examinations will be conducted only in English.

7. COMMENCEMENT OF THE COURSE:

The course shall commence on October of the academic year.

8. WORKING DAYS IN A SEMESTER:

Each semester shall consist of not less than 100 working days and each academic year shall have a total of 200 working days

9. REGISTRATION

A Candidate admitted to the course shall be registered by remitting the prescribed fees along with the Application form for registration duly filled with in the stipulated dates.

10. COMMENCEMENT OF THE EXAMINATIONS:

Regular Semester Examinations will commence from last week of November and last week of April

If the date of commencement of the examination falls on Saturday, Sunday or declaredPublic Holidays, the examination shall begin on the next working day.

SEMESTER-I

Sl.No.	Category	Course Titles	Hours/Credits							Maximum Marks				
			Lecture		Tutorial		Practical		Total	IA		UA		Total
			Hours	Credits	Hours	Credits	Hours	Credits	Credits	Theory	Practical/Viva	Theory	Practical/Viva	
1.1	Program Core	Ultrasound physics & Instrumentation	45	3	30	1	60	2	6	25	50	75	50	200
1.2	Program Core	Cardiac Anatomy ,physiology, Pathology	45	3	30	1	60	2	6	25	50	75	50	200
1.3	Program Core	Basic of surgical treatments in cardiology	45	3	30	1	60	2	6	25	50	75	50	200
1.4	Program Core	Biostatistic &Research Methodology	45	3	30	1	-	-	4	25		75		100
1.5	Program Core	Clinical Cardiology I					90	3	3	50	50	-	-	100
								Total	22			Total		800

SEMESTER II

Sl.No.	Category	Course Titles	Hours/Credits							Maximum Marks				
			Lecture		Tutorial		Practical		Total	IA		UA		Total
			Hours	Credits	Hours	Credits	Hours	Credits	Credits	Theory	Practical/Viva	Theory	Practical/Viva	
2.1	Program Core	Ischemic heart Disease	60	4	30	1	60	2	7	25	50	75	50	200
2.2	Program Core	Valvular Heart Disease	60	4	30	1	60	2	7	25	50	75	50	200
2.3	Program Core Elective	Health Care management*	30	2	-	-	-	-	2	100	-	-	-	100
2.4	Program Core	Clinical Cardiology II	-	-	-	-	120	4	4	50	50	-	-	100
								Total	20			Total		600

SEMESTER III

Sl.No.	Category	Course Titles	Hours/Credits							Maximum Marks				
			Lecture		Tutorial		Practical		Total	IA		UA		Total
			Hours	Credits	Hours	Credits	Hours	Credits	Credits	Theory	Practical/Viva	Theory	Practical/Viva	
3.1	Program Core	Embrology & approach to pediatrics & Recent advances in Echocardiography	45	3	30	1	60	2	6	25	50	75	50	200
3.2	Program Core	Congenital Heart Disease in Echocardiography	45	3	30	1	60	2	6	25	50	75	50	200
3.3	Program Core	Echocardiography in Myocardial,, Aortic ,Systemic Disorders	45	3	30	1	60	2	6	25	50	75	50	200
3.4	Program Elective	Patient care*	30	2	-	-	-	-	2	100	-	-	-	100
3.5	Program Core	Clinical Cardiology – III	-	-	-	-	120	4	4	50	50	-	-	100
								Total	24			Total		700

SEMESTER IV

Sl.No.	Category	Course Titles	Hours/Credits							Maximum Marks				
			Lecture		Tutorial		Practical		Total	IA		UA		Total
			Hours	Credits	Hours	Credits	Hours	Credits	Credits	Theory	Practical/Viva	Theory	Practical/Viva	
4.1	Program Core	Vascular Ultrasound - Arterial &Venous Doppler Theory	60	4	30	1	60	2	7	25	50	75	50	200
4.2	Program Core	Basics of CT&MRI in cardiac Theory	60	4	30	1	60	2	7	25	50	75	50	200
4.3	Program Core-Lab	Seminars, Journal Clubs and Group Discussions	-	-	-	-	120	4	4	-	50	-	50	100
4.4	Program Elective	CSSD including Sterilization	30	2	-	-	-	--	2	100			-	100
4.5	Thesis	Dissertation and viva voice	-	-	120	4	-	-	4	50	50	-	-	100
								Total	23			Total		600

11. SUBMISSION OF LABORATORY RECORD NOTE BOOKS

At the time of practical examination, each candidate shall submit to the examiners his / her laboratory note books duly certified by the Head of the Department as a bonafide record of the work done by the candidate

12. INTERNALASSESSMENT:

a) A minimum of two written internal assessment examinations shall be conducted in each subject during a semester and the Best / Average marks of two examinations shall be taken into consideration for the award of internal marks.

b) A model practical examinations shall be conducted in each subject (wherever practical have been included in the curriculum) shall be taken into consideration for award of internal marks in practical.

c) Tests will be conducted giving sufficient time for preparation.

d) No repeat, reschedule and postponement of the assessment date is permitted .Students shall compulsorily attend any three continuous assessments

13. ATTENDANCE REQUIRED FOR ADMISSION TO EXAMINATIONS:

a) No candidate shall be permitted to appear for the University examinations, unless he/she attends the course for the prescribed period.

b) Every candidate is required to put in a minimum of 80% of attendance both in theory and practical separately in each subject for admission to the examination.

c) A candidate lacking in the prescribed attendance in any subject in theory or practical shall not be admitted to the entire examination.

14. CONDONING LACK OF ATTENDANCE

Condoning of shortage of attendance up to a maximum of 10% in the prescribed eligible attendance for admission to year end examination rests with the discretionary power of the Vice Chancellor. A Candidate lacking in attendance should submit an application in the prescribed form and remit the stipulated fee, 15days prior to the commencement of the theory examination,The Head of the Department should satisfy himself on the reasonableness of the candidate's request while forwarding the application of the candidate to the Controller of Examinations, whowould obtain the Vice – Chancellor's approval for admission to the examination. No application would be accepted if it is not forwarded through proper channel.

1. Condoning lack of attendance should be taken up for consideration under the following circumstances:-

a) Any illness affecting the candidate – Candidates should submit a medical certificate from registered medical practitioners.

b) Any unforeseen tragedy in the family. The parents/ guardian should give in writing about what had happened.

c). Participation in National Service Scheme and other co-curricular activities representing the University.

15. RE-ADMISSION AFTER BREAK OFSTUDY:

A separate regulation is available for all the UG/PG courses of this university for the readmission of candidates after a break of study.

16. INTERNSHIP

- Internship means 8 hours of integrated clinical duties
- Internship should be carried out as 8 Hours per day @ 48 hours per week
- Students will be supervised by the Faculties & well Trained Professionals during Internship.
- Internship will be started after passing in the third year Examination.

17. YEAR END EXAMINATIONS

- Commencement of the Examination will be in November /April
- If the date of commencement falls on Saturdays, Sundays or declared public holidays, the examination shall begin on the next working day.
- The duration of the examination of each subject is 3hours.
- Minimum pass marks shall be 50 % in each of the theory and practical papers separately except in Internal papers.
- Minimum Pass marks in Internal papers Shall be 50%.

Carryover of failed subjects:

- A candidate has to pass in theory and practical examinations separately in each of the subject.
- If a candidate fails in either theory or practical of the subjects, he/she has to reappear for both the Theory and Practical.

- The candidate if fails can be permitted for admission to next year.
- d.)The candidate shall have to clear all the previous examination before appearing for the Sixth Semester examination.

18. REVALUATION / RETOTALLING OFANSWER PAPERS:

There is provision for revaluation of the answer papers of failed candidates in any examination. However, the failed candidates cannot apply for retotaling.

19. CREDITS

Credits will be assigned on the basis of the lectures (L) /tutorials (T) Clinical Training (CR) /laboratory work (P) /Research Project (RP) and other form of learning in a 15-20week schedule.

- L- One credit for one hour lecture per week (1 credit = 15 hours)
- P/T – One credit for every two hours of laboratory or practical (1 credit = 30hours)
- CR – One credit for every two hours of Clinical Training/Clinical Rotation/Posing (1 credit = 30 hours)
- RP – One credit for every two hours of Research Project per week – Max Credit20-25 (1 credit =30 hours)

20. GRADING SYSTEM

Based on the performance, each student shall be awarded a final grade at the end of the semester for each course. Absolute grading is used by converting the marks to grade, based on pre-determined class intervals.

UGC 10-point grading system is used with pass grade modified.

Letter Grade	Grade Point	Range of Marks*
O (Outstanding)	10	85% & above
A+ (Excellent)	9	80-84.99%
A (Very Good)	8	75-79.99%
B+ (Good)	7	65-74.99%
B (Above Average)	6	60-64.99%
C (Average)	5	50-59.99%
P(Pass)	-	>50%
F (Fail) / RA (Reappear)	0	<50%
AB (Absent)	0	0

1. A candidate is declared to have pass in a course if he /she secures a minimum 50% marks the university theory & practical Examinations separately & 50% in aggregate of university theory/practical & Internal assessment put together

Computation of Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):

SPGA is the weighted average of the grade points obtained in all courses by the student

during the semester

SGPA Computation:

$$SGPA = \frac{\sum_{i}^{n} (C_i \times (GP)_i}{\sum^{n} C_i}$$

Where C_i - credits for the course, $(GP)_i$ - the grade point obtained for the i^{th} course , n – total number of courses and the sum is over all the courses taken in that semester, including those in which the students has secured "F" and "Ab" grades.

CGPA Computation:

Computation of CGPA:

CGPA is calculated with SGPA of all semesters to two decimal points and is indicated in final grade in mark card/transcript showing grades of all 8 semesters and their courses/subjects.

$$CGPA = \frac{\sum_{i}^{r} Si \times (SGPA)_i}{\sum_{i}^{r} S_i}$$

where:-S_i- sum of credits in i^{th} semester , $(SGPA)_i$- semester grade point average earned in i^{th} semester and r- number of semester and the sum is over all the semesters under consideration. The cumulative grade point average (CGPA) is calculated by consideration all the courses taken from the first semester onwards for regular students and from third semester onwards taken for lateral entry students.

21. CLASSIFICATION OF SUCCESSFUL CANDIDATES:

The CGPA arrived at the completion of the course shall be the criteria for the classification of successful candidates as below:

Cumulative Grades and Grade Points

Letter Grade	Grade Point	Range of Marks*
O (Outstanding)	10	85% & above

A+ (Excellent)	9	80-84.99%
A (Very Good)	8	75-79.99%
B+ (Good)	7	65-74.99%
B (Above Average)	6	60-64.99%
C (Average)	5	50-59.99%
P(Pass)	-	>50%
F (Fail) / RA (Reappear)	0	<50%
AB (Absent)	0	0

a) Successful candidates who secure 75% marks and above as a course aggregate in the first appearance taking University theory, practical, project / dissertation evaluation and viva shall alone be awarded Distinction. This will also apply for award of University rank.

b) Successful candidates who secure 60% marks and above as a course aggregate in the University theory, practical, project / dissertation evaluation and viva shall be awarded First Class.

c) All others who secure 50-59% in gross percentage will be classified to have passed in Second Class.

22. PATTERN OF QUESTION PAPER FOR UNIVERSITYEXAMINATION:

EXAMINATION QUESTION PAPER PATTERN

Essay	**2 x 15**	**= 30 Marks**
Short Notes	**7 x 5**	**= 35 Marks**
Short Answers	**5 x 2**	**= 10 Marks**
Total		**75 Marks**

Internal Split up – Theory

1. Continuous Assessment: 10 Marks

S.no	Continuous Assessment	Marks
1	Attendance	5
2	Assignment	5

2. Internal Assessment: 15 marks

Two Sessional Exams per Course

Internal Split up – Practical

1. **Continuous Assessment: 20 Marks**

S.no	Continuous Assessment	Marks
1	Seminar	10
2	Record note Book	10

2. Model Practical Examination: 30 Marks

23. GRACE MARKS

Maximum of 8 grace marks for each subject is permitted, and grace marks should not exceed 8 marks in subjects.

24. MARKS QUALIFING FOR PASS

A candidate is declared to have passed in a course if he/she secures a minimum of 50% marks in university theory and practical examinations separately and 50%.

SEMESTER I

Ultrasound Physics and Instrumentation : THEORY

Unit I

Physical Properties of Ultrasound: Properties of ultrasound that facilitate its clinical use, limitations of ultrasound in clinical use, properties of ultrasound-cycle, wavelength, frequency, velocity, acoustic impedances of media, specular and scattered echoes, resolving power of ultrasound, attenuation, acoustic shadowing.

Unit II

Transducers and the Production of Ultrasound Beams: Piezoelectric crystals, transducer design, side-lobes, phased array transducers, Fresnel and Fraunhofer's zones, manipulating the ultrasound beam, focal zones, linear and Azimuthal beams, manipulating the ultrasound beam, gain settings,Artifacts

Unit III

Principles of M-mode and Two Dimensional Echocardiography: Concept of gray scale, temporal and spatial resolution, Pulse repetition frequency, echocardiography interface, intensity modulation, B-mode, Standard M-mode recording,

Unit IV

Principles of Doppler Echocardiography and Colour Flow Imaging: Doppler shift and its medical applications, determination of blood flow velocity and gradients, angle corrections, Pulse and continuous wave Doppler, Nyquist limit, aliasing Doppler display, technical limitations of Doppler flow imaging, colour gains and colour maps, assessing severity of regurgitations, limitations of colour flow, 'billiard ball effect', Proximal Isovelocity Surface Area (PISA).

Unit V

Specialized Techniques in Echocardiography- Technical Aspects: Tissue Doppler imaging, tranoesophageal echocardiography and probes, contrast studies-intracavitary and myocardial, cardiac dysynchrony, tissue identification using ultrasound, three dimensional echocardiography.

Cardiac Anatomy, Physiology and Etiopathology of cardiac diseases :

THEORY

Unit I

I. Anatomy of the heart and great vessels
II. Structure of Pericardium
III. Coronary Circulation
IV. Venous drainage
V. Structure of Aorta, Aortic branches and vasculature

Unit II

I. Cardiac cycle
II. Conduction system of heart
III. Cardiac output , factors influencing cardiac output,Fick's Principle
IV. Sympathetic and parasympathetic innervations
V. Systemic and pulmonary circulation

Unit III

Diseases of the Coronary Arteries: Causes, Pathology and Prevention, Coronary Heart Disease – Angina and Unstable Angina; Coronary Heart Disease – Myocardial Infarction: Treatment of acute infraction, complications of acute myocardial infarction and their management.

Unit IV

Heart Failure: The Pathophysiology of heart failure, clinical syndromes of heart failure, the General management of heart failure, acute circulatory failure (shock).

Rheumatic Fever, Disorders of the Cardiac Valves: Mitral valve disease, aortic valve disease, tricuspid valve disease, pulmonary valve disease, infective endocarditis.

Unit V

Congenital Heart Disease: Embryology and the varieties of congenital heart disease.

Diseases of Myocardium: Myocarditis, Pericarditis, Restrictive Cardiomyopathy, Dilated Cardiomyopathy, Hypertrophic Cardiomyopathy, pericardial effusion, constrictive Pericarditis

PRACTICAL- ECG and Hemodynamics

1. The Electrical Activity of the Heart: the Electrocardiogram: The cardiac action potential.
2. Normal ECG interpretation .Normal variations,intervals
3. ECG in CAD/hypertension/valvular heart disease
4. Tachy Arrythmias basics
5. Brady arrythmias basics

Basics of Surgical treatments in Cardiology : THEORY

Unit I

Coronary artery bypass grafting (on pump CABG) - Indications and contraindications - Valve replacement - Mechanical prosthesis - Bio-prosthesis - Aortic root replacement/Enlargement - Tricuspid valve repair

Unit II

Congenital heart disease - ASD closure and VSD closure - TOF repair and Arterial switch (Jatene) - Rastelli Operation, Norwood operation , Glen-shunt and Hemi-fonton - Fonton operation - Pulmonary artery banding - Aorta-Pulmonary shunts - Pulmonary Valvotomy - Coarctation of aorta repair - LVOT obstruction repair

Unit III

Diseases of the thoracic aorta: Repair of debakey type I, type II dissection/Surgery for ascending and aortic arch aneurysm/Repair of descending aortic aneurysm

Unit IV

Management of IHD: CAD, Myocardial infarction.

Management of Valvular heart disease: Aortic stenosis, Aortic regurgitation, Mitral stenosis, Mitral regurgitation, Tricuspid stenosis, Tricuspid regurgitation.

Unit V

Management of Congenital heart disease: ASD, VSD, PDA, CoA, Congenital valvular heart disease, TGA, DTGA, DORV, Hypo plastic left heart syndrome.

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Practical

1. Anatomy of the heart and great vessels

2. Coronary artery and distribution/Venous drainage and distribution
3. Basic echo views
4. Normal echocardiographic values
5. Normal echocardiographic anatomy

BIOSTATISTICS AND RESEARCH METHODOLOGY

COURSE OBJECTIVES:

Discuss the process of health sciences research.
Differentiate various study designs.
Discuss validity. Discuss descriptive and inferential statistics.

• What is statistics – Importance of statistics in behavioural sciences Descriptive statistics and inferential statistics – Usefulness of quantification in behavioural sciences

• Measurements – Scales of measurements – Nominal, Ordinal, Interval and Ratio scales.

• Data collection – Classification of data – Class intervals – Continuous and discrete measurements – Drawing frequency polygon – types of frequency polygon – Histogram.

• Cumulative frequency curve – Ogives – Drawing inference fromgraph.

• Measures of central tendency – Need – types: Mean, Median, Mode – Working out these measures with illustrations.

• Measures of variability – Need – Types: Range, Quartile deviation, Average deviation, Standard deviation, Variance – Interpretation.

• Normal distribution – General properties of normal distribution – Theory of probability – Illustration of normal distribution – area under the normal probability curve.

• Variants from the normal distribution – skewness – Quantitative measurement of skewness – kurtosis – measurement of kurtosis – factors contributing for non- normal distribution.

• Correlation – historical contribution – meaning of correlation – types: Product, moment, content correlation, variation of product, movement correlation, rank correlation, Regression analysis. Tests of significance-need for – significance of the mean – sampling error – significance of differences between means – interpretation of probability levels – small samples – large samples.

SEMESTER II

ISCHEMIC HEART DISEASE

Unit I

Understanding coronary circulation: Coronary anatomy and physiology, pathogenesis of atherosclerotic plaques, abnormalities of coronary perfusion, wall thickening

Wall motion scoring: Segmental analysis for wall motion defects, coronary artery territories, detection and quantitation of Ischemic muscle-wall motion scoring,

Unit II

Global ventricular function: Assessment of overall performance of the Ischemic left ventricle-systolic and diastolic function, estimating volumes rule of disks.

Myocardial infarction: Detecting and assessing MI, co-relation with coronary anatomy, prognostication following MI.

Unit III

Stress echocardiography: Protocols for stress echocardiography, detection of reversible Ischemic, detecting inducible ischemia/viability, specificity and sensitivity

Complications of MI: Aneurysm, pseudo aneurysm, Ventricular Septal Defect, thrombi-embolic potential, right ventricular involvement

Unit IV

Newer techniques and their application for IHD: Tissue Doppler, strain, strain rate and velocity vector imaging, studying myocardial perfusion using contrast echocardiography.

Unit V

Surgical aspects of IHD-role of echo cardiographer: Pre and postoperative evaluation for Coronary Artery Bypass Grafting (CABG), Linear endo-ventricular patchplasty (Dorr's procedure), Mitral regurgitation- morbid anatomy repair versus replacement decision/post-operative, coronary anomalies-echocardiographic aspects.

Practical - Echocardiography for Ischemic Heart Disease

1. Linear measurements: indirect M-Mode markers of left ventricular function.

2. Assessing global LV function.

3. Regional left ventricular function: wall motion scoring, relationship to vascular supply, use of tissue Doppler where indicated.

4. Evaluation of diastolic function: Methods for evaluating diastolic function, Doppler evaluation of diastolic function, Evaluation of mitral inflow,

determination of isovolumic relaxation time, Evaluation of pulmonary vein flow, Doppler tissue imaging,

5. Complications of IHD such as aneurysms, VSD, clots & MR especially from a surgical perspective.

VALVULAR HEART DISEASE

Unit I

Mitral Stenosis: Etiopathogenesis, pathophysiology and hemodynamics, diagnosis, assessing severity, secondary effects, assessment for balloon mitral valvotomy- transesophageal echocardiography and its uses, post-procedural assessment, open mitral valvotomy versus mitral valve replacement- pre and post-operative assessment.

Unit II

Mitral regurgitation: Mitral valve prolapse and analysis of segments, Hemodynamics of MR, diagnosis of MR, assessing severity and secondary effects, pre-op, intra-op and post-operative, assessment for mitral valve repair

Unit III

Use of three dimensional echocardiography for mitral valve surgery, flail mitral valve, papillary muscle dysfunction. mitral annular calcium.

Unit IV

Aortic stenosis: Etiopathogenesis and hemodynamics, sub-valvar, valvar and supravalvar lesions, cuspal morphology, diagnosis and assessment of secondary effects, time course and prognostication, pre-operative and post-operative assessment

Unit V

Aortic regurgitation: Etiopathogenesis and haemodynamics, diagnosis, assessing severity, secondary effects, relevant aspects of left ventricular function, timing of surgery, pre-operative and post-operative assessment.

UNIT-VI

Tricuspid valve disease: Anatomy and physiology of the healthy valve structural and functional changes in various disease states organic and functional involvement, tricuspid Stenosis, tricuspid regurgitation and assessment of severity, approach to pulmonary artery hypertension.

Pulmonary valve disease: Embryology, morphology, infundibular, valvar, supra valvar and peripheral pulmonic stenosis, assessing severity of pulmonic stenosis, pre and post procedural assessment for pulmonary valvuloplasty, pulmonary regurgitation.

Practical – Echocardiography for Valvular heart disease

1. Aortic valve disease: Aortic stenosis- Diagnosis, assessing mechanism and severity, assessing site, possible etiology, secondary effects such as LV function, impact on associated lesions and therapeutic approach
2. Aortic regurgitation: establishing a diagnosis, evaluating the severity of aortic, regurgitation, acute versus chronic aortic, regurgitation, assessing the left ventricle.
3. Mitral valve disease: Mitral stenosis – two-dimensional echocardiography in rheumatic mitral stenosis, congenital mitral stenosis, M-model echocardiographic appearance, transoesophageal echocardiography, three dimensional of severity, anatomic determination of severity, exercise gradients, secondary features of mitral stenosis, Atrial fibrillation, secondary pulmonary hypertension, decision making regarding intervention.
4. Mitral regurgitation: Doppler evaluation of mitral regurgitation, determination of mitral regurgitation, severity, other considerations in assessing mitral regurgitation.
5. pulmonary valves: Pulmonary valve: Pulmonary valve stenosis, pulmonary valve regurgitation, evaluation of the right ventricular outflow tract, miscellaneous abnormalities of the pulmonary valve.
6. Tricuspid Valve – Tricuspid Stenosis assessment/Tricuspid regurgitation assessment-Primary/Secondary

BIOPHYSICS & BIOMEDICAL INSTRUMENTATION

UNIT-I: PHYSIOLOGICAL SIGNALS AND ITS CHARACTERISTICS

Physiologicalsystems ofthe body, sources ofbio medical signals, Origin of bioelectric signals-ECG, EEG, EM, electrode –tissue interface, types of electrodes, pressure transducer, thermistor , Photoelectric transducer, optic fibre sensors

UNIT-II: MEDICAL IMAGING TECHNIQUES

X ray machine, Computed tomography, different generations Ultra- sonography: A , B andM mode scans, Magnetic resonance Imaging system PET, SPECT, thermography

UNIT-III: CARDIAC PACEMAKERS AND DEFIBRILLATORS

Basics of cardiac pacemakers, external pacemaker

Implantable pacemaker-types, programmable pacemaker, power sources, DC defibrillator,Automatic external defibrillator

UNIT-IV: NON-ELECTRICAL PARAMETER MEASUREMENTS

Measurement of blood pressure: direct and indirect methods, Blood flow measurements: electromagnetic blood flow meter, ultrasound blood flowmeter, laser Doppler blood flowmeter, cardiac output measuring techniques: dye dilution method, thermal dilution method, Heart rate measurement

UNIT-V ELECTRICAL HAZARDS AND PATIENT SAFETY

Electrical shock hazards, micro and macro shock, Leakage current and its types, Safety codes for electro medical equipments and electrical safetyanalyzer, testing of biomedicalequipment.

Reference books:

1. BiomedicalEngineering: APractical Approach by Satish Chandra
2. Biomedical Instrumentation and Measurements by Leslie Cromwell, Fred J. Weibell, and Erich A. Pfeiffer – Second edition

HOSPITAL MANAGEMENT

Objectives:

- To familiarise with the healthcare environment
- To understand the concepts of management with relevance to hospitals

UNIT I

Introduction – Theoretical frame work - Environment - Internal and External – Environmental

Scanning – Economic Environment – Competitive Environment – Natural Environment – Politico Legal Environment – Socio Cultural Environment - International and Technological

Environment.

UNIT II

A Conceptual Approach to Understanding the Health Care Systems – Evolution – Institutional

Setting - Out Patient services – Medical Services – Surgical Services – Operating department – Pediatric services – Dental services – Psychiatric services – Casualty & Emergency services – Hospital Laboratory services – Anesthesia services – Obstetrics and Gynecology services – Neuro – Surgery service – Neurology services.

UNIT III

Overview of Health Care Sector in India – Primary care – Secondary care – Tertiary care – Rural

Medical care – urban medical care – curative care – Preventive care – General & special

Hospitals-Understanding the Hospital Management – Role of Medical, Nursing Staff,

Paramedical and Supporting Staff - Health Policy - Population Policy - Drug Policy – Medical

Education Policy

UNIT IV

Health Care Regulation – WHO, International Health regulations, IMA, MCI, State Medical

Council Bodies, Health universities and Teaching Hospitals and other Health care Delivery

Systems

UNIT V

Epidemiology – Aims – Principles – Descriptive, Analytical and Experimental Epidemiology - Methods - Uses

REFERENCES

Seth,M.L. MACROECONOMICS, Laksminarayana Agrawal, Edu,Pub.Agra.1996

Peter,Z & Fredrick, B. HEALTH ECONOMICS, Oxford Pub., New York, 1997

Shanmugansundaram, Y., HEALTH ECONOMICS, Oxford Pub. New York, 1997

SEMESTER III

PAPER-I

Embrology & approach to pediatrics & Recent advances in Echocardiography Theory

RECENT ADVANCES:

COURSE OUTCOME :

Upon completion, The student should be able to advances in the field of cardio-sonography

OBJECTIVES:

Upon completion, The student should be able to gain knowledge about the recent advances in the field of cardio-sonography.

Myocardial strain abnormalities in congenital heart disease

Myocardial strain in Rv function , LA strain using 2D echocardiography

Advance echocardiography techniquies the future stethescope of systemic disease

Advance echocardiography in aortic valve disease

Advance echocardiography in mitral valve disease

Cardiac trends in Integration of Artificial Intelligence

Adoption of advanced 3D echocardiography in structural heart pre- procedural planning and to guide procedures in Interventional lab.

3D echocardiography in ventricular function

4D echocardiography in Heart disease

TEE assessment with advanced 3D/ 4D Echocardiography

3D/ 4D Echocardiography in Fetal

Doppler echocardiography in advanced

Future direction of Echo

- Point line care

PAPER-II

CONGENITAL HEART DISEASE :Theory

Unit I

Approach to the paediatric echocardiography: Special needs of paediatric patients, administering sedation-monitoring and possible complications, segmental analysis- approach to congenital heart disease. Embryology,Classification of congenital heart disease, congenital heart diseases detected for the first time in adulthood.

Unit II

Atrial septal defect: Development of the interatrial septum, haemodynamics, site, size of defect, magnitude of the shunt, assessing for feasibility of device closure versus surgery, trans esophageal echocardiography in ASD, assessing pulmonary circulation, associated malformations.

Ventricular septal defect: Development of the interventricular septum, haemodynamics, site, size of defect, magnitude of the shunt assessing pulmonary arterial hypertension, pre-op and postoperative assessment, secondary effects,

assessing pulmonary circulation, Eisenmenger's syndrome associated malformations.

Unit III

Atrio-ventricular septal defects: Pertinent embryology, components, diagnosis, haemodynamics assessing pulmonary circulation, pre-surgical evaluation with particular reference to the atrio-ventricular valves. Post-operative evaluation.

Tetralogy of Fallot and Double outlet right ventricle: Pertinent embryology, diagnosis, haemodynamics assessing pulmonary anatomy with a view to surgical planning, associated malformations, post-operative assessment, systemic-pulmonary shunts performed.

Unit IV

Transposition of the great arteries: Pertinent embryology, diagnosis, associated malformations, pre and postoperative evaluation. Corrected Transposition of the great arteries: Pertinent embryology, diagnosis, associated malformations, approach to the adult patient with C-tga, indications for surgery.

Coarctation of the aorta, Patent ductus arteriosus: Coarctation of the aorta-relevant embryology, haemodynamics, associated malformations, pre and postoperative evaluation. Brief overview of other aortic malfomations. Patent ductus arteriosus: Fetal versus adult circulation, haemodynamics, magnitude of the shunt, pulmonary arterial hypertension Eisenmenger's syndrome, anatomical evaluation for feasibility of device closure.

Unit V

Anamalous pulmonary venous connections: Pertinent embryology, classification-site, total vs. partial, assessing newborn with suspected TAPVC, pre and post-operative evaluation. Other miscellaneous conditions such as truncus arteriosus and A-P window.

Recent developments in paediatric echocardiography

Practical - Congenital heart disease

1. Abnormalities of right ventricular inflow
2. Abnormalities of left ventricular inflow: Pulmonary veins, left atrium, and mitral valve.
3. Abnormalities of right ventricular outflow: Right ventricle, pulmonary valve, pulmonary artery

4. Abnormalities of left ventricular inflow: subvalvular obstruction, Valvular aortic stenosis, supravalvular aortic stenosis.
5. Coarctation of the aorta
6. Abnormalities of cardiac septation: Atrial septal defect, ventricular septal defect, endocardial cushion defect.
7. Abnormalities vascular connection and structures: patient ductus arteriosus, abnormal systemic venous connections, abnormal pulmonary venous connections, abnormalities of the coronary circulation.
8. Conotruncal abnormalities: Tetralogy of Fallot, transposition of the great arteries, double outlet right ventricle, persistent truncus arteriosus and aortopulmonary window.

PAPER-III

Echocardiogram for Diseases of Heart Muscles, Aorta and Systemic Disorders :Theory

Unit I

Hypertrophic Cardiomyopathy: Morphological variants, diagnosis, hemodynamics, assessing intracavitary and outflow tract gradients, evaluation of therapy, pre and post-procedural evaluation.

Idiopathic dilated Cardiomyopathy: Diagnosis and differentiation from other disorders such as IHD, ventricular functions and secondary effects, pre and post-procedural evaluation for cardiac re-synchronization therapy. Overview of cardiac transplantation

Restrictive Cardiomyopathy: Diagnosis and haemodynamics, infiltrative cardiomyopathies, miscellaneous- myocardial diseases in neuromuscular disorders, infectious agents and toxins.

Unit II

Diseases of the pericardium: Pericardial effusion: Detection of fluid, diagnosis-pleural versus pericardial fluid, quantitation, loculated effusions, cardiac tamponade-diagnosis, haemodynamics etiology, pericardiocentesis Constrictive Pericarditis: Diagnosis and haemodynamics. Differentiation from restrictive Cardiomyopathy, pre and post-surgical evaluation. Miscellaneous: acute Pericarditis, pericardial thickening, pericardial cysts, absent pericardium.

Diseases of the aorta: Aortic dilatation and aneurysms, Aortic dissection-diagnosis and classification, false aneurysms, aneurysms of the aortic sinuses-rupture, hemodynamics, pre-and post surgical evaluation. Miscellaneous-trauma, infections, aorta-left-ventricular tunnel, atherosclerosis, Role of transesophageal echocardiography.

Unit III

Cardiac masses: Normal variants, primary cardiac neoplasms and secondaries involving the heart, secondary effects, extra cardiac masses, intra cardiac thrombi, ultrasonic typing, man-made objects in the heart.

Contrast Echocardiography

Microbubble properties , Microbubble characteristics, Size, Stability, persistence, Gas diffusivity, Encapsulation, other Contrast Agents

Unit IV

TRANSOESOPHAGEAL ECHOCARDIOGRAPHY

Procedural considerations

Laboratory requirements, Patient preparation, Technique, Indication and Contraindication, complications

Endocarditis

Diagnostic findings , Diagnostic accuracy , Surgical indications, timing and intraoperative guidance

Unit V

ECHOCARDIOGRAPHY IN SYSTEMIC DISORDERS:

Diabetes hypertension, renal failure, neurological conditions, collagen vascular diseases

Practical - Echocardiogram for Diseases of Heart Muscles, Aorta and Systemic Disorders

1. Cardiomyopathies: Dilated cardiomyopathy, Doppler evaluation of systolic and diastolic function, secondary findings in dilated cardiomyopathy, etiology

of dilated cardiomyopathy, determination of prognosis in dilated cardiomyopathy.

2. Hypertrophic cardiomyopathy: echocardiography evaluation of hypertrophic cardiomyopathy, assessment of the left ventricular outflow tract in obstructive cardiomyopathy, Mitral regurgitation in hypertrophic cardiomyopathy, other variants hypertophic cardiomyopathy, mid-cavitary obstruction, conditions mimicking hypertrophic cardiomyopathy, therapeutic decision making and monitoring in hypertrophic cardiomyopathy.
3. Disease of the aorta: echocardiographic evaluation, aortic dilation and aneurysm, marfan syndrome, Valsalva sinus aneurysm, aortic dissection, aortic atheroma.
4. Masses, tumors and source of embolus: Normal variants and artifacts, cardiac tumors; primary tumors, metastatic tumors of the heart
5. Intra-cardiac thrombi: left ventricular thrombi, left atrial thrombi, right atrial thrombi, spontaneous echo contrast.
6. TEE basics/views

PAPER III PATIENT CARE

Patient vital signs - temperature, pulse, respiration and blood pressure - normal values and methods of taking and recording them. Development of communication skills with patient- general comfort and reassurance to the patient-patient education and explaining about the study drugs used in the preparation of the patient. Handling of an unconscious patient shifting of patients - hazards of lifting and maneuvering patients - rules for correct lifting- transfer from chair/wheel chair or trolley to couch and vice-versa - safety of patient and worker while lifting & shifting of patients- handling of geriatric, pediatric and trauma patients -handling female patients-pregnant women. Communicable diseases - hygiene in the department-cross infection and prevention-handling of infectious patients in the department -application of asepsis.

SEMESTER IV

Cardiac Rehabilitation

UNIT-I Basics of Cardiac Rehabilitation

Definition ,Development ,Phases ,Indications ,Contraindications

Cardiovascular System and Exercise ,Exercise-Induced Preconditioning

Ischemia-Reperfusion Injury (IRI) ,Ischemic Preconditioning

Exercise Promotes Preconditioning

UNIT-II. Functional Capacity Assessment

- Exercise Tests in Cardiac Rehabilitation

Introduction ,Indications ,Contraindications ,Exercise Test Modalities,Predicted Functional Capacity ,Choice of the Individual Protocol The Patient's Preparation Measurements ,Indications for Test Termination,Stress Test Interpretation ,Arm .

- Cardiopulmonary Exercise Test Rationale
  Indications ,Technical Aspect, Parameters,Interpretation ,Walking Tests ,Six-Minute Walk Test ,The Two-Minute Step Test ,The Incremental ShuttleWalking Test , Safety of Exercise Testing

UNIT-III Phase Of Rehabilitation

Phase-I Idea of Early Mobilization

Phase II—Supervised Exercise Training

Phase III—Long-Term Exercise Training

UNIT-IV Exercise Prescription for Specific Populations

Acute Coronary Syndromes ,Chronic Coronary Syndromes ,

Coronary Artery Bypass Graft Surgery ,Valve Surgery

Exercise Prescription ,Heart Failure -Rationale

Implantable Cardiac Electrical Devices

Heart Transplantation

Exercise Prescription,The Elderly

Frailty ,Peripheral Arterial Disease Rationale ,Exercise Testing,Exercise Training,COVID-19

BASIC AND ADVANCED LIFE SUPPORT

1. BLS
2. TRIAGE
3. PrimarySurvey

4. Secondary Survey
5. Airway&Ventilator management
6. Shock
7. Central& peripheral venous access
8. Thoracic trauma – Tension pneumothorax
9. Other thoracic injuries
10. Abdominaltrauma – Blunt injuries
11. Abdominaltrauma – Penetrating injuries
12. Spine and spinalcordtrauma
13. Headtrauma
14. Musculoskeletaltrauma
15. Electrical injuries
16. Thermal burns
17. Cold injury
18. Pediatric trauma
19. Trauma in pregnant women
20. Workshop BLS
21. Workshop cervicalspine immobilization
22. Imaging studies intrauma
23. The universalalgorithm for adult ECC
24. Ventricular fibrillation/Pulseless ventricular tachycardia algorithm
25. Pulseless electricalactivity(PEA) / asystole algorithm
26. Bradycardia treatment algorithm
27. Tachycardia Treatment algorithm
28. Hypotension / Shock
29. Acute myocardial infarction
30. Pediatrics Advanced life support
31. Defibrillation
32. Drugsused in ACLS
33. Emergencycardiac pacing
34. AED
35. Techniques for oxygenation and ventilation

Reference books:

1. Bailey & Love's Short Practice ofSurgery
2. Highlights ofthe 2020 American Heart Association Guidelines for CPR and ECC
3. ATLS, Advanced Trauma Life Support for Doctors.

DISSERTATION & VIVA –VOICE

The student is required to carry out research under supervision in the chosen area, calculate sample size, collect relevant data, analyze and prepare the research report in the scientific format and present it for evaluation.

All candidates registered to undergo M.Sc. ECHOCARDIOGRAPHY Degree shall have to submit a dissertation as part of the programme. Each candidate would be assigned a recognized guide at the beginning of third semester and the topics assigned to the candidates will be intimated to the Controller of Examinations of this university at the end of 0.the third semester.

- Obtaining ethics clearance for the proposal is compulsory.
- The dissertation will consist of experimental work and data collection.
- The dissertation shall be in a bound volume not exceeding 150 pages (double line spacing and on one side of A4 size paper only) excluding references.

  The dissertation should contain five chapters (Introduction, Review of Literature, Materials & Methods, Results with Discussion and Summary).
- Four hard copies and one electronic copy of dissertation shall be submitted one month prior to the commencement of the University examination to the Controller of Examination of the University.

a. Three copies of the dissertation work shall be submitted one month prior to the commencement of the University examination to the Controller of Examinations of the University.

b. A digital version of the final dissertation shall be submitted to the Controller of Examinations of the University.

Learning Outcome

- Develop, under supervision an original and/or a substantial research paper
- Be able to present this review to professionals in clinical front and dietetics as part of the presentation of thesis results.
- Add on the existing scientific knowledge through publications.

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