KERALA UNIVERSITY OF HEALTH SCIENCES

THRISSUR – 680 596, KERALA

REGULATIONS, CURRICULUM AND SYLLABUS OF

BACHELOR CARDIO VASCULAR TECHNOLOGY

CONTENTS

Bachelor Degree in Cardiovascular Technology (BCVT)

1. Introduction:

Cardiovascular Technologist assists cardiologists with invasive and noninvasive diagnostic and therapeutic interventional procedures. Catheterization involves inserting a small tube, known as a catheter, into a patient's blood vessel and then into the heart. The procedure is done to determine whether the patient has a blood vessel blockage or heart disease. The procedure also involves balloon angioplasty, valvoplasty, closure of congenital defects, pacemaker implantation, vascular diagnosis and interventions etc.

Cardiovascular technologists prepare patients for invasive heart procedures, monitor the patients' blood pressure and heart rate with ECG equipment, notify the cardiologist immediately of any changes in the patients' condition as well as assist the cardiologist during the procedures. Moreover, they can perform noninvasive diagnostic procedures like echocardiography, Holter and treadmill exercise testing under supervision

It goes without saying that cardiovascular technologists hold an important role in the diagnostic and interventional procedures in cardiology. There is increasing need for these personnel as the number of cardiac centers and investigative facilities is increasing in the state by leaps and bounds. Unlike most other disciplines in medicine where these technologists help the doctors in diagnostic procedures only, cardiovascular technologists assist in invasive procedures and meet with life and death situations. So; they have to be trained more rigorously and need to be more mature in their approach, because mistakes may cost lives. Hence the course has to be at least 3 years with a year of internship. The course has to be a bachelor degree course.

Detailed Curriculum:

2. General Information:

a) Name of the course – **Bachelor Degree in Cardiovascular Technology (BCVT)**

b) Objective:

To train the student to assist *the* cardiologist in invasive or non invasive cardiac laboratory, in performing routine cardiac investigations and interventional procedures.

a. **Scope:** After successful completion of the course, the person can be allowed to perform noninvasive procedures like echocardiography, treadmill and Holter testing under supervision of cardiologist and assist the cardiologist in cardiac catheterization laboratory.

3. Regulations

3.1 Eligibility Criteria

a. Minimum educational qualification

i. ***Plus Two or equivalent with Biology, Physics and Chemistry*** *with at least 50% aggregate marks in the above subjects in the qualifying examination.*

ii. **Age limit** The candidate should have completed 17 years of age at the time of admission.

3.2 SELECTION OF STUDENTS

The Selection of students for the course shall be made based strictly on merit as decided by the competent authority approved by the Government of Kerala/Kerala University of Health Sciences.

3.3 REGISTRATION

A candidate on admission to the BCVT course shall apply to the University for Registration

By making a formal application in the prescribed format.
Original mark lists of qualifying examination.
Transfer certificate from the previous institution.
Allotment letter from the competent authority Examination/ allotment letter from the Principal in the case of NRI candidates. Equivalency and migration certificate wherever needed.
Original SSLC/equivalent certificate.
Document for sponsorship of the student, employment certificate and copy of passport of the sponsor in case of NRI candidates.
The fees prescribed for the registration.

3.4 Migration and Transfer

No migration or transfer will be allowed during the entire course of study and internship.

3.5 Attendance

Minimum 80% of attendance separately in practicals and theory for each Subject is the criteria for appearing for University examination. Condonation for 10% in the attendance once in the entire course period can be granted by the Head of the Institution, after remitting the prescribed fee to the University.

3.6 **Duration of the course and structure:**

Three years plus one year of compulsory rotating internship. Students have Sunday off and Government holidays.

a) Instructional Period:

1st year , II nd year and III rd year - 1 hour lecture and 5 hours practical training per day .

A minimum of three months posting during final year in any reputed institution should be arranged for each student for training in advanced procedures like electrophysiology and other interventional procedures, if these procedures are not performed in the institution concerned

b) What is expected of the student at the end of the course:

Candidate should have acquired basic and applied knowledge in cardiovascular diagnostic and therapeutic procedures.

IV. Examination Regulations

4.1 Essentialities to qualify for examinations.

- A student who has secured 35% marks for internal assessment in theory and practical separately is qualified to appear for University examination provided he/she satisfies that 80% attendance each in theory and practical separately.
- Submit records (log book), duly certified every week by the faculty in charge.
- Progress evaluated continuously through internal assessment
- Certificate of satisfactory completion of the course by the Head of department

4.2 Internal Assessment:

Scheme of assessing the progress during the course of study. Calculation of internal assessment is done by conducting written tests by the Cardiology Department. 35% marks of the total marks fixed for internal assessment in a particular subject in order to be eligible to appear in the final University examination of that subject. Internal Assessment should be a continuous evaluation**.**

4.3 Eligibility criteria for appearing for the final examination:

i) Attendance – Minimum 80% in each theory and practicals separately

ii) Completed records in the subjects duly approved by the faculty concerned

iii) Should have obtained minimum of 35% marks in the internal assessment

iv) Should produce certificate of satisfactory completion of course from the Head of the Department conducting the course.

4.4) *Criteria for Pass*

A candidate must obtain

1. A separate minimum of 50% marks in University theory and university practical for a pass.
2. 50% in aggregate for University Practicals including viva.
3. 50% aggregate for university theory, Practical and Viva Voce.

4.5) Declaration of Class

Candidates who pass the whole examination shall be ranked in the order of proficiency as determined by the total marks obtained by each in both parts and shall be arranged in three classes .

i. Distinction	-	75% and above
ii First Class	-	65% and above, less than 75%
iii Second Class	-	50% and above, less than 65%

Candidates who scores highest marks in the aggregate of theory and practical + viva voce will be awarded 1st Rank at the end of the course. All candidates who fail in the first attempt in any subject and pass subsequently shall not be ranked in distinction or first class.

4.6) ***Scheme of Examination:***

At the end of third year University examination will be conducted for all the subjects in the following pattern. This regulation is applicable till 2013-14 admission. From 2014 -15 admission onwards university examination will be conducted with one paper each year as follows: -

Paper I – Basic Sciences – 1st year

Paper II – ECG, Echo , Holter – 2nd year

Paper III - Cardiac Cathetarisation and Cath lab procedure – 3rd year

The examination will comprise of written examination, practical and viva voce

i) Theory:

Internal Assessment *: 100 marks*

Final exam

Number of papers : 3

Duration of written exam : 3 hours each

Maximum marks : 100 marks per paper

Total : **300 marks**

ii) Practical /Viva voce

Duration : 1 hour (comprising of all papers except paper I)

Maximum marks : **100 marks** (80 for practical/viva voce 20 marks)

Grand Total **: 400 marks**

Supplementary Examination

Students who fail in the regular examination can appear for supplementary examination.

Question Paper:

Theory – 3 papers as follows

Paper I - Basic sciences

Paper II - ECG, Echo, Holter

Paper III - Cardiac Catheterisation and Cath lab procedure

Practical / Viva voce- Performance of procedures, spotters and viva.

Distribution of Marks: -

a) Admissions upto 2013-14.

Sl. No	**Name of Subject**	**University theory**		**Total**		**University Practical**		**Viva Voce**	**Total (University theory+Viva Voce+Practical)**	
		Min	**Max**	**Min**	**Max**	**Min**	**Max**		**Min**	**Max**
1	**Paper 1 - Basic Sciences**	**50**	**100**	**50**	**100**				**50**	**100**
2	**Paper 2 – ECG, Echo, Holter**	**50**	**100**	**50**	**100**				**50**	**100**
3	**Paper 3 – Cardiac Catheterisation and Cath lab**	**50**	**100**	**50**	**100**				**50**	**100**
	University Practical/Viva Voce					**40**	**80**	**20**	**50**	**100**
	Total									**400**

b) Admissions from 2014-15 onwards

1st Year

Sl. No	Name of Subject	University theory		Total		University Practical		Viva Voce	Total (University theory+Viva Voce+Practical)	
		Min	Max	Min	Max	Min	Max		Min	Max
1	Paper 1 - Basic Sciences	50	100	50	100				50	100
	Total									100

2nd Year

Sl. No	Name of Subject	University theory		Total		University Practical		Viva Voce	Total (University theory+Viva Voce+Practical)	
		Min	Max	Min	Max	Min	Max		Min	Max
1	Paper 2 – ECG, Echo, Holter	50	100	50	100				50	100
	Total									100

3rd Year

Sl. No	Name of Subject	University theory		Total		University Practical		Viva Voce	Total (University theory+Viva Voce+Practical)	
		Min	Max	Min	Max	Min	Max		Min	Max
1	Paper 3 – Cardiac Catheterisation and Cath lab	50	100	50	100				50	100
	University Practical/Viva Voce					40	80	20	50	100
	Total									200

4.7) Examiners

Qualification – Minimum DM or DNB Cardiology with atleast 5 years experience.

Number of examiners – 2 - One internal and one external.

4.8) Award of Degree: The Degree is awarded by the authority at the completion of the course successfully, passing the final examination and successful completion of internship.

V. Internship duration:

One year, after successful completion and passing of the course. Before internship the students should be registered with Kerala Paramedical Council. The internship will consist of compulsory rotating practical training in the various subjects duly certified by the Head of department. Maximum no. of leave will be 20 for the whole period. 1 day weekly off may be additionally permitted. No holidays. Sick leave may be permitted by the head of institution on production of bona fide medical certificate. Stipend as fixed by the Govt. will be paid during internship

5.1 **Duration of Posting of trainees in different stations during training period**

Posting station	**First year**	**Second year**	**Third year**
Echocardiography	4 months	4 months	4 months
ECG, Stress Testing, Holter	4 months	2 months	2 months
Catheterization laboratory	4 months	6 months	6 months

VI. Minimum Requirements for the conduct of the course:

The course shall be conducted only in a well equipped hospital setting with a proper Department of Cardiology. The following are the minimum requirements for registration of the course

The following are the minimum requirements for admitting maximum 2 students for BCVT

The hospital shall have active and well functioning Cardiology and Cardio thoracic Surgery Department.

6.1 Infrastructure

Library	Of minimum 30ft x 20ft. area and minimum of 20 books of related subjects including major journals in cardiology
Lecture Hall	1 number, 30 ft x 20ft.
Students room	Separate for boys and girls
Hostel	Separate for boys and girls
Office, Staff room, Toilet facilities for staff and students	

6.2 Equipments: The following equipments should be available in good working condition in the Department

1. ECG machines sufficient no. of digital and analog single channel /6 or 12 channel

with facility for bedside ECG

2. Modern automated treadmill machines
3. Holter analyzer with sufficient no' of recorders
4. Standard quality dedicated echocardiograph suitable for cardiac applications with adult, pediatric and transesophageal probes and facility for dobutamine stress echo and transesophageal echo
5. A modern cath lab consisting of:
    a. Digital angiographic equipment with motorized gantry
    b. Hemodynamic recorder,
    c. Hemoximeter
    d. Pressure injector
    e. IABP
    f. other necessary ancillary equipments for adult and pediatric studies

6.3 ***Patients and procedures:***

1. Minimum bed strength for cardiology – 20
2. CCU with at least 4 beds with all modern amenities like invasive and noninvasive monitors and ventilators
3. Minimum ECG load of 2500 per year
4. Minimum number of treadmill tests 1000 per year
5. Minimum number of Holter testing 100 per year
6. Minimum number of echoes – 3000 per year which should include congenital, valvular and coronary heart diseases. TEE - 40 per year
7. Minimum number of cath lab procedures*
    a. Coronary angiography – 600 per year
    b. Coronary angioplasty – 120 per year
    c. Balloon valvotomy – 20 per year
    d. Electrophysiology – 20 per year
    e. Closure of congenital cardiac defects – 20 per year
    f. Diagnostic right and left heart catheterizations – 20 per year

*Departemnts which do not perform the procedures as specified may be permitted to register for the course but should send the candidates for 3 months training in any other reputed institution where such procedures are performed

6.4 ***Minimum staff requirement***

i. For 2 seats per batch

Cardiologist	DM/DNB Cardiology with al least 5 years experience after the qualification	2
Instructors	1. Cath lab Technologist with ≥ 2 years experience 2. ECG Technicians	1 2
Administrative Officer	Graduate with experience administration for 3 years Degree/Diploma in Hospital Management preferred	1
Assistant	Graduate with computer knowledge	1

Note:

1. *The cardiologists should be full time and in the pay roll of the institution*

ii. For each additional seat

- one additional full time cardiologist with at least 3 years experience after qualification

7. Syllabus

Year	Subject	
1	**Anatomy** **gross Human Anatomy**	General introduction to anatomy Organ systems in the body with various parts
	Anatomy of Cardio Vascular system	Anatomy of Heart: • Surface Anatomy • Gross anatomy, cardiac chambers, septa, valves • Pericardium Arteries, Veins, Lymphatics • Aorta and branches • Venous drainage • Pulmonary vessels and circulation Conduction System of Heart
	Physiology	• Normal Cradiac Cycle • Pulse • Heart rate • Blood pleasure • Cardiac output • Heart Sounds, Murmurs • Measurement of Blood Pressure: Technique: Sphygmomanometer • ECG and Cardiac Cycle • Chambers: Pressure and wave forms • Arterial, Venous Pressure and Wave forms • Oxygen Saturations: Physiology of Oxygen Transport • Blood Gases – Technique and Various parameters • Flow, pressure and resistance • Cardiac Cycle, circulation, Tissue Perfusion – Unified concept
	Pathology and Pathophysiology	• Coronary artery disease and myocardial infraction • Rheumatic Fever • Valvular Heart Disease ◆ Mitral stenosis ◆ Mitral regulation ◆ Aortic stenosis ◆ Aortic regualtion ◆ Tricuspid value disease ◆ Combined value diseases • Pericardial, Myocardial Disease including End

		mycardial Disease • Hypertension • Pulmonary Hypertension • Congenital Heart Disease: ◆ Acyanotic ◆ Cyanotic • Shunts ◆ Left to Right Shunts ◆ Right to Left Shunts • Heart Failure • Inasive Monitoring, CVP, Intra Arterial BP, PA Wedge pressure, Cardiac Output
	Microbiology	• Common micro organisms • Sepsis • Aseptic precautions • Sterilization procedures
	Pharmacology and Therapeutics	• Modes/ routes of Drug Administration (Rationale) • Intra Venous Fluids: Crystalloids, Colloids • Common Cardiac Drugs – Part – 1: Digoxin, Diuretics, Vasodilators, Nitrates • Common Cardiac Drugs – Part – II: Beta Blockers, Calcium Blockers, ACE inhibitor • Common Cardiac Drugs – Part – III: Antiarrhythmic drugs, positive intotropic drugs • Drug for Cardiac Resuscitation • Drug for all Cardiac and Medical Emergencies • Contrast Media • Heparin, Protamine • Anaphylaxis, Drug reactions, Drug interaction (Basics)
II	**Electrocardiography**	• Basic and Principle • Electrode/ Lead Placements • Normal ECG: Wave Form • Normal ECG: Intervals • ECG Machined: Functions, Frequency Response, Recording Speed, Sensitivity, Standardisation, Stylus Lag(Heat Stylus) • ECG and Chamber Hypertrophy • ECG and Arrhythmia • ECG in Myocardial Infraction, Myocardial

		Ischemia • ECG in Miscellaneous Conditions: Metabolic, electrolyte changes • ECG for Technician: Summary
	Exercise ECG	• Equipments/ Types of Exercise ECG • Indication / Contradiction • Lead placement – Rationale, Limitation • Monitoring during Ex. ECG: Clinical/ECG/Parameters • Exercise ECG Protocol: Indications/ Advantage and Disadvantage • Exercise Physiology • Exercise ECG: Preparation of Patient / Equipment/ Defibrillators, Emergency Drugs • Exercise ECG: Detection of Various Arrhythmais, Ischemia and Plan of action • Exercise ECG: • Endpoints: Recognition and Action • Post Exercise ECG: Observation, Instructions
	Echocardiography	• Principle of Echocardiography • Transducers • Anatomical Planes for viewing in Echocardiography • Normal M-Mode Echo Study: Anatomy / Function: Measurements. • Echo for Cardiac Function – systolic and diastolic • Echo in Heart Disease: Acquired • Echo in Heart Disease: Congenital • Contrast Echocardiography: Technique and Indications • Transesophageal Echocardiography • Echo Echocardiography: Technician's Role:
		Disposables Archiving Record Keeping Stock-Indents, Stock Maintenance, Stock Verification
		Principle of Doppler Measurement of Flows and Gradients • Assessment of gradients, shunts, valve areas, cardiac output

		• Assessment of valve regurgitations Utility of Doppler in Assessment of Cardiac Disease • Tissue Doppler Stress Echocardiography: Protocols, 2D Echo Views, Analysis Trans - esophageal Echo • Indication/Contraindication • Patient Preparation • Transducer: Maintenance, Sterilization, Handling etc. • Monitoring • Emergency Drugs • Utility 8. Intra Vascular Ultrasound, Intracoronary Doppler Wire
	Holter Recording	• Principles of Holter • Utility and indications • Analysis of Holter
III Year	• **Cardiac Catheterization Part I – Introductory Course**	• Cardiac Catheterisation: Laboratory Setup / Types Procedures • Sterile Techniques in Cath Lab / Sterile Areas, Sterile Procedure, Sterile trolley setting, Scrubbing, gowns and Gloves, scrubbing and draping patients, handling sterile disposables etc. • Sterilisation and re-use of hardware • Equipments: Cath-Lab Equipments • * Defibrillator / Pacemaker / IABP/ BOYLE's Apparatus / Suction Machine/ Oxygen • * Infusion Pumps / Programmed Stimulators, Pacing System Analysers • Equipments in Cath-Lab • * Hemodynamic Recorders • *Transducers • *Recording of Pressure Wave Form • Range/ Gain/ Speed/ Systolic/ Diastolic and Mean Pressures in Chambers and Vesseles • Hazard Management • * Radiation Protection • * Infection Prevention • * Injury Prevention: Electrical/ Mechanical • Wastes Management

		• * Plastics • * Biological Wastes • * Glass/ Needle/ Syringes • Technician's Role • * Patient Monitoring • * Procedure Related: Data Collection • * Acquisition and entry of Data, Procedure Books, Log Books, Registers etc. • * Stock of all disposables Eg. Catheters etc. • * Stores (Disposable Items) • * Accounting (Used Items) • Equipment Maintenance • Cine Angiography: Cine Filiming, Cine Film Procesing and Cine Film Viewing, cine film library • Contrast Media
	Cardiac Catheterisation – Part -II	• Cardiac Catheterisation Procedure: Diagnostic Studies • Cardiac Catheterisation Procedures: Therapeutic/ Interventional Procedures • Acquisition of Cath Data: Cardiac output / Oximetry and Shunts • Acquisition of Cath Data: Pressures and Wave Forms; Recording Technique, Analysis • Angiography: Technique/ Views/ Contrast Media • Cardiac Catheterisation • Hardware: Catheters/ Connections/ Sheaths/ Stopcocks/ Wires/ Angioplasty Catheters • Complication of Cardiac Catheterisaiton: Recognition and management • Cardiopulmonary Resuscitation • Special Procedures: • * Pericardial Tap • * Atrial Septostomy • * Endomyocardial Biopsy • * Balloon Angioplasty (Valve) • * Coronary Angioplasty • Case Study of Simple Cardiac Disease - • * ASD, MS, Tetralogy of Fallot • Hardware of Cardiac Catheterisation And Interventions • Venus and Arterial Check Flow Sheaths,

		Mainfolds, 3-way Stock Cocks etc • Guide Wires and Dilators • Puncture Needles (Vascular Access Needles) • Woven Darcon Cathetes: GL, NIH, Lehman, Woven, Dacron Electrode Catheters • Flow Directed Catheters(Swan Ganz Type) Balloon Angio Catheters • Polyurethane Catheters: Pig Tail, Judkins, Coronary, Amplatz Coronary, Brachial Coronary, Sones Catheters • Guide Wires: Short, Normal Lendth, Exchange Length 'J ' Tipped Movable Core, Tips, Deflectable Types • Valvuloplasty Catheters, Atrial Septostomy Cathetes • Coronary Angioplasty: Guide Catheters, Guide Wire, Balloon Dilatation Catheters, Indflators, Y Connectors. * Stents: Bare Stents, Mounted Stents, Other Types of Stents.
	Cardiac Catheterisation Part III Pacing and Electrophysiology	• Arrhythmias: Brady and Tachy Arrythmias • Indication for Temporary / Permanent Pacing Technique: Temporary Pacing • Permanent Pacing: VVI AAI Pacing (Single Chamber Pacing) • Permanent Pacing: DDD, other Modes of Pacing • Pacemaker Clinic: Management of Pacemaker Patients, Programmers • Intracardiac Electrogram – Technique • Electrophysiological Studies • Radio Frequency Ablation for Arrhythmia's • Implantable Cardioverter Ddfibrillator
		• Cardiac Arrest • Cardio Respirator Resuscitation • Hypotension/ Hypertensive Crisis • Cardiac Tamponade • Anaphylaxis • Emer gency Drugs • Intra-aortic Balloon Pump • Records Keeping: Indents, Stocks, Log Books, Procedure Books etc.

QP Code: Reg. No.:……

Bachelor in Cardiovascular Technology (BCVT) Examination

(Model Question Paper)

Basic Sciences

Time: 3hrs **Maximum marks: 100**

- *Answer all questions*
- *Draw diagrams wherever necessary*

Essay **(20)**

1. Explain in detail the normal cardiac cycle.

Short notes **(10x8=80)**

2. Dobutamine
3. Blood culture
4. Sterilization techniques
5. Universal aseptic precausions
6. Boyles apparatus
7. Noninvasive BP measurement
8. Placement of ECG leads- routine
9. Femoral artery pressure tracing
10. Anatomy of coronary sinus
11. Coronary circulation

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QP Code: Reg. No.:……

Bachelor in Cardiovascular Technology (BCVT) Examination

(Model Question Paper)

Applied Sciences – ECG, ECHO, HOLTER

Time: 3hrs **Maximum marks: 100**

- *Answer all questions*
- *Draw diagrams wherever necessary*

Essay **(20)**

1. Wrie down briefly the echocardigraphic features of mitral stenosis .Draw the pressure trace of severe mitral stenosis. Describe noninvasive management of mitral stenosis.

Short notes **(10x8=80)**

2. Tread mill test
3. Mitral valve M - mode in echo
4. Pulmonary artery hypertension
5. Atrial fibrillation
6. Dukes score
7. Indications of Holter monitoring
8. Continuity equation and its applications in echo lab
9. Colour Doppler echocardiography
10. Normal ECG
11. Stress echocardiography

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QP Code: Reg. No.:……

Bachelor in Cardiovascular Technology (BCVT) Examination

(Model Question Paper)

Cardiac Catheterization & Cathlab Procedures

Time: 3hrs **Maximum marks: 100**

- *Answer all questions*
- *Draw diagrams wherever necessary*

Essay **(20)**

1. Coronary angiography techniques, views, clinical usefulness. Briefly describe on the contrast media used in cathlab.

Short notes **(10x8=80)**

2. Radiation hazards
3. Holter monitoring
4. PTCA
5. Balloon mitral valvotomy
6. Permanent pacemaker
7. Echocardiography in nitral stenosis
8. Coronary guide wire
9. Fractional flow reserve
10. Cardiopulmonary resuscitation
11. IABP

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