

B.Sc. Cardiac Technology Degree course

SYLLABUS

BASIC ANATOMY

THEORY

Introduction to Anatomy

Basic Anatomical terminology

Osteology- Upper limb – clavicle, scapula, humerus, radius, ulna
Lower limb - femur, hipbone, sacrum, tibia, fibula
Vertebral column

Thorax – Intercostal space, pleura, bony thoracic cage, ribs sternum & thoracic vertebrae

Lungs – Tracheae, bronchial tree

Heart – Surface anatomy of heart, chambers of the heart, valves of the heart, major blood Vessels of heart, pericardium, coronary arteries.

Myology – Muscles of thorax, muscles of upper limb (arm & fore arm)
Flexor and extensor group of muscles (origin, insertion, nervr supply, action)

Histology – Types of tissue
(a) Epithelia - Squamous
Glandular
Transitional
Cartilage

(b) Connective tissue – bone, fibrous tissue, muscle

Excretory sytem – Kindneys, ureters, bladder, structure of nephrons .

PRACTICALS

Osteology – Bones identification (right and left side) and prominent features and muscle attachment of the bone, clavicle, scapula, radius, ulna, humerus, femur, hip bone, sacrum, tibia, fibula.

Histology – Slides for identification and general features

PHYSIOLOGY

1. Overview of the cardiovascular system
 - Functions of the cardiovascular system
 - Circulation of blood
 - Central control of the cardiovascular system
2. Cardiac cycle
 - Mechanical events
 - Arterial cycle and central venous pressure cycle
 - Clinical aspects of human cardiac cycle
3. Cardiac excitation and contraction
 - Mechanism of contraction
 - Sinoatrial node function
 - The cardiac conduction system
 - Atrioventricular node function
 - Autonomic regulation of the heart rate
4. Assessment of cardiac output
 - Fick principle
 - Thermodilution and indicator dilution methods
 - Pulse Doppler methods
 - Miscellaneous methods
5. Hemodynamics
 - Relationship between pressure, flow and resistance
 - Frank-Starling law
 - Preload, afterload and contractility
 - Control of stroke volume and cardiac output
6. Solute transport between blood and tissues
 - Circulation of fluid between plasma, interstitium lymph

7. Vascular smooth muscle
 - Mechanism of contraction
 - Pharmacomechanical coupling, automaticity
8. Control of blood vessels
 - Local control mechanisms
 - Nervous control
 - Hormonal control
9. Specialization in individual circulation
 - Coronary circulation
 - Cerebral circulation
 - Pulmonary circulation
 - Cutaneous circulation
10. Cardiovascular receptors, reflexes and central control
11. Coordinated cardiovascular responses
 - Posture
 - Valsalva manoeuvre
 - Exercise
 - Diving reflex
12. Cardiovascular responses in pathological situations
 - Shock and haemorrhage
 - Syncope
 - Essential hypertension
 - Chronic cardiac failure
13. Respiratory physiology
 - Mechanics of respiration
 - Principles of gas exchange regulation of respiration
14. Hematology and coagulation physiology blood components
 - Blood groups and blood transfusion
 - Hemostasis

BIO-CHEMISTRY

Biomolecules and the cell:

Major complex biomolecules of cell and cell organelles-Prokaryotic and eukaryotic cell

Carbohydrates

Chemical structure, function- Classification- Monosaccharides- Disaccharides-Polysaccharides-Homopolysaccharides-Heteropolysaccharides- Glycoproteins

Proteins:

Amino acids- Classification- Structure of proteins- Determination of protein structure- Properties of proteins- Denaturation- Classification of proteins- Antigen, Antibody- Types, Plasma proteins- Blood clotting.

Lipids:

Chemical structure, functions, Classification-fatty acids Triacylglycerols, Phospholipids, glycoproteins, Lipoproteins- Steroids - Amphipathic lipids.

Nucleic acids:

Purines and pyrimidine- Structure of DNA – Watson & Crick model of DNA - Structure of RNA – Types of RNA

Enzymes:

Definition – Nomenclature – Classification – Factors affecting enzyme activity – Active site – Coenzyme – Enzyme Inhibition – Mechanism of enzyme action – Units of enzyme – Isoenzymes – Enzyme pattern in diseases.

Vitamins & Minerals:

Fat soluble vitamins(A,D,E,K) – Water soluble vitamins – B-complex vitamins- principal elements(Calcium, Phosphorus, Magnesium, Sodium, Potassium, Chlorine and sulphur)- Trace elements – Calorific value of foods – Basal metabolic rate(BMR) – respiratory quotient(RQ) Specific dynamic action(SDA) – Balanced diet – Marasmus – Kwashiorkor

Hormones:

Classification – Mechanism of action – Hypothalamic hormones – Pituitary – Anterior, posterior – Thyroid – Adrenal cortex, Adrenal medulla – Gonadal hormones – Menstrual cycle – GI hormones

Acids and bases:

Definition, pH, Henderson – Hasselbalch equation, Buffers, Indicators, Normality, Molarity, Molality

BIOCHEMISTRY SYLLABUS FOR PRACTICALS–(UNDERGRADUATES)**QUALITATIVE TESTS OF MONOSACCHARIDES (GLUCOSE AND FRUCTOSE)**

1. Molisch's test
2. Fehling's test
3. Benedict's test
4. Seliwanoff's test

QUALITATIVE TESTS OF LIPIDS

1. Solubility tests
2. Emulsification tests
3. Saponification tests

QUALITATIVE TESTS OF PROTEINS

1. Isoelectric precipitation tests
2. Heat coagulation tests

II. PHARMACOLOGY RELATED TO CARDIAC TECHNOLOGY

Course objective:

This course will cover general pharmacology with special emphasis on common drugs used, route of administration, types of formulations, dose and frequency of administration, side effects and toxicity, management of toxic effect, drug interaction, knowledge of chemical and trade names, importance of manufacture and expiry dates and instructions about handling each drug.

1. Anti-anginal agents
Beta blockers-propranolol, atenolol, metoprolol, bisoprolol carvedilol, esmolol.
Nitrates-nitroglycerine, isosorbide dinitrate, isosorbide mononitrate, transdermal nitrate patches
Calcium channel blockers-nifedipine, verapamil, dilteazem, amlodipine
2. Anti-failure agents
Diuretics-furosemide, torsamide, thiazide diuretics, metolazone, spironolactone, combination diuretics
Angiotensin convertying enzyme (ACE) inhibitors – captopril
Enalapril, ramipril, lisinopril, ACE inhibitors for diabetics and hypertensive renal disease
Digitalis and acute ionotropes – digoxin, odoubutamine, dopamine, adrenaline, noradrenaline, isoprenaline
3. Anti-hypertensive drugs
Diuretics, beta-blockers, ACE inhibitors, calcium antagonists, direct Vasodilators, centrally acting and peripherally acting vasodilators.
4. Anti- arrhythmic agents
Amiodarone, adenosine, verapamil, diltiazem, lidocaine, mexiletine, Phenytoin, flecainide, bretylium, atropine
5. Antithrombotic agents
Platelet inhibitors: aspirin, clopidogrel
Anticoagulants: heparin, low molecular weight heparin, warfarin
Fibrinolytics: streptokinase, urokinase
Glycoprotein 2b3a antagonists: abciximab, tirofiban, eptifibatide

6. Lipid lowering and anti-atherosclerotic drugs: statins, exetimibe, niacin, fenofibrate

7. Miscellaneous drugs
 - Protamine
 - Narcotics: morphine, pethidine, fentanyl
 - Sedatives: diazepam, midazolam
 - Steroids: hydrocortisone, prednisolone,
 - Antihistamines: diphenhydramine
 - Antibiotics: penicillins, cephalosporins, aminoglycosides
 - Antacids and proton pump inhibitors
 - Anaesthetic agents: local general

III. PATHOLOGY, MICROBIOLOGY, CLINICAL FEATURES AND TREATMENT OF DISEASES PERTINENT TO CARDIAC TECHNOLOGY

Course Objective

This course will cover common cardiovascular diseases, their related pathology and microbiology and microbiology, outline of clinical presentation and management of these conditions including medical and surgical interventions.

1. Valvular heart disease
 - Etiology
 - Acquired valvular heart disease
 - Rheumatic fever and rheumatic heart disease
 - Aortic stenosis
 - Aortic regurgitation
 - Mitral valve disease
 - Mitral stenosis
 - Mitral regurgitation
 - Mitral valve disease
 - Tricuspid valve disease
 - Infective endocarditis
 - Valvuloplasty and valve surgery

2. **Coronary artery disease**
 - Pathophysiology and clinical recognition
 - Angina Pectoris
 - Symptomatic and asymptomatic myocardial ischemia
 - Types and locations of myocardial infarction
 - Thrombolytic therapy
 - Medical treatment
 - Percutaneous interventions
 - Surgical treatment
 - Cardiac rehabilitation

3. **Systemic hypertension**
 - Essential and secondary hypertension

4. **Heart failure**
 - Surgical and medical treatment

5. **Myocardial diseases**
 - Dilated cardiomyopathy
 - Hypertrophic cardiomyopathy
 - Restrictive cardiomyopathy
 - Myocarditis

6. **Pericardial Diseases**
 - Pericardial effusion
 - Constrictive pericarditis
 - Cardiac tamponade

7. **Electrical disturbances of the heart**
 - Sinus node dysfunction
 - Arrhythmias and conduction disturbances
 - Treatment of arrhythmias – pharmacological, radiofrequency ablation and surgery

8. **Pulmonary hypertension**
 - Primary pulmonary hypertension
 - Pulmonary thromboembolism

9. **Peripheral Vascular Disease**

Atherosclerotic peripheral vascular disease
Aortic aneurysms
Aortic dissection
Takayasu arteritis

10. **Congenital heart disease**

(a) Acyanotic heart disease
Atrial septal defect
Ventricular septal defect
Patent ductus arteriosus
Congenital valvular disease
Coarctation of aorta

(b) Cyanotic congenital heart disease
Tetralogy of Fallot
Double outlet right ventricle
Pulmonary atresia
Transposition of great arteries
Truncus arteriosus
Total anomalous pulmonary venous connection

**IV. MEDICAL ELECTRONICS, BIOPHYSICS AND COMPUTER
USAGERELEVANT TO CARDIAC TECHNOLOGY**

Syllabus

Introduction to medical physics
Blood pressure recording
Pressure transducers
Defibrillators
Cathode ray tubes and physiological monitors
Impedance plethysmography
Pulse oximetry
Medical ultrasound and Doppler
Ionic currents and Electrocardiography
Electrocardiographic processing and display system
Radiation physics
Techniques of monitoring radiation exposure
Measures to reduce radiation exposure
Computer use in medical care and data entry

V. BASIC ELECTROCARDIOGRAPHY (ECG)

Syllabus

Fundamental principles of electrocardiography
Cardiac electrical field generation during activation
Cardiac wave fronts
Cardiac electrical field generation during ventricular recovery
Electrocardiographic lead systems
Standard limb leads
Precordial leads and the Wilson central terminal
Augmented limb leads
The hexaxial reference frame and electrical axis
Recording adult and pediatric ECGs
The normal electrocardiogram
Atrial activation
The normal P wave
Atrial repolarization
Atrioventricular node conduction and the PR segment
Ventricular activation and the QRS complex
Ventricular recovery and ST-T wave
U wave
Normal variants
Rate and rhythm

ENGLISH

Communication:-

Role of communication
Defining Communication
Classification of communication
Purpose of communication
Major difficulties in communication
Barriers to communication
Characteristics of successful communication – The seven Cs
Communication at the work place
Human needs and communication “Mind mapping”
Information communication

Comprehension passage:-

Reading purposefully
Understanding what is read
Drawing conclusion
Finding and analysis

Explaining:-

How to explain clearly
Defining and giving reasons
Explaining differences
Explaining procedures
Giving directions

Writing business letters:-

How to construct correctly
Formal language
Address
Salutation
Body
Conclusion

Report writing:-

Reporting an accident
Reporting what happened at a session
Reporting what happened at a meeting

BASICS OF COMPUTER

COURSE CONTENT:

Introduction to computer – I/O devices – memories – RAM and ROM – Different kinds of ROM – kilobytes. MB, GB their conversions – large computer – Medium, Micro, Mini computers – Different computer languages – Number system – Binary and decimal conversions – Different operating system – MS DOS – Basic commands – MD, CD, DIR,TYPE and COPY CON commands – Networking – LAN, WAN,MAN(only basic ideas)

B.Sc. in Cardiac Technology

Typing text in MS word – Manipulating text – Formatting the text – using different font sizes, bold, italics – Bullets and numbering – Pictures, file insertion – Aligning the text and justify – choosing paper size – adjusting margins – Header and footer, inserting page No's in a document – Printing a file with options – Using spell check and grammar – Find and replace – Mail merge – inserting tables in a document.

Creating table in MS-Excel – Cell editing – Using formulas and functions – Manipulating data with excel – Using sort function to sort numbers and alphabets – Drawing graphs and charts using data in excel – Auto formatting – Inserting data from other worksheets.

Preparing new slides using MS-POWERPOINT – Inserting slides – slide transition and animation – Using templates – Different text and font sizes – slides with sounds – Inserting clip arts, pictures, tables and graphs – Presentation using wizards.

Introduction to Internet – Using search engine – Google search – Exploring the next using Internet Explorer and Navigator – Uploading and Download of files and images – E-mail ID creation – Sending messages – Attaching files in E-mail – Introduction to “C” language – Different variables, declaration, usage – writing small programs using functions and sub – functions.

PRACTICAL

- Typing a text and aligning the text with different formats using MS-Word
- Inserting a table with proper alignment and using MS-Word
- Create mail merge document using MS-word to prepare greetings for 10 friends
- Preparing a slide show with transition, animation and sound effect using MS-Powerpoint
- Customizing the slide show and inserting pictures and tables in the slides using MS-powerpoint
- Creating a worksheet using MS-Excel with data and sue of functions
- Using MS-Excel prepare a worksheet with text, date time and data
- Preparing a chart and pie diagrams using MS-Excel
- Using Internet for searching, uploading files, downloading files creating e-mail ID
- Using C language writing programs using functions

SECOND YEAR

- I. Advanced Electro Cardiography (3months)
- II Treadmill exercise stress testing and 24 hour Ambulatory ECG recording (3months)
- III. Echocardiography (6months)

SYLLABUS

I. ADVANCED ELECTROCARDIOGRAPHY (ECG)

The abnormal electrocardiogram
Left atrial abnormality
Right atrial abnormality
Left ventricular hypertrophy and enlargement
Right ventricular hypertrophy and enlargement
Intraventricular conduction delays
Left anterior fascicular block
Left posterior fascicular block
Left bundle branch block
Right bundle branch block
Myocardial ischemia and infarction
Repolarization (ST-Twave) abnormalities
QRS changes
Evolution of electrocardiographic changes
Localization of ischemia or infarction
Non-infarction Q waves
Primary and secondary T wave change
Electrolyte and metabolic ECG abnormalities
Cardiac arrhythmias
Ventricular premature beats
Supra-ventricular tachycardias
Atrial flutter/fibrillation
Ventricular Tachycardia/Ventricular fibrillation
Atrio Ventricular block
Prolonged PR interval

Mobitz type 1 and 2 block
Complete heart block
Direct Current (DC) shock
Defibrillator
Monophasic and biphasic shock
Technique of cardioversion
Indications for cardioversion

Textbook recommended:

Introduction to Electrocardiography-Schamroth

**II. TREADMILL EXERCISE STRESS TESTING AND 24 HOUR
AMBULATORY ECG (HOLTER) RECORDING**

Duration 3 months

Syllabus

Exercise physiology

Exercise protocols

Lead systems

Patient preparation

ST segment displacement – types and measurement

Non-electrocardiographic observations

Exercise test indications, contra-indications and precautions

Cardiac arrhythmias and conduction disturbances during stress testing

Emergencies in the stress testing laboratory

Principles of Holter Recording

Connections of the Holter recorder

Holter Analysis

Guidelines for ambulatory electrocardiography

III. ECHOCARDIOGRAPHY

Duration 6 months

Syllabus

M- mode and 2D transthoracic echocardiography

Views used in transthoracic echocardiography

Doppler echocardiography: pulsed, continuous wave and colour

Measurement of cardiac dimensions

Evaluation of systolic and diastolic left ventricular function

Regional wall motion abnormalities

Stroke volume and cardiac output assessment

Transvalvular gradients

Orifice area

Continuity equation

Echocardiography in Valvular heart disease:

Mitral stenosis
Mitral regurgitation
Mitral valve prolapse
Aortic stenosis
Aortic regurgitation
Infective endocarditis
Prosthetic valve assessment
Echocardiography in Cardiomyopathies:
Dilated
Hypertrophic
Restrictive
Constrictive pericarditis
Pericardial effusion and cardiac tamponade
Echocardiographic detection of congenital heart disease:
Atrial septal defect
Ventricular septal defect
Patent ductus arteriosus
Pulmonary stenosis
Tetralogy of Fallot
Coarctation of aorta
Left atrial thrombus
Left atrial myxoma
Transoesophageal echocardiography

Text book recommended:

Echocardiography – Feigenbaum

THIRD YEAR

- I. Cardiac catheterization laboratory basics (3months)
- II. Cardiac catheterization laboratory advanced (9months)

Syllabus

Type of catheters
Catheter cleaning and packing
Techniques of sterilization-advantages and disadvantages of each
Setting up the cardiac catheterization laboratory for a diagnostic study
Table movement
Image intensifier movement
Image play back
Intra cardiac pressures
Pressure recording systems
Fluid filled catheters versus catheter tipped manometers
Artifacts, damping, ventricularization

Pressure gradient recording – pullback, peak – to peak
Cardiac output determination
Thermo dilution method
Oxygen dilution method
Principles of oximetry
Shunt detection and calculations.
Coronary angiography
Coronary angiographic catheters
Use of the manifold
Angiographic views in coronary angiography
Laboratory preparation for coronary angiography
Left Ventriculography – catheters, views, use of the injector
Right heart catheterization and angiography

II. CARDIAC CATHETERIZATION LABORATORY ADVANCED

Syllabus

Aortic angiography – aortic root, arch, abdominal aorta
Peripheral angiography and carbondioxide angiography
Catheterization and angiography in children with congenital heart disease
Contrast agents
 Ionic and non-ionic
 Types of non-ionic agents
 Contrast nephropathy
 Measures to reduce incidence of contrast neophropathy
Coronary angioplasty (PTCA)
 Equipment and hardware used in PTCA:
 Guiding catheters
 Guidewires
 Balloons
 Stents
 Setting up the laboratory for a PTCA case
 Management of complications:
 Slow flow/no flow
 Acute stent thrombosis
 Dissection
 Perforation
Pediatric Interventions
 Aortic and pulmonary valvuloplasty
 Coarctation angioplasty and stenting
 Device closure of PDA, ASD, VSD
 Technique and decices used
 Sizing of devices
 Coil.closure of PDAs

Balloon Mitral valvuloplasty (BMV)

- Techniques and hardware used in BMV
- Setting up the laboratory for a BMV case
- Technique and equipment used for transseptal puncture
- Recording of transmitral pressure gradients
- Management of cardiac tamponade

Peripheral intercessions

- Equipment and techniques used
- Endovascular exclusion of aneurysms
- Self-expanding stents, covered stents and cutting balloons

Intra-aortic balloon pump (IABP)

- Theory of intra-aortic balloon counterpulsation
- Indications for IABP use
- Setting up the IABP system

Thromboembolic disease

- Indications and use of venacaval filters
- Techniques of thrombolysis – drug and catheters used
- Thrombus aspirations systems – coronary, peripheral
- Thrombus aspirations systems – coronary, peripheral

Cardiac pacing

- Temporary pacing – indications, technique
- Permanent pacing
- Indications
- Types of pacemakers and leads
- Setting up the laboratory for permanent pacing
- Pacemaker parameter checking
- Follow-up of pacemaker patients

Cardiac electrophysiology

- Catheters used in electrophysiology studies
- Connection of catheters during an EP study
- Equipment used in arrhythmia induction and mapping
- Radiofrequency ablation
- Image archival systems and compact disc (CD) writing

Text book recommended:

Cardiac Catheterization – Grossman

ALLIED HEALTH SCIENCES
EXAMINATION QUESTION PAPER PATTERN
B.Sc. DEGREE COURSES

Essay	3 x 10 = 30 Marks
Short Notes	8 x 5 = 40 Marks
Short Answers	10 x 3 = 30 Marks
Total	100 Marks

EXAMINATION PATTERN – I YEAR

B.Sc. Degree in Cardiac Technology

S.No.	Subjects	Internal Assessment (IA)		Theory		Practical		Viva Voice	
		Max	Min	Max	Min	Max	Min	Max	Min
1.	Applied Anatomy, Physiology and Bio-chemistry related to Cardiac Technology	50	25	100	50	50	25	-	-
2.	Pharmacology related to Cardiac Technology	50	25	100	50	50	25	-	-
3.	Pathology, Microbiology, Clinical Features and Treatment of Diseases pertinent to Cardiac Technology	50	25	100	50	50	25	-	-
4.	Medical Electronics, biophysics and computer usage relevant to Cardiac Technology	50	25	100	50	50	25	-	-
5	Basic Electrocardiography	50	25	100	50	-	-	-	-

Internal Paper:

S.No.	Subject	Internal Assessment (IA)		Theory	
		Max	Min	Max	Min
1.	* English	50	25	100	50
2.	* Computer	50	25	100	50

* English and Computer are internal papers. Marks to be sent to the university. There will be no university examination for English and Computer paper.

Internal Assessment

Theory (20)	Practical (20)	Log Book/Project/Record(10)
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* Wherever there is no Log Book/Project/ Record work the 10 mark be added to the Practical of the respective subject.

B.Sc. ALLIED HEALTH SCIENCES**EXAMINATION PATTERN – II YEAR****B.Sc. Degree in Cardiac Technology**

S.No.	Subjects	Internal Assessment (IA)		Theory		Practical		Viva Voice	
		Max	Min	Max	Min	Max	Min	Max	Min
1.	Advanced Electro Cardiography	50	25	100	50	50	25	-	-
2.	Treadmill exercise stress testing and 24 hour Ambulatory ECG recording	50	25	100	50	50	25	-	-
3.	Echocardiography	50	25	100	50	50	25	-	-

B.Sc. ALLIED HEALTH SCIENCES

EXAMINATION PATTERN – III YEAR

B.Sc. Degree in Cardiac Technology

S.No.	Subjects	Internal Assessment (IA)		Theory		Practical		Viva Voice	
		Max	Min	Max	Min	Max	Min	Max	Min
1.	Cardiac catheterization laboratory basics	50	25	100	50	50	25	-	-
2.	Cardiac catheterization laboratory advanced	50	25	100	50	50	25	-	-
