

**SRI GURU RAMDAS UNIVERSITY OF HEALTH
SCIENCES, SRI AMRITSAR, PUNJAB**



**CURRICULUM FOR
B.Sc. Catheterization Laboratory
Technology**

(Applicable w.e.f. academic session 2021-22)

COURSE NAME: B.Sc. (Catheterization Laboratory Technology)

DURATION OF COURSE: THREE YEARS

FULL-TIME/ PART – TIME: FULL-TIME

1. B.Sc. Catheterization Laboratory Technology

B.Sc. Catheterization Laboratory Technology is an undergraduate course. Cardiac technology is an area of specialization for allied health professionals. Cardiovascular technologists and technicians assist physicians in the diagnosis and treatment of cardiac (heart) and peripheral vascular (blood vessel) conditions. Cardiac technologists prepare patients for open-heart surgery and the implanting of pacemakers. Technologists monitor patients during these procedures. The course is three years duration and career orienting in nature that opens many jobs for them after its successful completion.

2. Duration of Course

The Bachelor of Science Catheterization Laboratory Technology Course is proposed to be a 3 years integrated degree course.

3. Eligibility Criteria for Admission

The students shall be admitted as per the admission criteria and qualification prescribed in the Notification issued by the Board of Management of Sri Guru Ram Das University of Health Sciences from time to time.

4. Medium of Instructions

The Medium of instruction during the course and for the university examination shall be in English.

5. Examination Scheme

- 5.1 The examination for the first, second and third year shall ordinarily be held twice year in the months of May/June and November/ December by the Institute as per University rules.
- 5.2 Annual Examination shall be held in May/June and supplementary within 6 months of annual examination.
- 5.3 The examination in theory/practical shall be held at the end of the 1st academic year (1st Year) and the end of 2nd academic year (2nd Year) and third exam at the end of the 3rd academic year (3rd Year) with one internal and one external examiners.
- 5.4 Date of examination and appointment of examiner will be made by the Board of Management on recommendation of Faculty of Medical Sciences.
- 5.5 The examination for the first, second and third year of B.Sc. Catheterization Laboratory Technology Course would be held according to the prescribed syllabus.

6. Rules of Examination for Bachelor of Science in Catheterization Laboratory Technology Course:

- 6.1 The students shall submit his/her application for admission to the examination to Controller of Examinations SGRDUHS, Sri Amritsar through the Director Principal of the SGRDIMSAR, Sri Amritsar on the prescribed form with the required fee (the last date of which will be updated on university website after

notification issued from Board of Management time to time).

- 6.2 The candidates will be given 25 marks for theory and 15 marks for practical as internal assessment in each subject on the basis of their performance during the year. That a candidate be eligible to appear in the examination provided he/she secured a minimum of 35% marks in internal assessment in theory and practical.
- 6.3 There will be fresh internal assessment and compulsory attendance for the students for the examination in which he/she has failed at the time of subsequent examination in that subject.
- 6.4 The students will not be allowed to appear in the examination unless he/she attends 75% of the total theory and practical in each subject separately.
- 6.5 Director Principal of the college is empowered to condone the shortage of attendance of lectures to the extent of 5% lectures delivered in each course of theory and practical.
- 6.6 A student will be deemed to have passed in the examination if he/she passes in each subject separately.
- 6.7 In case of students joining late owing to the late admission with the approval of the Vice-chancellor, their lecturers are to be counted from the date of joining. Deficiency in studies should be made up by attending special classes for them at the level of Head of the Department.

7. First Year B.Sc. Catheterization Laboratory Technology Examination:

The First Year B.Sc. Catheterization Laboratory Technology examination shall be in the following subjects and candidate shall be required to pass all the subjects:-

B.Sc. Part – I

Paper	Subject	Theory			Practical			Grand Total
		Marks	Internal Assessment	Total	Marks	Internal Assessment	Total	
Paper-I	Anatomy	75	25	100	35	15	50	150
Paper-II	Physiology	75	25	100	35	15	50	150
Paper-III	Biochemistry	75	25	100	35	15	50	150
Paper-IV	Medical Electronics and Biophysics	75	25	100	35	15	50	150
	Basics of Computer	----	----	----	----	----	----	----

Note. The Examination in the subject of Basics of Computer will be conducted at college level and marks will be sent to University for final inclusion in the result.

Grading System

Grade	A+	A	B+	B	C+	C	D	E
Marks Range	81 - 100	76 - 80	71 - 75	61 - 70	51 - 60	41 - 50	31 - 40	0 – 30

8. Second Year B.Sc. Catheterization Laboratory Technology Examination:

The First Year B.Sc. in Catheterization Laboratory Technology Examination shall be open to a person who has previously passed the Second Year B.Sc. in Catheterization Laboratory Technology Examination of this University.

B.Sc. Part – II

Paper	Subject	Theory			Practical			Grand Total
		Marks	Internal Assessment	Total	Marks	Internal Assessment	Total	
Paper-I	Pathology and Microbiology	75	25	100	35	15	50	150
Paper-II	Pharmacology	75	25	100	35	15	50	150
Paper-III	Basic Electrocardiography and Echocardiography	75	25	100	35	15	50	150
Paper-IV	Basic Cardiac catheterisation and Treadmill exercise stress testing	75	25	100	35	15	50	150

9. Third Year

The Third Year B.Sc. Catheterization Laboratory Technology Examination shall be open to a person who has previously passed the Second Year B.Sc. Catheterization Laboratory Technology Examination of this University.

B.Sc. Part-III

Paper	Subject	Theory			Practical			Grand Total
		Marks	Internal Assessment	Total	Marks	Internal Assessment	Total	
Paper-I	Advanced Electrocardiography	75	25	100	35	15	50	150
Paper-II	Advanced Echocardiography	75	25	100	35	15	50	150
Paper-III	Advanced Cardiac Catheterization	75	25	100	35	15	50	150
Paper-IV	Cardiology	75	25	100	35	15	50	150

10. Promotion and Number of Attempts allowed

10.1 A candidate who fails in all the subjects in the First Year **B.Sc. Catheterization Laboratory Technology** examination shall not be promoted to Second Year class.

- 10.2 A Candidate who fails in one more or more subjects will be given four attempts including first attempt as a regular candidate, plus one mercy chance at the discretion of the Vice-Chancellor, at six monthly intervals. However, he/she will have to clear all these attempts within 6 years of admission to the said course.
- 10.3 The candidate who will absent himself/herself from the examination will be deemed to have been failed in that subject.
- 10.4 A candidate who passes in at least one subject of University level First Year B.Sc. Catheterization Laboratory Technology examination will be permitted to attend classes of Second Year. However, the candidate will be required to pass in all subjects of 1st Year examination at least 6 months before the final examination of 2nd Year examination.
- 10.5 A candidate who fails in all subjects in the second year B.Sc. Catheterization Laboratory Technology examination shall not be promoted to Third Year class.
- 10.6 A candidate who passes in at least one subject of University level Second Year B.Sc. Catheterization Laboratory Technology examination will be permitted to attend classes of Third Year. However, the candidate will be required to pass in all subjects of 2nd Year examination at least 6 months before the final examination of 3rd Year examination.
- 10.7 Candidate who passes in one or more subjects of Second Year B.Sc. Catheterization Laboratory Technology examination shall be exempted from appearing in these subject at a subsequent examination, but the candidate must pass the examination in a maximum of four attempts including first attempt, as a regular candidate plus one mercy chance at the discretion of the Vice-Chancellor failing, at six monthly intervals. However, he/she will have to clear all these attempts within 6 years of admission to the said course.
- 10.8 Candidate who passes in one or more subjects of third Year B.Sc. Catheterization Laboratory Technology examination shall be exempted from appearing in these subject at a subsequent examination, but the candidate must pass the examination in a maximum of four attempts (including first attempt, as a regular candidate), plus one mercy chance at the discretion of the Vice-Chancellor failing, at six monthly intervals. However, he/she will have to clear all these attempts within 6 years of admission to the said course.

11. Appointments of Examiners:

- 11.1 There shall be two examiners – One internal and one external.
- 11.2 Professor & head of the Department shall be Convener. The Examiner at least 3 years post PG teaching experience in that specification field will be appointed as Internal Examiner.
- 11.3 The external examiner shall be appointed from other Universities at least 3 years post PG teaching experience in that specification field.

12. Paper Setting and moderation of Question Papers

The questions papers for 1st Year, 2nd Year and 3rd Year will be set under the direction of Controller of Examinations.

Each Question Paper covering entire course consists of seven questions out of which six questions carry 10 Marks and one question carry 15 marks.

13. Evaluation of Answer Books

The answer books shall be got evaluated by putting fictitious roll numbers thereon or spot evaluation (Table marking) or any other method under the direction of the Controller of Examinations.

14. Minimum Pass Marks

During all the three annual examinations in each subject paper the candidate shall have to obtain 50% in theory including internal assessment 50% practical including internal assessment.

14.1 The successful candidates shall be classified into divisions as under:-

- a) Those who obtain 60% or more marks First Division.
- b) Those who obtain 50% or more marks but below 60% marks Second Division.
- c) A candidate who will obtain 75% or more marks of the total marks in any subject shall be declared to have obtained distinction in that subject provided he/she passed in all the subjects of the courses in all the parts in the first attempt.

A candidate is eligible to appear in the examination provided he/she secures a minimum of 35% marks in internal assessment in theory and practical separately.

15. Grace Marks

There shall be no provision for grace marks.

16. Declaration of Result

The results will be tabulated and declared by the Controller of Examination's office.

17. Award of Degree

On successfully passing the Third Year B.Sc. Catheterization Laboratory Technology examination the students shall be awarded the degree of Bachelor of Sciences in Catheterization Laboratory Technology.

First Year

Paper-1: Anatomy (70 hours)

Theory Syllabus

Anatomy

1. Introduction:

- 1.1 Definition of anatomy and its divisions, Terms of location, positions and planes.
- 1.2 Cell and its organelles, Tissues & its classification, Glands.

2. Musculoskeletal system:

- 2.1 Structure of Bone & its types.
- 2.2 Joints- Classification of joints with examples; details of synovial joint.
- 2.3 Bones & joints of upper limb, lower limb and their movements.
- 2.4 Axial skeleton & appendicular skeleton.
- 2.5 Skull, spine & its movements, intervertebral disc.
- 2.6 Muscles & its types.
- 2.7 Muscles of the upper limb, lower limb, trunk and neck.

3. Cardiovascular System:

- 3.1 Arteries & veins, Capillaries & arterioles.
- 3.2 Heart- size, location, chambers, blood supply of heart, pericardium.
- 3.3 Systemic & pulmonary circulation.
- 3.4 Major blood vessels of Heart- Aorta, pulmonary artery, common carotid artery, subclavian artery, axillary artery, brachial artery, common iliac artery, femoral artery.
- 3.5 Inferior vena cava, portal circulation, great saphenous vein.

4. Lymphatic System:

- 4.1 Lymph & Lymph vessels.
- 4.2 Structure of lymph node, names of regional lymphatics, axillary and inguinal lymph nodes.

5. Gastro-intestinal System:

- 5.1 Parts of GIT, structure of tongue, pharynx, salivary glands.
- 5.2 Location & Gross structure of Oesophagus, stomach, intestine (small and large), liver, gall bladder, pancreas, spleen.

6. Respiratory system:

- 6.1 Parts of Respiratory system; Structure of nose, nasal cavity, larynx, trachea, lungs, pleura, bronchopulmonary segments.

7. Urinary System:

- 7.1 Parts of Urinary system, location and gross structure of kidney, ureter, urinary bladder, urethra.

8. Reproductive system:

- 8.1 Parts of male reproductive system, gross structure of testis, vas deferens, epididymis, prostate.
- 8.2 Parts of female reproductive system, gross structure of uterus, ovary, fallopian tube, mammary gland.

9. Endocrine glands:

- 9.1 Name of all endocrine glands, gross structure & functions of pituitary gland, adrenal gland, thyroid gland and parathyroid gland.

10. Nervous system:

- 10.1 Neuron, classification of NS.
- 10.2 Meninges, ventricles, CSF.
- 10.3 Gross features of cerebrum, midbrain, pons, medulla oblongata, cerebellum, name of basal nuclei.
- 10.4 Blood supply of brain, cranial nerves.
- 10.5 Spinal cord and spinal nerves.
- 10.6 Autonomic nervous system.
- 10.7 Visual & auditory pathways

Practical Syllabus(20 Hours):

1. **Demonstration** of all bones of the human body.
2. **Demonstration** of all organs of the human body.
3. **General Histology:**
Epithelium: Simple (squamous, cuboidal, columnar, ciliated), Stratified, Transitional.
Bone, muscles (skeletal, smooth, cardiac) • Cartilage (hyaline, elastic, fibro cartilage). Connective Tissue (loose and dense).
Arteries (large & medium sized), Veins.

Books Recommended

1. Ross and Wilson, Anatomy and Physiology, Churchill Livingstone.
2. Companion Pocketbook for quick review B.D. Chaurasia's Human Anatomy: -Vol. (1,2,3)
3. B.D. Chaurasia's Human Anatomy -Vol. (1,2,3)
4. B.D. Chaurasia's Handbook of General Anatomy
5. Textbook of Anatomy & Physiology for Nurses- Nachiket Shankar/ Mario Vaz
6. Anatomy for B.Sc. Nursing – Dr Renu Chauhan

Paper-II: Physiology (70 hours)

Theory:

1. Blood
 - Red Blood Cells- Functions, count, Physiological variations.
 - Erythropoiesis-stages -
 - Hemoglobin-Functions, Physiological variations.
 - White Blood cells-Functions, count, morphology.
 - Platelets-count, morphology, functions. Hemostasis-Definition, Mechanism, clotting factors.
 - Blood groups-ABO system, Rh system, Blood transfusion- Indication, transfusion reactions.
 - Anaemias-classification, morphological and Etiological, effects of anaemia on body.
2. Cardiovascular System
 - Heart-Physiological Anatomy, Nerve supply, Properties of cardiac muscle.
 - Cardiac Cycle-Events –systole, diastole
 - Cardiac Output-Definition and factors affecting it.
 - Heart sounds-normal heart sounds, its causes, areas of auscultations.

- Blood Pressure-Definition, normal value, Physiological variations, its measurement.
- ECG- normal waves.
- Shock-Definition, Types.

3. Gastrointestinal System

- Physiological Anatomy, functions of GIT.
- Salivary Gland-functions of saliva.
- Stomach- structure and functions, Gastric secretions-composition, functions, Mechanism
- Pancreas- structure, functions, composition of Pancreatic juice.
- Liver-Functions of liver.
- Bile-Composition, functions.
- Jaundice-Types and its causes.
- Gall Bladder- Functions
- Intestine- Movements of small and large intestine.
- Digestion and Absorption of Carbohydrates, Proteins, Fats.
- Hormones of GIT- Functions of Gastrin, Secretin, CCK-Pz.

4. Respiratory System

- Physiological Anatomy, Functions of the respiratory system.
- Types of respiration, respiratory membrane.
- Lung volumes and capacities, vital capacity and factors affecting it.
- Transport of Oxygen-Forms of transportation, Oxy-hemoglobin dissociation curve and factors affecting it. \
- Transport of Carbon-Dioxide- Forms of transportation.
- Hypoxia-Definition, types, effects of hypoxia.
- Cyanosis-Definition and types.
- Artificial Respiration- CPR

5. Endocrine System

- Classification of Endocrine glands and their hormones.
- Thyroid Gland-Physiological Anatomy, hormones secreted, functions, disordersHypo and hyper secretion of hormone.
- Adrenal Gland-Adrenal Cortex-Physiological Anatomy, its hormones and functions.
- Adrenal Medulla-Hormones, functions.
- Pituitary Gland- Anterior and posterior pituitary hormones and their functions, disorders.
- Pancreas- Hormones and their functions, Diabetes Mellitus-types, pathophysiology, signs and symptoms.
- Parathyroid Gland- Hormones and their functions.

6. Central Nervous System

- Structure of neuron, functions of nervous system.
- Classification and properties of nerve fibres
- Synapse- structure and types
- Receptors-Definition, classification, properties, Reflex Arc
- Ascending and Descending tracts- names and functions
- Functions of Hypothalamus
- Functions of Cerebellum and Basal Ganglia
- Functions of Cerebral Cortex

- **Autonomic Nervous System-** Actions of sympathetic and parasympathetic system and their comparison.
- **Special Senses-**Eye-structure, functions of different parts, Visual acuity, Refractive errors
- Ear-structure, functions, General mechanism of hearing

7. Excretory System

- Kidneys-structure of nephron, functions of kidney
- Glomerular filtration Rate(GFR) and factors affecting it
- Counter Current Mechanism
- Bladder-its innervation, micturition reflex

8. Reproductive System

- Male Reproductive System-Stages of spermatogenesis, function of Testosterone
- Female Reproductive System-Ovulation, menstrual cycle, functions of Estrogen and progesterone

9. Nerve Muscle Physiology

- Classification of Muscle, structure of skeletal muscle
- Neuromuscular Junction
- Excitation Contraction Coupling

Practicals:

- Estimation of Hemoglobin Concentration
- Determination of Bleeding Time and Clotting Time
- Determination of Blood Groups
- Recording of normal Blood Pressure
- Clinical Examination of Arterial Pulse
- Determination of Vital Capacity

Paper-III: BIO-CHEMISTRY- 50 hours

Theory

1. **Biomolecules and the cell:** Major complex biomolecules of cell and cell organelles Prokaryotic and eukaryotic cell
2. **Carbohydrates:** Chemical structure, function and Classification: Monosaccharides, Disaccharides, Polysaccharides, Homopolysaccharides, Heteropolysaccharides, Glycoproteins
3. **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.
4. **Lipids:** Chemical structure, functions and Classification, fatty acids, Triacylglycerols, Phospholipids, glycoproteins, Lipoproteins, Steroids, Amphipathic lipids.
5. **Nucleic acids:** Purines and pyrimidine, Structure of DNA, Watson & Crick model of DNA, Structure of RNA, Types of RNA

6. **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.
7. **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
8. **Hormones:** Classification, Mechanism of action, Hypothalamic hormones, Pituitary– Anterior, posterior; Thyroid – Adrenal cortex, Adrenal medulla; Gonadal hormones, Menstrual cycle, GI hormones
9. **Acids and bases:** Definition, pH, Henderson Hasselbach equation, Buffers, Indicators, Normality, Molarity, Molality

PRACTICALS

I. Qualitative tests of monosaccharide (glucose and fructose)

- a. Molisch's test
- b. Fehling's test
- c. Benedict's test
- d. Seliwanoff's test

II. Qualitative tests of lipids

- a. Solubility tests
- b. Emulsification tests
- c. Saponification tests

III. Qualitative tests of proteins

- a. Isoelectric precipitation tests
- b. Heat coagulation tests

Paper-IV: MEDICAL ELECTRONICS & BIOPHYSICS

1. Introduction to medical physics

Medical Physics & its application in field of medicine, Concept of CT scan, Concept of MRI imaging, Concept of PET scan, Concept of SPECT SCAN

2. Radiation physics

Structure of Atom, Electromagnetic radiation, Production of X-rays, The interaction of X-ray & gamma with matter, Characteristic X-rays, Bremsstrahlung X-rays, Coherent scattering, Compton scattering, Photoelectric effect

3. Techniques of monitoring radiation exposure

Radiation dosimetry, Radiation dose ND UINTS. Tld Badge, Ionization chamber & its working

4. Measures to reduce radiation exposure

Ionizing radiation interaction with tissue, Effects of Radiation, Principles of radiation protection Practical aspects of Radiation protection

5. Ionic currents and Electrocardiography

Excitable cells, with Nerve/ Neuron Cell, Composition ICF & ECF, Ionic basis of Resting Membrane Potential Action Potential & Its ionic basis, Cardiac Muscle, Properties of Cardiac Muscle with Excitability, Autorhythmicity, Pacemaker Potential, Conductivity

6. Pressure transducers

Concept of Resistance, Capacitance and Inductance, Concept of Analog to Digital and Digital to Analog Conversion, Concept of Potentiometer, Variable Capacitance, Strain Gauge and Differential Transformer

7. Defibrillators

Working Principle of DC Defibrillators, Circuit Diagram and Applications

8. Cathode ray tubes and physiological monitors

Components of CRT, Working of CRT, Scanning, Convergence and Purity in Color CRT, Degaussing of CRT, Application as Voltmeter, Frequency Measurement, Voltage and Time period

9. Impedance plethysmography

Working Principle of Impedance plethysmography, Advantages and Applications

10. Pulse oximetry

Concept of Wavelength, Frequency and Time period, Working of Photo detector, Types of Waveforms in Pulse Oximeter

11. Medical ultrasound and Doppler

Concept of Reflection, Refraction, Diffraction, Concept of Attenuation and Scattering, Working of Piezoelectric devices, Concept of Echo and Absorption, Working Principle of Medical Ultrasound, Working Principle of Colour Doppler

BASICS OF COMPUTER

Theory : 30 hours

Practical's : 30 hours

THEORY

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 operating system – Networking – LAN, WAN, MAN (only basic ideas)

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.

Role of Computers in the Health care: - HIS, Medical Equipment, Pharmacy in inventory management, Patient record maintenance.

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 MSPowerpoint
- Customizing the slide show and inserting pictures and tables in the slides using MSpowerpoint
- Creating a worksheet using MS-Excel with data and sue of functions Using MSExcel 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

B.Sc. Cath. Lab Tech. - 2nd year

Paper-I :PATHOLOGY and MICROBIOLOGY OF DISEASES PERTINENT TO CARDIAC TECHNOLOGY- 70 hours

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, **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, Myocarditis, Restrictive cardiomyopathy.
- 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 thrombo-embolism
- 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.

MICROBIOLOGY(20 hours)

Theory:

1. Introduction to Microbiology.

2. Medically important Gram Positive & Gram Negative Cocci.
3. Medically important Gram Negative Bacilli.
4. Classification of fungus, Yeast & Yeast like.
5. Dry heat sterilization.
6. Moist heat sterilization
7. Chemical disinfectants.
8. Hospital acquired infection.
9. Blood stream infectious.
10. Subacute Bacterial endocarditis (SABE).
11. Rheumatic fever & its lab diagnosis.
12. Biochemical waste management.

Practical:

1. Introduction to Microbiology & Aseptic techniques.
2. Safety measures in Microbiology Lab.
3. Study of compound microscope.
4. Principal & working of an Autoclave.
5. Principal & working of Hot air oven.
6. Culture media (Liquid).
7. Culture media (Solid).
8. Biomedical test for identification of Bacteria.
9. Antimicrobial sensitivity testing.
10. Smear preparation & staining techniques (Gram staining & ZN staining).
11. Mantoux test.
12. KOH preparation & SDA

RECOMMENDED BOOKS

1. Textbook on Microbiology for DMLT & Paramedical courses.
2. Textbook on Microbiology Dr C P Baveja
3. Essentials of Practical Microbiology

Paper-II: PHARMACOLOGY- 50 hours

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, diltiazem, amlodipine
2. **Anti-failure agents: Diuretics-**furosemide, torsemide, 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, dobufamine, 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, ezetimibe, niacin, fenofibrate
7. **Miscellaneous drugs:**
Narcotics: morphine, pethidine, fentanyl
Sedatives: diazepam, midazolam
Steroids: hydrocortisone, prednisolone,
Antihistamines: diphenhydramine
Antibiotics: penicillins, cephalosporins, aminoglycosides
Anesthetic agents: local, general
Antacids and proton pump inhibitors, Protamin

Paper-III: BASIC ELECTROCARDIOGRAPHY (ECG) and ECHOCARDIOGRAPHY
(10+10 hours)

ELECTROCARDIOGRAPHY

1. Electrocardiography
2. Electrocardiographic processing and display system
3. Fundamental principles of electrocardiography: Cardiac electrical field generation during activation, Cardiac wave fronts
4. Cardiac electrical field generation during ventricular recovery
5. Electrocardiographic lead systems: Standard limb leads, Precordial leads and the Wilson central terminal, Augmented limb leads
6. The hexaxial reference frame and electrical axis
7. Recording adult and pediatric ECGs
8. The normal electrocardiogram, Atrial activation
9. The normal P wave Atrial repolarization
10. Atrioventricular node conduction and the PR segment Ventricular activation and the QRS complex
11. Ventricular recovery and ST-T wave, U wave Normal variants
12. Rate and rhythm

Practical Syllabus:

1. Basic Principles: The Electrocardiographic paper, The Electrograph, The electrical field of Heart, The leads, standard limb lead, Precordial lead, 'V' lead & 'AV' lead Basic ECG deflections.
2. Normal ECG The 'P' wave The 'QRS' complex T wave, the S-T segment, P-R segment The 'U' wave Rate & rhythm Rotation of the heart, The Q-T interval.
3. The Electrical axis
4. Precordial pattern of ECG
5. Chamber enlargement-atrial enlargement, LV hypertrophy & RV hypertrophy
6. Bundle branch block General principles Right Bundle branch block Left Bundle branch block The Hemi blocks (Fascicular blocks)
7. Exercise stress Testing a. Exercise b. Exercise protocols c. Electrocardiographic measurements d. Exercise testing-Indication and techniques.
8. ECG in myocardial infarction –ECG in anterior wall, Inferior wall, true posterior wall and sub endocardial infarction and RV infarction

9. ECG in rheumatic heart disease–ECG in mitral stenosis, mitral incompetence, aortic stenosis and aortic incompetence.
10. ECG in hypertension

ECHOCARDIOGRAPHY

1. **M- Mode and 2D transthoracic echocardiography**, Views used in transthoracic echocardiography,
2. Doppler echocardiography: pulsed, continuous wave and colour,
3. **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,
4. **Echocardiography in Valvular heart disease**: Mitral stenosis, Mitral regurgitation, Mitral valve prolapsed, Aortic stenosis, Aortic regurgitation, Infective endocarditis Prosthetic valve assessment,
5. **Echocardiography in Cardiomyopathies**: Dilated, Hypertrophic, Restrictive, Constrictive pericarditis, pericardial effusion and cardiac tamponade,
6. **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

Practical Syllabus: Posting in ECG norm & Echo Lab and maintain Log book 50 cases

Text book recommended: Echocardiography – **Feigenbaum**

Paper-IV: BASIC CARDIAC CATHETERIZATION AND TREADMILL EXERCISE STRESS TESTING (6+6 Hours)

BASIC CARDIAC CATHETERIZATION

1. Types 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.
2. Intra cardiac pressures, Pressure recording systems, Fluid filled catheters versus catheter tipped manometers, Artifacts, damping, ventricularization, Pressure gradient recording pullback, peak-to peak.
3. Cardiac output determination, Thermo dilution method, Oxygen dilution method, Principles of oximetry, Shunt detection and calculations.
4. Coronary angiography, Coronary angiographic catheters, Use of the manifold, Angiographic views in coronary angiography, Laboratory preparation for coronary angiography,
5. Left Ventriculography – catheters, views, use of the injector, Right heart catheterization and angiography

TREADMILL EXERCISE STRESS TESTING

1. Exercise physiology, protocols, Lead systems, Patient preparation
2. ST segment displacement – types and measurement, Non electrocardiographic observations Exercise test indications, contra-indications and precautions
3. Cardiac arrhythmias and conduction disturbances during stress testing, Emergencies in the stress testing laboratory.
4. Principles of Holter Recording, Connections of the Holter recorder, Holter Analysis
5. Guidelines for ambulatory electrocardiography

Practical Syllabus:

1. Cardiac Monitoring- definition, purpose of cardiac monitoring, how to Recognise various arrhythmias how to set up a intensive coronary care unit and usefulness of ICCU
2. Interpretation of TMT report-criteria for TMT positive test contraindication for TMT conditions where TMT is not useful, complications that may occur in TMT room and its management
3. Use of defibrillator – indications, how to use the defibrillator, complications during the procedure and its management
Management of cardiac arrest – definition, causes external cardiac massage, artificial respiration and other drugs and procedures used in the management of Cardiac Arrest (ACLC, BLS) myocardial perfusion scan-procedures and usefulness of myocardial perfusion scan
Cardiac arrhythmias- bradyarrhythmia and tachy arrhythmias and ECG diagnosis of all rhythm disturbances.
Electrolyte disturbances- ECG in hypokalemia, hyperkalemia etc.
Holter monitoring- procedure and usefulness

Recommended Books:

- Grossmann text book of heart disease
- Braunward text book of heart disease

B.Sc. Cath Lab Tech. – 3rd year

Paper-1.ADVANCED ELECTROCARDIOGRAPHY (ECG)

- 1. 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,
- 2.** Left bundle branch block, Right bundle branch block, Myocardial ischemia and infarction, Repolarization (ST-Twave) abnormalities, QRS changes,
- 3. Evolution of electrocardiographic changes**, Localization of ischemia or infarction, Noninfarction Q waves, Primary and secondary T wave change,
- 4. Electrolyte and metabolic ECG abnormalities**, Cardiac arrhythmias, Ventricular premature beats, Supra-ventricular, tachycardias, Atrial flutter/fibrillation,
- 5.** 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

Practical syllabus: Cardiac CCU posting and maintain ECG log book 25 cases.

Textbook recommended: Introduction to Electrocardiography-Schamroth, Chugh textbook of ECG

Paper-2. ADVANCED CARDIAC CATHETERIZATION

Theory

- 1.** Aortic angiography – aortic root, arch, abdominal aorta, Peripheral angiography and carbon dioxide angiography, Catheterization and angiography in children with congenital heart disease,
- 2.** Contrast agents: Ionic and non-ionic, Types of non-ionic agents, Contrast nephropathy,
- 3.** Measures to reduce incidence of contrast nephropathy,
- 4.** 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
- 5.** Pediatric Interventions: Aortic and pulmonary valvuloplasty, Coarctation angioplasty and stenting, Device closure of PDA, ASD, VSD, Technique and devices used, Sizing of devices, Coil,
- 6.** Balloon Mitral valvuloplasty (BMV): Techniques and hardware used in BMV, Setting up the laboratory for a BMV case
- 7.** Technique and equipment used for trans-septal puncture, Recording of transmitral pressure gradients, Management of cardiac tamponade, Peripheral intercessions, Equipment and techniques used, Endovascular exclusion of aneurysms

8. Self-expanding stents, covered stents and cutting ballons, Intra-aortic balloon pump (IABP) Theory of intra -aortic balloon counterpulsation, Indications for IABP use, setting up the IABP system,
9. Thromboembolic disease, Indications and use of venacaval filters, Techniques of thrombolysis – drug and catheters used, Thrombus aspirations systems – coronary, peripheral,
10. 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,
11. Cardiac electrophysiology, Catheters used in electrophysiology studies, Connection of catheters during an EP study,
12. Equipment used in arrhythmia induction and mapping Radiofrequency ablation, Image archival systems and compact disc (CD) writing

Practical Syllabus:

1. Preparation for Cath procedure and post procedure care.
2. Cardiac Catheterization laboratory- General details of Cardiac Catheterization equipment, how to handle the machine, common problems, one may come across and how to overcome it. Radiation hazards.
3. Materials used in the Cath Lab- All catheters , balloons, guidewires, pacemakers, contrast materials & other materials used in the Cardiac Catheterization Laboratory and Sterilisation of all these materials.
4. Right heart Catheterization- procedure, cath position, Oxymetry at various levels, angios done & its interpretation.
5. Left heart catheterization- procedure, cath position, Oxymetry at various levels, angios done & its interpretation.
6. Coronary Angiogram-procedure, materials used, type & amount of dye used, indications & contra indications, various pictures recorded in various angles and gross interpretation.
7. Peripheral Angiogram- procedure, indication & contra indication.
8. Coronary Angioplasty- procedure, materials used, complications one may encounter and how to manage it.
9. Peripheral Angioplasty- materials used & procedure. Angioplasty of coarctation of aorta
10. Valvuloplasties- procedure, indications, complications and preparation of balloons, mitral valvuloplasty, balloon aortic valvuloplasty, Balloon pulmonary valvuloplasty & Balloon tricuspid valvuloplasty.
11. Coil closure & device closure of PDA- procedure , indications & materials used for coil & device closure of PDA
12. Device Closure of ASD- procedure , indications & materials used for device closure of ASD.
13. Device Closure of VSD procedure , indications & materials used for & device closure of VSD. 32
14. Electrophysiological studies-basic knowledge of electrophysiological studies.
15. Oxymetry – handling of the instruments & use fullness of the instruments, normal & abnormal values.
16. Pressure recording- handling of the instrument & pressures in various chambers, normal & abnormal values.
17. Temporary & permanent pacing- materials used, procedure, complications one may encounter & management.
18. CD recording & storage- Recording & storage of all the procedures over CD.
19. Procedure during pregnancy- precautions to be followed.
20. Nuclear cardiology- instrumentation, radiopharmaceuticals, patient imaging techniques.

Recommended Books: M. Kern Cardiac Cath textbook

Paper-3. ADVANCED ECHOCARDIOGRAPHY

Theory

1. **Echocardiography in Valvular heart disease:** Mitral stenosis, Mitral regurgitation, Mitral valve prolapsed, Aortic stenosis, Aortic regurgitation, Infective endocarditis Prosthetic valve assessment,
2. **Echocardiography in Cardiomyopathies:** Dilated, Hypertrophic, Restrictive, Constrictive pericarditis, pericardial effusion and cardiac tamponade,
3. **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

Practical Syllabus: Posting in Echo lab and log book (50 cases)

Recommended Books: Tazik text book Echocardiography

Paper-4.CARDIOLOGY

Theory

1. **Prevalence, causes and prevention of cardiovascular diseases**
a) IHD b) RHD c) Hypertension d) CHD
2. **Heart failure :** Causes, Types, symptoms and signs, diagnosis, management, prevention.
3. **Arrhythmias :** Brady and Tachyarrhythmias, causes, diagnosis and management.
4. **Atherosclerosis:** Definition, risk factors, pathogenesis, Clinical significance and prevention.
5. **Coronary artery disease:** Types, Causes, Symptoms and signs, diagnosis, investigations, management, complications.
6. **Hypertension :** Definition, causes, signs and symptoms, diagnosis, evaluation, management.
7. **Pulmonary Hypertension :** Definition, Causes, diagnosis and treatment.
8. **Rheumatic fever, Rheumatic Heart disease, Mitral valve and aortic valve disease. Infective endocarditis.**
9. **Congenital Heart Diseases Common CHD, Diagnosis and management ASD, VSD, PDA, PS, AS, coarctation of aorta, Dextrocardia.**
10. **Cardiomyopathies:** Dilated Cardiomyopathy, Hypertrophic Cardiomyopathy, Restrictive Cardiomyopathy
11. **Pericardial diseases :** Acute Pericarditis, Pericardial effusion, Pericardial tamponade. Chronic constrictive pericarditis.
12. **Peripheral vascular diseases**
13. **Anaemia**
14. **Chronic obstructive Lung disease**
15. **Acute and chronic renal failure**
16. **Fluid therapy, Central venous lines. Interpretation of Investigation reports.**
17. **Basics of 64 slice CT angio, CT and MRI.**
