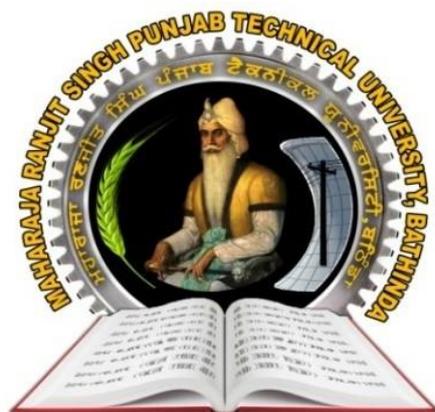


**Maharaja Ranjit Singh Punjab Technical University
Bathinda-151001**



FACULTY OF PHARMACY

SYLLABUS

FOR

M.SC. (CARDIAC CARE TECHNOLOGY)

(2 YEARS PROGRAMME)

2023 BATCH ONWARDS

Note: (i) Copy rights are reserved.

Nobody is allowed to print it in any form.

Defaulters will be prosecuted.

(ii) Subject to change in the syllabi at any time.

Please visit the University website time to time.

**MRSPTU M.SC. (CARDIAC CARE TECHNOLOGY)
SYLLABUS 2023 BATCH ONWARDS**

SCHEME

1 st Semester		Contact Hrs.			Marks			Credits
Subject Code	Subject	L	T	P	Int.	Ext	Total	
MCCTS1-101	Introduction to Clinical Cardiology	4	0	0	40	60	100	4
MCCTS1-102	Fundamentals of cardiac Diagnostic Procedures and investigation	3	1	0	40	60	100	4
MCCTS1-103	Introduction to Pacing and Electrophysiology Study Techniques	3	1	0	40	60	100	4
MCCTS1-104	CCT Directed Clinical Education-I	-	-	8	100	-	100	4
MCCTS1-105	Introduction to Clinical Cardiology Practical	-	-	4	40	60	100	2
MCCTS1-106	Fundamentals of cardiac Diagnostic Procedures and investigation Practical	-	-	4	40	60	100	2
Total		10	2	16	300	300	600	20

2 nd Semester		Contact Hrs.			Marks			Credits
Subject Code	Subject	L	T	P	Int.	Ext	Total	
MCCTS1-201	Introduction to Non-Invasive Techniques in Cardiology	4	0	0	40	60	100	4
MCCTS1-202	Invasive Cardiology	3	1	0	40	60	100	4
MCCTS1-203	Research Methodology & Biostatistics	4	0	0	40	60	100	4
MCCTS1-204	Introduction to Non-Invasive Techniques in Cardiology- Practical	0	0	4	60	40	100	2
MCCTS1-205	Invasive Cardiology – Practical	0	0	4	60	40	100	2
MCCTS1-206	Research Methodology & Biostatistics - Practical	0	0	4	60	40	100	2
MCCTS1-207	Basics of Clinical Skill Learning	4	-	-	100	-	100	4
Total		14	1	12	400	300	700	22

**MRSPTU M.SC. (CARDIAC CARE TECHNOLOGY)
SYLLABUS 2023 BATCH ONWARDS**

3 rd Semester		Contact Hrs.			Marks			Credits
Subject Code	Subject	L	T	P	Int.	Ext	Total	
MCCTS1-301	Echocardiography- Advanced	4	0	0	60	40	100	4
MCCTS1-302	Development of cardiovascular system-fetal and neonatal	4	0	0	60	40	100	4
MCCTS1-303	CCT Directed Clinical Education-II	0	0	8	100	-	100	4
MCCTS1-304	Dissertation/ Project	0	0	8	100	-	100	4
MCCTS1-305	Echocardiography Advanced – Practical	0	0	4	40	60	100	2
Total		8	0	20	360	140	500	18

4 th Semester		Contact Hrs.			Marks			Credits
Subject Code	Subject	L	T	P	Int.	Ext	Total	
MCCTS1-401	Internship and Dissertation	0	0	40	80	120	200	20
Total							200	20

For internship the candidate shall undergo internship in relevant department. The internship report shall be submitted to the parent institute & Viva-Voce examination shall be conducted by external expert.

For project/ dissertation the candidates will be supervised by the concerned faculty & the project report will be submitted to the institute. The Viva-Voce examination shall be conducted by external expert.

Overall Marks / Credits

Semester	Marks	Credits
1 st	600	20
2 nd	700	22
3 rd	500	18
4 th	200	20
Total	1700	80

FIRST SEMESTER

INTRODUCTION TO CLINICAL CARDIOLOGY

Subject Code: MCCTS1-101

L T P C

Duration: 60 (Hrs.)

3 1 0 4

Course Outcomes: Students will get knowledge about

- The medical management of important conditions including hypertension, acute coronary syndromes, arrhythmias, valvular heart diseases and other cardiovascular disorders.
- The clinical skills required for medical management of patients admitted with various cardiovascular disease.
- The ultimate measure of quality of care in cardiology and there is no excuse to ignore them.
- The main outcomes in cardiology trials (mortality, hospitalization, myocardial infarction/re-infarction, and stroke) constitute the strongest reference for guideline recommendations.

Unit: 1 (16 hrs)

Basic Cardiology: Anatomy of the heart, Conduction system of the heart, Symptoms of the heart diseases, Examination of Cardiovascular diseases

Cardiac Auscultation: The stethoscope: components, working, uses, Heart sound – Types of heart sounds: normal and abnormal, Prosthetic heart sounds

Unit: 2 (14 hrs)

Physical Appearance: General appearance, Gestures and gait

Detailed Appearance: Face, Eyes—external and internal Mouth—external and internal Hands and feet, Skin, Muscles and tendons, Thorax, Abdomen

Unit: 3 (16 hrs)

Arterial pulse: Information derived from the arterial pulse, Sites of Arterial Pulse, Methods of measuring Arterial pressure, Physical determinants of Arterial pressure

The Jugular and Peripheral Veins: External and Internal Jugular Veins, Techniques of Examination for External and Internal Jugular Veins, Assessment of Jugular Venous Pressure, Anatomic-Hemodynamic Inferences, Electrophysiologic Inferences— Arrhythmias and Conduction Defects

Unit: 4 (14 hrs)

Heart failure & Cardiomyopathy: Heart failure, Cardiogenic shock, Pulmonary edema, Cardiomyopathy

Cardiovascular diseases: Hypertension, Ischemic Heart disease, Rheumatic heart disease, Arrhythmias, Pregnancy and heart diseases

Reference books:

- Physical Examination of the Heart and Circulation Fourth Edition, Joseph K. Perloff, M.D.
- Textbook of Anatomy (Vol.1,2,3): B.D. Chaurasia
- Ross and Wilson Anatomy & Physiology in Health and Illness, 12th Edition by Anne Waugh and
- Allison Grant
- Principles of Anatomy & Physiology ,12th Edition by Gerard J. Tortora& Bryan Derrickson
- Textbook of Physiology (Vol.1,2): Dr. A.K. Jain

**MRSPTU M.SC. (CARDIAC CARE TECHNOLOGY)
SYLLABUS 2023 BATCH ONWARDS**

INTRODUCTION TO CLINICAL CARDIOLOGY (PRACTICAL)

Subject Code: MCCTS1-105

**L T P C
0 0 4 2**

Duration: 60 (Hrs.)

Course Outcomes:

- The medical management of important conditions including hypertension, acute coronary syndromes, arrhythmias, valvular heart diseases and other cardiovascular disorders.
- The clinical skills required for medical management of patients admitted with various cardiovascular disease.
- Clinical outcomes are the ultimate measure of quality of care in cardiology and there is no excuse to ignore them.
- The main outcomes in cardiology trials (mortality, hospitalization, myocardial infarction/re-infarction, and stroke) constitute the strongest reference for guideline recommendations.

Experiments related to:

Cardiac Auscultation

Physical Examination in Cardiovascular diseases.

Chest roentgenogram

Electrocardiography

Reference books:

- Physical Examination of the Heart and Circulation Fourth Edition , Joseph K. Perloff, M.D.
- Textbook of Anatomy (Vol.1,2,3): B.D. Chaurasia
- Ross and Wilson Anatomy & Physiology in Health and Illness, 12th Edition by Anne Waugh and Allison Grant
- Principles of Anatomy & Physiology ,12th Edition by Gerard J. Tortora& Bryan Derrickson
- Textbook of Physiology (Vol.1,2): Dr. A.K. Jain

**MRSPTU M.SC. (CARDIAC CARE TECHNOLOGY)
SYLLABUS 2023 BATCH ONWARDS**

**FUNDAMENTALS OF CARDIAC DIAGNOSTIC PROCEDURES AND
INVESTIGATION**

Subject Code: MCCTS1-102

**L T P C
3 1 0 4**

Duration: 60 (Hrs.)

Course Outcomes:

- The students will develop a systematic and comprehensive understanding of, and skills in, cardiac investigations and diagnostic procedures.
- They will understand, interpret and commission basic and complex diagnostic cardiac investigations.
- They will know about various cardiac complications.
- They will get knowledge about how to treat emergency cardiac conditions.

Unit: 1 (12 hrs)

Cardiac Catheterization in detail: Types of procedures, Hardware used, vascular access, Conditions for Cardiac Catheterization

Unit: 2 (15 hrs)

Physics and Operation of Radiation equipment in Cardiac Cath Lab: X-RAY tube & its design, Image intensifier, Gantry, Exposure factors, Projections used in various procedures

Unit: 3 (15 hrs)

Diagnostic Procedures: Coronary Angiography, Peripheral Angiography, Renal Angiography, Cerebral Angiography

Unit: 4 (18 hrs)

HEMODYNAMICS: Introduction to Hemodynamics, Pressure Measurement System, Sources of Error and Artifacts: Fluid Artifacts, Electronic and Electrical Artifacts, Human Error: Leveling and Balancing, Slope calibration, Hemodynamic waveforms, Gradient, Valve Area Calculations, Cardiac output formulas- Fick, Ejection fraction
Emergencies in the Cardiac Catheterization Laboratory: Major and Minor complications in CCL, Basic Life support and ACLS algorithms in emergencies

Reference books:

Invasive Cardiology- A MANUAL FOR CATH LAB PERSONNEL, 3rd Edition by Sandy Watson

**FUNDAMENTALS OF CARDIAC DIAGNOSTIC PROCEDURES AND
INVESTIGATIONS PRACTICAL**

Subject Code: MCCTS1-106

**L T P C
0 0 4 2**

Duration: 60 (Hrs.)

Course Outcomes:

- This course provides a basis for the student to develop a systematic and comprehensive understanding of, and skills in, cardiac investigations and diagnostic procedures.
- To educate and train students to understand, interpret and commission basic and complex diagnostic cardiac investigations
- To educate the students about various cardiac conditions
- To provide knowledge about treatment of cardiac ailments

Experiments related to:

1. Cardiac Catheterization
2. Angiography & its types
3. Hemodynamic assessments
- 4 BLS & ACLS algorithm
5. Physics of Radiation Equipment
6. Hardware used in CCL

Reference Books

Invasive Cardiology- A MANUAL FOR CATH LAB PERSONNEL, 3rd Edition by Sandy Watson

**INTRODUCTION TO PACING AND ELECTROPHYSIOLOGY STUDY
TECHNIQUES**

Subject Code: MCCTS1-103

**L T P C
3 1 0 4**

Duration: 60 (Hrs.)

Course Objectives:

- To teach students about common pacemaker problems.
- Identify indications for ICD and biventricular pacemaker implantation based on international guidelines
- Identify indications for cardiac pacing based on international guidelines.
- Identify indications for electrophysiological studies with/ without ablation in cases of complex arrhythmias.

UNIT: 1 (15 Hrs)

Anatomy of conduction system: SA node, AV node, Intermodal and inter-atrial conduction, AV junctional and inter-ventricular conduction delay, The bundle of His, penetrating portion of the AV bundle, The bundle branches, The branching portion of the AV bundle, Terminal Purkinje fibres, Innervations of the AV node, His bundle & ventricular myocardium

UNIT: 2 (16 Hrs)

Nervous & hormonal control of heart: Anatomy of ANS, Various hormones involved in control of heart, Effect of vagal stimulation, Effect of sympathetic stimulation

Basics of Electrophysiology: History, Equipment used, Personnel, Procedure, Arrhythmias treated, Differences between Children and Adults for Electrophysiology

UNIT-3 (19 Hrs)

Radiofrequency ablation therapy: Procedure, Arrhythmias treated: Atrioventricular Nodal Reentrant Tachycardia (AVNRT), Atrial Fibrillation, Atrial Flutter and Ventricular Tachycardia
Introduction to Cardiac Pacing: Normal conduction, NBG codes for pacemaker, Indications for Temporary and Permanent Pacing, Pacemaker Components

UNIT-4 (10 Hrs)

Temporary Pacing (in detail): Myocardial conduction, Pacemaker therapy, Basic terminologies used in Temporary Pacing, Types of Temporary pacemaker, Complications associated

Reference books:

- Invasive Cardiology- A MANUAL FOR CATH LAB PERSONNEL, 3rd Edition by Sandy Watson
- Principles of Anatomy & Physiology ,12th Edition by Gerard J. Tortora& Bryan Derrickson

**MRSPTU M.SC. (CARDIAC CARE TECHNOLOGY)
SYLLABUS 2023 BATCH ONWARDS**

CCT DIRECTED CLINICAL EDUCATION-I

Subject Code: MCCTS1-104

L T P C

Duration: 150 (Hrs.)

0 0 8 4

Students will gain additional skills in interventional procedures, cardiac pharmacology and recent advancements. Students apply knowledge from previous clinical learning experience under the supervision of a senior technologist at a designated hospital or clinic. Students will be tested on intermediate pharmacological and invasive techniques.

The progress of students will be evaluated jointly at the department as well as at designated hospital or clinic. One faculty or staff member will be deputed for the student at both places.

MRSPTU

SECOND SEMESTER

INTRODUCTION TO NON-INVASIVE TECHNIQUES IN CARDIOLOGY

Subject Code: MCCTS1-201

L T P C

Duration: 60 (Hrs.)

4 0 0 4

Course Objectives: To teach students about common non-invasive techniques, investigations carried out with indications and complications.

Course Outcomes: Identify indications for non-invasive techniques based on international Guidelines. Identify indications for non-invasive techniques.

UNIT 1 (16 Hrs)

BASICS OF ELECTRODE PLACEMENT AND LEAD SELECTION AND AXIS DEVIATION: Basics of Electrodes and Leads, ECG deflections: Isoelectric, Upright, Negative and Biphasic, Types of ECG leads- Standard limb leads, Precordial leads and the Wilson central, Augmented limb leads, Unipolar V/S Bipolar leads, Placement of leads with universal color code, Hexa-axial reference frame and Electrical axis, X axis – time presentation, Y axis – voltage presentation, Right & Left axis in normal ECG, Einthoven's Triangle, Deviation of Axis.

STRESS TEST: Protocols, lead placement, instruction to the patient, rhythm analysis, Types of Exercise stress tests

UNIT II (15 Hrs)

ECG COMPONENTS-WAVES AND INTERVALS: ECG waveforms: Rate, Rhythm and Normal time intervals-The Normal Electrocardiogram, The Normal P wave & Atrial repolarization, Atrioventricular node conduction and the PR segment, Ventricular activation and the QRS complex, Genesis of QRS complex, Ventricular recovery and ST-T wave, Normal variants and Rotation of the heart, ECG PAPER, Rate measurement: Six second method, Large box method, Small box method

ECHOCARDIOGRAPHY TECHNIQUES: BASIC PRINCIPLES, INDICATIONS AND USES OF: 2D Transthoracic Echocardiography, M-mode, Echo windows and views used in Transthoracic echocardiography, Doppler echocardiography in detail: Pulsed, Continuous wave and Color flow mapping

UNIT III (15 Hrs)

KNOBOLOGY AND INSTRUMENTATION: Transducer: Basic principle and working, Types of Transducers, Piezoelectric crystals and its effect, various knobs used on Echo machine with its description and application

UNIT IV (14 Hrs)

BASICS OF TOE, STRESS ECHO & CONTRAST ECHO: Advantages & Disadvantages, Applications, Indications & Contraindications, Complications, Patient positioning and medications used

Textbooks:

1. ECG Made Easy –Atul Luthra
2. Reference by PGDCC – IGNOU Handbooks for ECG, ECHO and Stress Test
3. Echo Made Easy: Sam Kaddoura
4. Reference by PGDCC – IGNOU Handbooks for ECG, ECHO and Stress Test.
5. Feigen Baum's Echocardiography Tajik Jamil for Echocardiography.

**MRSPTU M.SC. (CARDIAC CARE TECHNOLOGY)
SYLLABUS 2023 BATCH ONWARDS**

INVASIVE CARDIOLOGY

Subject Code: MCCTS1-202

L T P C

Duration: 60 (Hrs.)

3 1 0 4

Course Objectives: To enable students, understand new techniques for procedures in and around the heart emerge that again need expert knowledge and manual dexterity. To understand such interventions which include diagnostic and therapeutic electrophysiology; implantation or exchange of complex pacemaker systems or percutaneous cardioverter defibrillator-pacers; percutaneous valve repairs or replacements etc.

Course Outcomes: To enable students to not only be a helping hand to those just starting out in the specialty but also to serve as a reference for those who have been working in Invasive field for some time.

Unit: 1 (15 Hrs)

CONTRAST MEDIA: Basics, Definition of Hydrophilicity, Osmolarity, and Viscosity, Contrast Agents used in the CCL, Uses, Complications, Contrast medium reactions: Mild, Moderate, Severe, Allergies: Anaphylactic and Anaphylactoid Reaction, Contrast-Induced Nephropathy (CIN)

IVUS: History, Angiography vs. IVUS, IVUS systems, Diagnostic Applications of IVUS, Complications of IVUS, Optical Coherence Tomography (OCT)

Unit: 2 (15 Hrs)

FUNCTIONAL ASSESSMENT OF CORONARY DISEASE: Intravascular Pressure Measurement: Coronary Pressures and Fractional Flow Reserve

PTCA: History, Indications, Materials used, Types of Angioplasty balloons (OTW, SOE, Fixed-wire balloons, Perfusion balloons, Compliant and Non-Compliant balloons, Stent Implantation, Contraindications, Complications

Unit: 3 (15 Hrs)

IC HARDWARES: Stents: Composition, Types, Guide wires: Composition, Types, Catheters: Diagnostic and Guiding

IABP AND OTHER CARDIAC ASSIST DEVICES: IABP- Physiologic Principles of Counter pulsation, Indications, Contraindications, Insertion, Timing: Timing errors, Troubleshooting, Weaning and Balloon Removal, Complications, Basics of Percutaneous ventricular assist devices: Tandem Heart, Impella, Percutaneous Coronary Bypass.

Unit: 4 (15 Hrs)

PERIPHERAL CAROTID ANGIOGRAPHY: Introduction, Cerebrovascular Anatomy and pathology, Diagnosis and patient selection, Patient preparation, Diagnostic procedure, Post procedure Care

CARDIAC PHARMACOLOGY: Local Anesthetics, Analgesics And Sedatives: Opioids, Morphine, Fentanyl, Diazepam, Midazolam, Lorazepam, Vasodilators: Nitroglycerine, Sodium Nitroprusside, Beta receptor blockers: Metoprolol, Propranolol, Esmolol, Labetalol, Calcium Channel Blockers: Diltiazem, Verapamil, Nicardipine, Anticoagulation Agents: Platelet Aggregation Inhibitors, Aspirin, Clopidogrel, Glycoprotein IIb/IIIa Inhibitors, Tirofiban, Heparin, Warfarin, Thrombolytics: Streptokinase, Urokinase, Anistreplase, rTPA, Reteplase, Tenecteplase

**MRSPTU M.SC. (CARDIAC CARE TECHNOLOGY)
SYLLABUS 2023 BATCH ONWARDS**

Reference books:

- Invasive Cardiology, 3rd Edition by Sandy Watson.
- THE INTERVENTIONAL CARDIAC CATHETERIZATION HANDBOOK, 3rd Edition by Morton J. Kern

MRSPTU

RESEARCH METHODOLOGY & BIOSTATISTICS

Subject Code: MCCTS1-203

L T P C

Duration: 60 (Hrs.)

4 0 0 4

Course Objectives: The course is intended to give an overview of research and statistical models commonly used in medical and bio-medical sciences. The goal is to impart an intuitive understanding and working knowledge of research designs and statistical analysis. The strategy would be to simplify, analyse the treatment of statistical inference and to focus primarily on how to specify and interpret the outcome of research.

Course Outcomes: Student will be able to understand develop statistical models, Research designs with the understating of background theory of various commonly used statistical techniques as well as analysis interpretation & reporting of results and use of statistical software.

Unit: 1 (15 Hrs)

Research Methodology

- Scientific Methods of Research: Definition of Research, Assumptions, Operations and Aims of Scientific Research. Research Process, Significance and Criteria of Good Research, Research Methods versus Methodology, Different Steps in Writing Report, Technique of Interpretation, Precaution in interpretation, Significance of Report Writing, Layout of the Research Report
- Research Designs: Observational Studies: Descriptive, explanatory, and exploratory, Experimental Studies: Pre-test design, post-test design, Follow-up or longitudinal design, Cohort Studies, Case Control Studies, Cross sectional studies, Intervention studies, Panel Studies
- Sampling Designs: Census and Sample Survey, Implications of a Sample Design, Steps in Sampling Design Criteria of Selecting a Sampling Procedure, Characteristics of a Good Sample Design, Different Types of Sample Designs (Probability sampling and non-probability sampling), How to Select a Random Sample?, Systematic sampling, Stratified sampling, Cluster sampling, Area sampling, Multi-stage sampling, Sampling with probability proportional to size, Sequential sampling.

Unit: 2 (15 Hrs)

- Measurement in research: Measurement Scales, Sources of Error in Measurement, Tests of Sound Measurement, Technique of Developing Measurement Tools, Scaling Meaning of Scaling, Scale Classification Bases, Important Scaling Techniques, Scale Construction Techniques, Possible sources of error in measurement, Tests of sound measurement.
- Methods of Data Collection: Types of data, Collection of Primary Data, Observation Method, Interview Method, Collection of Primary Data.
- Sampling Fundamentals : Need and importance for Sampling, Central Limit Theorem, Sampling Theory, Concept of Standard Error, Estimation, Estimating the Population Mean Estimating Population Proportion, Sample Size and its Determination, Determination of Sample Size through the Approach Based on Precision Rate and Confidence Level.

Unit: 3 (16 Hrs)

- Data Presentation: Types of numerical data: Nominal, Ordinal, Ranked, Discrete and continuous. Tables: Frequency distributions, Relative frequency, Graph: Bar charts,

MRSPTU M.SC. (CARDIAC CARE TECHNOLOGY)
SYLLABUS 2023 BATCH ONWARDS

Histograms, Frequency polygons, one way scatter plots, Box plots, two way scatter plots, line graphs. Measures of Central Tendency and Dispersion: Mean, Median, Mode Range, Inter quartile range, variance and Standard Deviation, Coefficient of variation, grouped mean and grouped standard deviation (including merits and demerits).

- Testing of Hypotheses: Definition, Basic Concepts, Procedure for Hypothesis Testing, Measuring the Power of a Hypothesis Test, Normal distribution, data transformation Important Parametric Tests, Hypothesis Testing of Means, Hypothesis Testing for Differences between Means, Hypothesis Testing for Comparing Two Related Samples, Hypothesis Testing of Proportions, Hypothesis Testing for Difference between Proportions, Hypothesis Testing for Comparing a Variance to Some Hypothesized Population Variance, Testing the Equality of Variances of Two Normal Populations
- Chi-square Test: Chi-square as a Non-parametric Test, Conditions for the Application Chi-square test, Steps Involved in Applying Chi-square Test, Alternative Formula, Yates' Correction, and Coefficient by Contingency. Measures of Relationship: Need and meaning, Correlation and Simple Regression Analysis

Unit: 4 (14 Hrs)

- Analysis of Variance and Covariance: Analysis of Variance (ANOVA): Concept and technique of ANOVA, One-way ANOVA, Two-way ANOVA, ANOVA in Latin Square Design Analysis of Co-variance (ANOCOVA), ANOCOVA Technique. Nonparametric or Distribution-free Tests: Important Nonparametric or Distribution-free Test Sign test, Wilcoxon signed-Rank Test, Wilcoxon Rank Sum Test: Mann-Whitney U test Kruskal Walli's test, Friedman's test, and Spearman Correlation test.
- Vital Health Statistics: Measurement of Population: rate, crude rate, specific rate, Measurement of fertility: specific fertility rate, Total fertility rate, Reproduction rate, Gross Reproduction Rate, Net Reproduction Rate, Measures related to mortality: Crude Death Rate (CDR), Age-specific death Rate, Infant and child mortality rate, Measures related to morbidity.
- Computer Application Use of Computer in data analysis and research, Use of Software and Statistical package. Introduction to SPSS. Importing data from excel, access, tab and comma separated files. Entering data, labeling a variable, coding and recoding a categorical and continuous variable. Converting data from string to numeric variables, sorting & filtering, merging, appending data sets. Frequencies, descriptive statistics, cross tabulations. Diagrammatic presentation include histogram, bar chart, pie chart, scatter diagram, box plot, line chart. Parametric test of hypothesis-one sample, Independent and paired sample t test, one way ANOVA & post HOC test. Testing for normality, Chi-square test with measures of association. Pearson correlation. Non parametric test.

Reference books:

1. Pharmaceutical statistics- Practical and clinical applications, Sanford Bolton, Publisher Marcel Dekker Inc. New York.
2. Fundamental of Statistics – Himalaya Publishing House- S.C. Gupta
3. Design and Analysis of Experiments – PHI Learning Private Limited, R. Pannerselvam,
4. Design and Analysis of Experiments – Wiley Students Edition, Douglas and C. Montgomery

**INTRODUCTION TO NON-INVASIVE TECHNIQUES IN CARDIOLOGY-
PRACTICAL**

Subject Code: MCCTS1-204

**L T P C
0 0 4 2**

Duration: 60 (Hrs.)

Course Objectives: To teach students about common non-invasive techniques, investigations carried out with indications and complications.

Course Outcomes: Identify indications for non-invasive techniques based on international Guidelines. Identify indications for non-invasive techniques.

Experiments:

- Steps to perform an 12 lead ECG
- Patient positioning according to various conditions
- Proper communication with patient to find out the history
- ECG machine operating and maintenance

Text Books

- ECG Made Easy –Atul Luthra
- Reference by PGDCC – IGNOU Handbooks for ECG, ECHO and Stress Test
- Echo Made Easy: Sam Kaddoura
- Reference by PGDCC – IGNOU Handbooks for ECG, ECHO and Stress Test.
- Feigen Baum’s Echocardiography Tajik Jamil for Echocardiography.

INVASIVE CARDIOLOGY - PRACTICAL

Subject Code: MCCTS1-205

**L T P C
0 0 4 2**

Duration: 60 (Hrs.)

Course Objectives: To enable students, understand new techniques for procedures in and around the heart emerge that again need expert knowledge and manual dexterity. To understand such interventions which include diagnostic and therapeutic electrophysiology; implantation or exchange of complex pacemaker systems or percutaneous cardioverter defibrillator-pacers; percutaneous valve repairs or replacements etc.

Course Outcomes: To enable students to not only be a helping hand to those just starting out in the specialty but also to serve as a reference for those who have been working in Invasive field for some time.

Lists of Experiments:

- Learn about Probe and Scanner settings.
- Learn about Structural and Functional assessment of the heart.
- Learn about various windows and views used in Echocardiography.
- Learn about qualitative reporting system along with various software's associated with Echo reporting.

Reference books:

- Invasive Cardiology, 3rd Edition by Sandy Watson.
- THE INTERVENTIONAL CARDIAC CATHETERIZATION HANDBOOK, 3 rd Edition by Morton J. Kern

RESEARCH METHODOLOGY AND BIOSTATISTICS (PRACTICAL)

Subject Code: MCCTS1-206

L T P C
0 0 4 2

Duration: 60 (Hrs.)

Course Objectives: The course is intended to give understanding about practical use of research and statistical models commonly used in medical and bio-medical sciences. The goal is to impart an intuitive understanding and working knowledge of research designs and statistical analysis. The strategy would be to simplify, analyse the treatment of statistical inference and to focus primarily on how to specify and interpret the outcome of research.

Course Outcomes: Students will be able to understand and develop statistical models, Research designs with the understating of background theory of various commonly used statistical techniques as well as analysis interpretation & reporting of results and use of statistical software.

List of experiments:

1. Statistical Analysis Using Excel, SPSS, MINITAB® , DESIGN OF EXPERIMENTS, R - Online Statistical Software's to Industrial and Clinical trial approach
2. Practical use of Factorial Designs: 22, 23 design.
3. Practical related to Response Surface methodology: Central composite design, Historical design, Optimization Techniques
4. Graphs: Histogram, Pie Chart, Cubic Graph, response surface plot, Counter Plot graph
5. Designing the methodology: methods of data collection, Sample size determination and Power of a study, Report writing and presentation of data, Protocol, Cohorts studies, Observational studies, Experimental studies, Designing clinical trial, various phases.
6. Data presentation
7. Measures of central tendency
8. Tests of hypotheses: Chi square test, measure of relationship
9. Analysis of variance and co-variance
10. Non-parametric test

Reference Books:

1. Pharmaceutical statistics- Practical and clinical applications, Sanford Bolton, Publisher Marcel Dekker Inc. New York.
2. Fundamental of Statistics – Himalaya Publishing House- S.C. Gupta
3. Design and Analysis of Experiments –PHI Learning Private Limited, R. Pannerselvam,
4. Design and Analysis of Experiments – Wiley Students Edition, Douglas and C. Montgomery

**MRSPTU M.SC. (CARDIAC CARE TECHNOLOGY)
SYLLABUS 2023 BATCH ONWARDS**

BASICS OF CLINICAL SKILL LEARNING

Subject Code: MCCTS1-207

**L T P C
4 0 0 4**

Duration: 60 (Hrs.)

Course Objectives:

1. To understand the basic ideas on how to check for Vital Signs of the Patient
2. In this course the students will learn how to handle the patients and their positioning
3. They will also learn on the Basics of Nasal-Gastric Tube
4. The Students will learn on Administration of IV, IV and Medication
5. Students will know about Cleanliness in the Asepsis

Course Outcomes: After successful accomplishment of the course,

1. The students would be able to Measure Vital Signs,
2. Do basic physical Examination of the patients, NG tube basics,
3. Administration of Medicines
4. The students will learn about Asepsis, and
5. The Cleanliness related to asepsis and on mobility of the patients

UNIT-I (15 Hrs)

MEASURING VITAL SIGNS: Temperature: Axillaries Temperature, Pulse: Sites of pulse, Measurement, Respiratory, Blood Pressure, Pain: Pain Scale

PHYSICAL EXAMINATION: Observation, Auscultation (Chest), Palpation, Percussion, History Taking

UNIT-II (15 Hrs)

FEEDING: ENTRAL FEEDING, NG TUBE: Measurement, Procedure, Care and Removal of Nasal-Gastric Tube, Nasal-Gastric Tube Feeding, and Parenteral Nutrition.

UNIT-III (15 Hrs)

ADMINISTRATIONS: Oral, Intravenous, Intramuscular, Subcutaneous, Recapping of Syringe, Loading of Drugs, Calculation of Drugs, Venipuncture, IV Infusion, Cannula, Attachment of IV infusion Set, Fluid Collection, Heparin Lock, Maintenance of IV set, Performing Nebulizer Therapy, Inhaler, Oxygen Therapy (Nasal, prongs, nasal Catheter, Venturi Mask, face mask)

UNIT-IV (15 Hrs)

ASEPSIS: Hand wash Techniques,(Medical, Surgical) Universal Precaution, Protecting Equipment: Using Sterile Gloves, Opening a Sterile package and Establishing a Sterile Field, Sterile Dressing Changes, Surgical Attire ,Wound Dressing, Suture Removal, Cleaning and Application of Sterile Dressing, Wearing and Removal of personal protective Equipment

MOBILITY AND SUPPORT: Moving and positioning, range of Motion exercises (Active & Passive) Assisting for Transfer, Application of Restraints

Reference Books:

1. ECG Made Easy –AtulLuthra
2. Reference by PGDCC – IGNOU Handbooks for ECG, ECHO and Stress Test
3. Echo Made Easy: Sam Kaddoura
4. Reference by PGDCC – IGNOU Handbooks for ECG, ECHO and Stress Test.
5. Feigen Baum's Echocardiography Tajik Jamil for Echocardiography.
6. Invasive Cardiology, 3rd Edition by Sandy Watson.
7. THE INTERVENTIONAL CARDIAC CATHETERIZATION HANDBOOK, 3rd Edition by Morton J. Kern

THIRD SEMESTER

ECHOCARDIOGRAPHY-ADVANCED

Subject Code: MCCTS1-301

L T P C

Duration: 60 (Hrs.)

3 1 0 4

Course Objectives: To provide practically and clinically useful application of Echocardiography. To explain echo techniques available and to put echo into a clinical perspective.

Course Outcomes: To develop an understanding regarding Echocardiography. To train students to perform Echocardiography examinations by explaining the position of transducers. To make students aware of recent advances in Echocardiography. To understand the role of Cardiac Care technician while assisting the Cardiologist as well as when performing individually.

Unit: 1. ECHOCARDIOGRAPHY FOR CORONARY ARTERY DISEASE (20 HRS)

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

- Wall motion segmentation, analysis and scoring: Segmental analysis for wall motion defects, coronary artery territories, detection and quantitation of Ischemic muscle-wall motion scoring, Ischemic Cardiomyopathy. Myocardial infarction: Detecting and assessing MI, co-relation with coronary anatomy, prognostication following MI. Complications of MI: Aneurysm, pseudo aneurysm, Ventricular Septal Defect, thrombo-embolic potential, right ventricular involvement. Stress echocardiography: Protocols for stress echocardiography, detection of reversible Ischemic, detecting inducible ischaemia/viability, specificity and sensitivity. Newer echo techniques and their application in CAD: Tissue Doppler, Speckle echo & Contrast echo - indications, contraindications, drug dosage, delivery of contrast, interpretation with study of myocardial perfusion and LV opacification. Role of CT Angiography, MRI and Nuclear perfusion & myocardial viability in CAD g. LVAD: indications, technique and post-op evaluation

Unit: 2 ECHOCARDIOGRAPHY FOR VALVULAR HEART DISEASE: (20 HRS)

- Haemodynamic information derived from Normal Echocardiography. Mitral stenosis: Etiopathogenesis, pathophysiology and haemodynamics, diagnosis, assessing severity, secondary effects, assessment for balloon mitral valvotomy- Transesophageal echocardiography and its uses. Mitral regurgitation: Mitral valve prolapse and analysis of segments, Haemodynamics of MR, diagnosis of MR, assessing severity and secondary effects, pre-op, intra-op and postoperative, assessment for mitral valve repair,
- Use of three dimensional echocardiography for mitral valve surgery, flail mitral valve, papillary muscle dysfunction. mitral annular calcium. Aortic stenosis: Etiopathogenesis and haemodynamics, sub-valvar, valvar and supra-valvar lesions, cuspal morphology, diagnosis and assessment of secondary effects, time course and prognostication, pre-operative and postoperative assessment.
- Aortic regurgitation: Etiopathogenesis and haemodynamics, diagnosis, assessing severity, secondary effects, relevant aspects of left ventricular function, timing of surgery, preoperative and post-operative assessment. Tricuspid & Pulmonary valve disease: Anatomy and physiology of the healthy valve, structural and functional changes in various disease states organic and functional involvement, tricuspid stenosis, tricuspid

**MRSPTU M.SC. (CARDIAC CARE TECHNOLOGY)
SYLLABUS 2023 BATCH ONWARDS**

regurgitation and assessment of severity, infundibular, valvar, supra valvar and peripheral pulmonic stenosis, approach to pulmonary artery hypertension.

- Prosthetic valves: Types and normal function of mechanical valves, stenosis regurgitation, use of transesophageal echo for prosthetic valves, endocarditis: and its sequelae in native and prosthetic heart valves.

Unit: 3 (10 Hrs)

- ECHOCARDIOGRAPHY IN MYO-PERICARDIAL, AORTIC, SYSTEMIC DISORDERS & CARDIAC MASSES

Hypertrophic Cardiomyopathy: Morphological variants, diagnosis, hemodynamics, assessing intracavitary and outflow tract gradients, evaluation of therapy, pre and postprocedural 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. Diseases of the pericardium

Unit: 4 (10 Hrs)

- 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. 20 29/54 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, haemodynamics, pre-and post surgical evaluation. Miscellaneous trauma, infections, aorta-left-ventricular tunnel, atherosclerosis, Role of transesophageal echocardiography. Echocardiography in systemic disorders.
- Cardiac masses: Normal variants, primary cardiac neoplasms and secondaries involving the heart, secondary effects, extra cardiac masses, intra cardiac thrombi, ultrasonic typing, manmade objects in the heart. Electrophysiology: echo in bundle branch blocks and Wolf-Parkinson-White syndrome, Atrial fibrillation, ectopic rhythm-ventricular and supra-ventricular, pacemakers, CRT & ICD. Use of TEE in intensive care setup

Reference books-

1. Echocardiography by Feigenbaum (Latest Edition)
2. Echo manuals by Mayo Clinic Lecture notes.
3. Text book of Clinical Echocardiography, Catherine M. Otto (Hardcover International)
4. Cardiology by Braunwald and Hurst (Latest edition)
5. Journal articles Cardiology by Braunwald and Hurst (Latest edition)
6. Echo made easy by Sam Kaudor

ECHOCARDIOGRAPHY- ADVANCED PRACTICAL

Subject Code: MCCTS1-305

**L T P C
0 0 4 2**

Duration: 60 (Hrs.)

Course Objectives: To provide practically and clinically useful application of Echocardiography. To explain echo techniques available and to put echo into a clinical perspective.

Course Outcomes: To develop an understanding regarding Echocardiography. To train students to perform Echocardiography examinations by explaining the position of transducers. To make students aware of recent advances in Echocardiography. To understand the role of Cardiac Care technician while assisting the Cardiologist as well as when performing individually.

LIST OF EXPERIMENTS

- Linear measurements: indirect M-Mode markers of left ventricular function. ii. Assessing global LV function. iii. Regional left ventricular function: wall motion scoring, relationship to vascular supply, use of tissue Doppler where indicated. iv. 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. v. Complications of IHD such as aneurysms, VSD, clots & MR especially from a surgical perspective.
- Intensive care setup, protocols to follow in emergency situations & CPR, IV line insertion
- Administrative issues – maintenance of quality & standards in hospitals, record
- maintenance, stocks & purchase, medico legal issues
- How to prepare a report in various procedure - Routine trans-thoracic echo: adult and congenital/pediatric, TEE, contrast echo, vascular study & advanced
- Archiving of clinical data and images & research: Basics

Reference books-

- Echocardiography by Feigenbaum (Latest Edition)
- Echo manuals by Mayo Clinic Lecture notes.
- Text book of Clinical Echocardiography, Catherine M. Otto (Hardcover International)
- Cardiology by Braunwald and Hurst (Latest edition)
- Journal articles Cardiology by Braunwald and Hurst (Latest edition)
- Echo made easy by Sam Kaudor

**MRSPTU M.SC. (CARDIAC CARE TECHNOLOGY)
SYLLABUS 2023 BATCH ONWARDS**

DEVELOPMENT OF CARDIOVASCULAR SYSTEM: FETAL & NEONATAL

Subject Code: MCCTS1-302

L T P C

Duration: 60 (Hrs.)

3 1 0 4

Course Objective:

- To understand the description of fate of certain fetal structures one postnatal circulation is established.
- To provide an outline of Cardiovascular Anatomy to improve the student's understanding of the technical and diagnostic procedures used with special emphasis on applied aspects in Cardiology

Course Outcomes:

- This course will provide overall information of the structural development of the cardiovascular system.
- To encourage students to apply this knowledge to understand developmental anomalies in the Cardiovascular System.

Unit 1 (15 Hrs.)

- Early development of embryo: Early development of embryo, early blood vessel formation, Intra-embryonic blood vessel, Extra-embryonic blood vessel.
- Development of the heart: Formation and position of the heart tube, Formation and position of the heart loop, Mechanism of cardiac looping, Formation of the embryonic ventricle, Development of the sinus venous, Formation of the cardiac septa, Atrial septation, the atrio-ventricular canal, the Muscular interventricular septum, the septum in truncus arteriosus and the cord is conus.

Unit 2 (15 hrs.)

- Formation of the cardiac valves: Formation of the cardiac valves, The Atrioventricular Valve, The semilunar valve.
- Formation of the great systemic veins: The cardiac veins, the vitelline veins, The Umbilical veins, the vena cava.

Unit 3 (15 hrs.)

Fetal & neonatal circulation: Blood flow pattern, oxygenation & venous return to the Heart, Cardiac output and its distribution, Intra - cardiac vascular pressure, myocardial function & its Energy metabolism

Characteristics of fetal circulation and changes occur at birth: Postnatal Circulation in Detail

Unit 4 (15 hrs.)

- Etiology of cardiovascular malformation: Congenital anomalies in detail
- Adult circulation: Systemic Circulation, Pulmonary Circulation.

REFERENCE BOOKS:

- E. Kenneth Weir, MD, ,Stephen L. Archer, MD. MD, John T. Reeves The Fetal and Neonatal Pulmonary Circulation. 2000.
- Cardiovascular and Respiratory Physiology in the Fetus ...Petter Karlberg, Michelle ,Couchard-MonsetJohn Lind. 1986.

**MRSPTU M.SC. (CARDIAC CARE TECHNOLOGY)
SYLLABUS 2023 BATCH ONWARDS**

CCT DIRECTED CLINICAL EDUCATION – II

Subject Code: MCCTS1-303

Duration: 405 (Hrs.)

Students will gain additional skills in interventional procedures, cardiac pharmacology and recent advancements. Students apply knowledge from previous clinical learning experience under the supervision of a senior technologist. Students are tested on intermediate pharmacological and invasive techniques.

*The Dissertation work will begin from 3rd Semester, and will continue through the 4th Semester.

For Seminar/Presentations there will be a maximum of 50 marks. Seminar / presentations will be evaluated by the teachers of the dept. The marks obtained in the same will be kept confidentially with the Head of the Dept. and will be submitted along with the internal assessment marks.

DISSERTATION / PROJECT WORK

1. Dissertation/Project work should be carried out as an individual Dissertation and actual bench work.
2. The students will carry independent project work under the supervision of the staff of Department on an advanced topic assigned to him/her. In house projects are encouraged. Students may be allowed to carry out the project work in other Departmental laboratories/ Research institutes / Industries as per the availability of Infrastructure.
3. Co guides from the other institutions may be allowed.
4. The Dissertation/Project work will begin from 3rd Semester, and will continue through the 4th Semester.
5. The Dissertation/Project report (also work book shall be presented at the time of presentation and viva voce) will be submitted at the end of the 4th Semester and evaluated.
6. Five copies of the project report shall be submitted to the Director, SBS.
7. For the conduct of the End Semester Examination and evaluation of Dissertation/Project work the University will appoint External Examiners.
8. Since the dissertation is by research, Dissertation/Project work carries a total of 250 marks and evaluation will be carried out by both internal and external evaluators.
9. The student has to defend his/her Dissertation/Project Work in a seminar which will be evaluated by an internal and external experts appointed by the University.
10. The assignment of marks for Project/Dissertation is as follows:

Part I: Topic Selection, Review of Literature, Novelty of works-50 marks

Part-II: a. Continuous Internal Assessment, Novelty, Overall Lab Work Culture - 100 Marks

b. Dissertation/Project work book: 50 Marks

c. Viva-Voce: 50 Marks

d. However, a student in 4th semester will have to opt for general elective course from other related disciplines in addition to his Dissertation/Project work in the parent department.