

Lab Rules, DO's & DON'Ts



Report any accident (spill, breakage etc.) or injury (cut, burn etc.) to the teacher immediately, no matter how trivial it seems. DO NOT PANIC.

If you or a lab partner is hurt, immediately (and loudly) yell out the teacher's Name to get the teacher's attention. DO NOT PANIC.

Lab Rule of conduct, DO's & DON'Ts

- Conduct yourself in a responsible manner at all times in the laboratory. Don't talk aloud or crack jokes in lab.
- A lab coat should be worn during laboratory experiments. Dress properly during a laboratory activity. Long hair, dangling jewelry and loose or baggy clothing are a hazard in the laboratory.
- Observe good housekeeping practices. Replace the materials in proper place after work to keep the lab area tidy.
- Do not wander around the room, distract other students, startle other students or interfere with the laboratory experiments of others.
- Do not eat food, drink beverages or chew gum in the laboratory and do not use laboratory glassware as containers for food or beverages. Smoking is strictly prohibited in lab area.
- Do not open any irrelevant internet sites on lab computer
- Do not use a flash drive on lab computers.
- Do not upload, delete or alter any software on the lab PC.

Rules & Guidelines for conducting Lab-Work

- ✓ Students are not allowed to touch any equipment, chemicals or other materials in the laboratory area until you are instructed by Teacher or Technician.
- ✓ Before starting Laboratory work follow all written and verbal instructions carefully. If you do not understand a direction or part of a procedure, ASK YOUR CONCERN TEACHER BEFORE PROCEEDING WITH THE ACTIVITY.
- ✓ Before use equipment must be read carefully Labels and instructions. Set up and use the equipment as directed by your teacher.
- ✓ If you do not understand how to use a piece of equipment, ASK THE TEACHER FOR HELP!
- ✓ Perform only those experiments authorized by your teacher. Carefully follow all instructions, both written and oral.
- ✓ Unauthorized experiments are not allowed in the Laboratory.
- ✓ Students are not allowed to work in Laboratory alone or without presence of the teacher.
- ✓ Any failure / break-down of equipment must be reported to the teacher.
- ✓ Protect yourself from getting electric shock.

Lab Safety Guidelines



Electrical hazard



Fire hazard



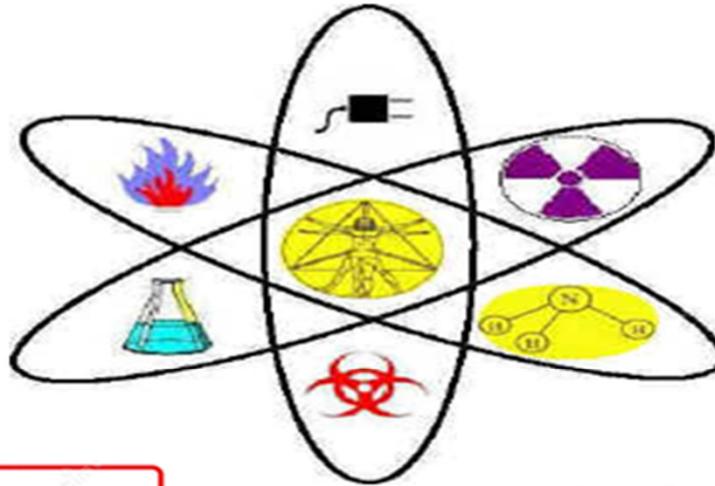
Explosive hazard



Sharp instrument hazard



Glassware hazard



Animal hazard



Heat hazard



Eye & face hazard



Laser radiation hazard



Radioactive hazard



Chemical hazard



Biohazard



Lab Safety Guidelines

Safety Measures & Guidelines

- Obtain authorization from the lab In charge prior to entering the lab working area.
- Smoking is strictly prohibited inside the Lab area.
- Ensure that safety devices are adequate, appropriate and in good working order.
- Wear the appropriate personal protective equipment when conducting work with hazardous materials or procedures.
- Eye protection should be worn when performing tasks with potential to generate flying particles or debris. Most power tool related tasks generate such hazards.
- Every Student should know the locations and operating procedures of all safety equipment including, First AID KIT (s) and Fire extinguisher. Know where the fire alarm and the exits are located.
- Laboratories must be locked if no one is in the lab.
- Proper handling and disposal of bio-hazardous materials, including all patient specimens.

Lab Safety Guidelines

Controlling Electrical Hazards



- Always disconnect a plug by pulling on the connector body not the cable.
- Disconnect any device from the circuit before service.
- Never bypass fuses or circuit breakers.
- Keep electrical service and breaker panels accessible at all times.
- Keep all cords and wires out of foot traffic areas and do not roll chairs over electrical cords or wires.
- Electrical equipment and connections should not be handled with wet hands, nor should they be used after liquid has been spilled on it.
- All lighting stands must be properly secured.
- Avoid using extension cords. Extension cords are intended for temporary use only. If additional wall receptacles are needed, the facility manager for our building should be contacted. Never overload a circuit.
- High wattage appliances like freezers, refrigerators, copy machines and laboratory equipment must be plugged directly into a wall holder. It must not be supplied power via extension cords or power strips.

contd...

Lab Safety Guidelines



Controlling Electrical Hazards

- Do not use any machine that smokes, sparks, or appears defective in any way. Immediately remove damaged or defective office machines from service.
- Avoid stretching or pinching cords. Check cable, cords, and connectors periodically and immediately replace any items that show signs of cracking, chipping or other deterioration.
- Attention for proper earthing of electrical equipment. A grounded tool has a three-conductor cord with a three-pronged plug that must be plugged into a grounded outlet. Never clip off ground pins on three-wire appliances or use two-wire adapters to wed incompatible equipment.
- All electrical repairs must be done by qualified individuals.



Lab Safety Guidelines

Mercury Spills

If a small amount of mercury is spilled (e.g. broken thermometer), use an aspirator bulb or eye drops to pick up droplets, place the mercury in a container, cover with water, seal it, and label the bottle appropriately. To clean up the residual micro-droplets that may have worked into cracks and other hard-to-clean areas, sprinkle sulphur powder or other commercially available product for mercury decontamination. Leave the material for several hours and sweep up solid into a plastic bottle, seal it in a plastic bag and label it appropriately.

USE EYE/FACE PROTECTION WHILE HANDLING MERCURY.

Checking of Smoke detectors in Lab

The “Smoke Detectors” must be checked at a regular intervals for its integrity. It is important for Fire prevention.

1D1

Medical Electronics Lab

Medical Electronics Lab

INTRODUCTION

This Lab facilitates two major skills development:

1. **Basic Analog & Digital Electronics**
2. **Medical Electronics** (Application of electronics in biomedical)

For Basic Electronics skills development the Lab is equipped with **Com3 Kits** which have electronics trainer boards interfaced with software on PC. This provides an hassle free learning tool to realize the theoretical aspects through easy to perform experiments. Students practically see and verify the theoretical concepts about all analog and digital component's characteristics, Its applications in circuit and circuit analysis.

To develop the second skill also the lab has the facility of **Medical Electronics Trainer kits interfaced with software**. It has set of kits to understand the basic medical electronic circuits, calibration and basic trouble shooting of the circuit. e.g. Bio-sensor & bio-signal amplifier, video monitor & recorder, physiological simulator, application of opto-electronics & fiber optics in biomedical .

Medical Electronics Lab

Courses Conducted:

- BMTS 351 Basic Analog Electronics
- BMTS 355 Basic Digital Electronics
- BMTS 362 Advanced Analog Electronics
- BMIS 471 Introduction to Biomed Electronic Instrument
- BMIS 595 Introduction to Telemedicine

Medical Electronics Lab

SKILLS Imparting:

PC aided Learning: Knowledge & Understanding of:

- Basic Analog Electronics Components & their characteristics
- Basic Digital Electronic components & their use
- Operational Amplifier: Properties, Its applications & Circuit designs

Introductory Biomed Instrument Circuits

- **Sensors** used in biomedical devices & Bio-signal Amplifier circuits
- Principle of working of the devices, calibration methods
- Circuit Troubleshooting by using electronic testing tools

Medical Electronics Lab

Instrument Facility Highlights: 1/2

PC Aided Electronic Trainer Kit-COM3Lab

- 70015 Basic Electronics (Course I)
- 70016 Field Effect Transistor (Course II)
- 70024 Three Phase Technology
- 70081 Operational Amplifier Course
- 70091 Proto board Course II

Medical Electronics Lab

Instrument Facility Highlights: 2/2

Biomedical Electronic Equipment Trainer

- Biomed Transducers
- Signal Amplifier + Signal Generator
- Video Monitor
- Signal Graphics Recorder
- Physiological Simulator
- Opto-electronic devices & Fiber Optics

Medical Electronics Lab

List of Experiments

BMTS 351 Basic Analog Electronics

- 1. DIODE CHARACTERISTICS
- 2. DIODE APPLICATIONS (RECTIFICATION CIRCUIT)
- 3. LIGHT EMITTING DIODE
- 4. ZENER DIODE
- 5. BJT TRANSISTOR CHARACTERISTICS
- 6. INPUT CHARACTERISTICS OF TRANSISTOR
- 7. OUTPUT CHARACTERISTICS OF TRANSISTOR
- 8. CONTROL CHARACTERISTICS OF TRANSISTOR
- 9. PHOTOTRANSISTOR & DARLINGTON CIRCUIT
- 10. Common Emitter Amplifier
- 11. Common COLLECTOR Amplifier
- 12. Common BASE Amplifier
- 13. JFET TRANSISTOR CHARACTERISTICS

Medical Electronics Lab

List of Experiments

BMTS 362 Advanced Analog Electronics

- 1. The comparator Features of the operational amplifier
- 2. Inverting op amp
- 3. Non-inverting op amp
- 4. Fault simulation in inverting op amps
- 5. Adders
- 6. Integrators
- 7. Differentiators
- 8. Active filters
- 9. Stabilized voltage sources
- 10. Stabilized current sources
- 11. Schmitt triggers
- 12. Astable multivibrators
- 13. Wien bridge oscillators
- 14. Function generators

1D2

**Bio-sensor & Bio-signal
processing Lab**

Bio-sensor & Bio-signal processing Lab

INTRODUCTION

This Lab facilitates two major skills development:

1. **Basic and Advanced Digital Electronics**
2. **Bio-Signals Processing**

This Lab has all the facilities for teaching from basic digital electronics from logic gates to microprocessor through computer aided trainer like Com3Lab and Digiboard kits making Logic gates circuit to understand the basics by doing it. It helps the student to realize the concepts well and will utilize to analyze more sophisticated digital circuits and its designing.

This Lab is also equipped with various Cassy *transducers* interfaced with PC for getting bio-signals. The PCs have advanced analog & digital processing softwares for bio-signal analysis and processing.

This lab also imparts knowhow about biomedical control systems.

Bio-sensor & Bio-signal processing Lab

Courses Conducted:

BMTS 361 Analog Signal Processing

BMTS 364 Advanced Digital Electronics

BMTS 471 Digital Signal Processing

BMIS 491 Biomedical Control System

BMIS 592 Digital Instruments Design

Bio-sensor & Bio-signal processing Lab

SKILLS Imparting:

PC aided Learning: Knowledge & Understanding of:

- **Advanced Digital Technology:** Microprocessor, architecture and design of memory, assembly language programming, applications of microprocessors & microcontrollers in biomedical instrumentation
- **Biosensors & Biosignals**

Learn the use of digital components by making digital circuits in Digital Trainer boards

- **Operation of Logic Gates, Logic circuit design using logic gates**
- **Verifying Boolean Algebra by Logic Gates**
- **Logic sequential circuits and memories applications in circuits**

Learn using MatLab software for signal processing

- **Learn how to deal with digital and analog signals, calibration of signals.**

Bio-sensor & Bio-signal processing Lab

SKILLS Imparting:

Learn the use of :

- **Universal frequency counter**
- **Spectrum Analyser**
- **4Channel Digital storage Oscilloscope**
- **Function Generator**
- **IC & Device Programmer:** Programming of programmable ICs

Learn the use of advanced pneumatic system control panel and Cassy sensor as Biomedical Control System

Applying skills & Facilities for Digital Instruments Design

- Learn how to build and test digital circuits

Bio-sensor & Bio-signal processing Lab

Instrument Facility Highlights: 1/4

Digital Electronics Trainer Board

PC Aided Electronics Trainer Kit-Com3Lab

- 70017 Digital Technology-1
- 70018 Digital Technology-2
- 70019 Microcomputer
- 70091 Protoboard -2

PCs with Software

- Matlab

Bio-sensor & Bio-signal processing Lab

Instrument Facility Highlights: 2/4

Bio-Sensors (Casey 524-010) PC based Trainer

Didactic pneumatic system control panel

Universal frequency counter

Spectrum Analyzer (1000MHz)

4Channel Digital storage Oscilloscope

Function Generator 25MHz

Bio-sensor & Bio-signal processing Lab

Instrument Facility Highlights: 3/4

13MHz- Wobbel Function Generator

Analog Oscilloscope (1000MHz)

IC Programmer-LV48

Device Programmer-EMP-100

Digital Multimeter (autorange 5in1)

Bio-sensor & Bio-signal processing Lab

Instrument Facility Highlights: 4/4

Digital Processing-Jitter Analyser

Fault Locator –PFL780

Multi-Layer Shorts Locator

Bread Board Power Supply

Logic probe & Digital Multimeters

Bio-sensor & Bio-signal processing Lab

List of Experiments

BMTS 471 Digital Signal Processing

Using MatLab Software application for:

- Addition of two images
- Subtraction of two images
- Multiplication of two images
- Complement and Absolute difference images
- Image negative and log transformation
- Histogram equalisation

Bio-sensor & Bio-signal processing Lab

List of Experiments

BMIS 491 Biomedical Control System

- **Study of Sensors, Controllers and Regulators in (Minimum 5):**
 - 1. Incubator
 - 2. Patient Monitor
 - 3. Suction Apparatus
 - 4. Steam Sterilizer
 - 5. Hot Air Oven
 - 6. Ultrasonogram
 - 7. X-Ray Machine
 - 8. Spectrometer
 - 9. Ultrasonogram
 - 10. Circuit Analysis

1D3
Electrical Skills
&
Safety Lab

Electrical Skills & Safety Lab

INTRODUCTION

This Lab facilitates three major skills development:

1. **Electrical circuits & measurements**
2. **AC 3-phase Electromechanical Equipment**
3. **Safety from Electrocutation**

This Lab imparts training on various electrical components and circuit making. Student understand the theoretical concepts by verifying through experiments, learn measurement techniques of electrical parameters by doing himself.

This Lab is equipped to impart training on AC 3-phase concepts and electro-mechanical machines. It also has facility of advanced Software Aided Electrical Analysis/Control like PWM and Fourier analysis learning.

This lab is also equipped to train about electrical safety from electrocutation. The student will learn about cause of electric shock and its fatality & methods of prevention measures through different training panels and modules.

Electrical Skills & Safety Lab

Courses Conducted:

BMTS 241/MET243 Electrical Circuits

BMTS 352 Electrical Measurements

BMTS 363 Electromechanical Energy

BMIS 473 Hospital Safety

Electrical Skills & Safety Lab

SKILLS Imparting:

Learn the use of and their application in electrical circuits :

- Plug-in Boards for making circuits
- DC power supply and Function Generator
- Ammeter, Voltmeter and Analog & Digital Multimeters
- Analog Oscilloscope to measure voltage, frequency, phase difference etc
- Decade Resistance, Capacitance and Inductance Box
- NTC/PTC Resistor, LDR, VDR, Potentiometer
- Changeover switch and Relay

How to measure different electrical parameters

- Low , medium and high Resistance applying basic laws of the current and voltage in electrical circuits
- Capacitance / Inductance by different bridge methods

Learn the design & principle of working of Transformer

Electrical Skills & Safety Lab

SKILLS Imparting:

Three Phase Electrical Measurements

Understanding Three Phase Transformer:

- Different Connection Topologies
- Voltage and Current measurement & Verify with the Theoretical Values
- Star /Delta connections of R, L, C load combinations
- Use of Isolation Transformer

Understanding Three Phase Motor Operation

- Star / Delta connections
- Application of control Circuits

PC Software Aided Electrical Analysis/Control

- Pulse Width Modulation
- Fourier Transform

Understanding Shock Current & Prevention Techniques

Electrical Skills & Safety Lab

Instrument Facility Highlights: 1/5

Electrical Circuits & Measurements Facilities

- Plug-in Boards
- Discrete Plug-in Components: Resistors, NTC/PTC resistor, LDR, VDR, Potentiometer, Capacitors, Inductor, Coil, Transformer, Diode, LED, Changeover switch, Relay, bulb holder, Bridging plug.
- Decade Resistance Box
- Decade Capacitance Box
- Decade Inductance Box

Electrical Skills & Safety Lab

Instrument Facility Highlights: 2/5

Electrical Circuits & Measurements Facilities

- Continuous dual DC Supply (0-16V/0-5A)
- Function Generator 20MHz
- Analog Oscilloscopes 100MHz
- DC Amplifier
- Digital Multimeters
- Analog Multimeters
- Moving Coil Milli-Voltmeter

Electrical Skills & Safety Lab

Instrument Facility Highlights: 3/5

3-Phase Transformer Trainer (Lucas –Nuelle)

- 3-phase AC/DC Power Supply for Electric Machines Panel
- R L C Load Panel
- Analog Digital Multimeter Panel
- 3-phase AC Motor
- DC Motor / Generator
- Isolation Transformer

Electrical Skills & Safety Lab

Instrument Facility Highlights: 4/5

PC Aided PWM Trainer & Fourier Analysis

- High Voltage Differential Amplifier

PC Aided Frequency Converter Trainer

- Universal Digital Controller

Electrical Skills & Safety Lab

Instrument Facility Highlights: 5/5

Electrical
Safety
Measures
Trainer
Panels

Protection
Against
Dangerous
body
current

- Mains Supply Panel
- Human Body Model Panel
- Body Impedance 50Hz Panel
- Shock Current Panel
- Fault Current Circuit Breaker Tripping Panel
- Potential Well (Earthing) Panel
- Load Panel
- RCD Panel

1D4

**Medical Imaging &
Electronic Instruments**

Medical Imaging & Electronic Instruments

INTRODUCTION

This Lab facilitates these skills development:

1. Training of **Ultra-Sound Imaging (Instrument & Imaging Technique)**
2. Training of **Medical Electronics Instruments**
3. **Computer Applications in Healthcare**
4. **Software based techniques for Image Processing, Pattern Recognition & Artificial Intelligence**

This lab is equipped with Ultrasound Scanner for training on imaging techniques and instrument controls and US cards based trainer for imparting training on ultrasound generation, receiving in A/CW /Pulse mode.

For training on some Medical Electronics Instruments Lab has ECG, Defibrillator, Patient monitor, LASER Therapy units and training cards for Pacemaker, ECG/EEG and Electro-surgery.

It has 10 PC to facilitate training on computer and software based skills as mentioned above in number 3 and 4.

Medical Imaging & Electronic Instruments

Courses Conducted:

BMIS 484 Advanced Biomed Electronic Instruments

BMIS 472 Basic Diagnostic Imaging Systems

BMTS 492 Computer Image Processing

BMTS 481 Computer Application for Biomed Systems

BMIS 593 Artificial Intelligence

BMIS 594 Pattern Recognition

Medical Imaging & Electronic Instruments

SKILLS Imparting:

Knowledge of Ultrasound Scanner its controls and use

Understanding US generation & receiving in A-mode /M-mode

Techniques of electronic Instruments by Trainer Circuit boards:

- ECG / EEG Amplifier
- Pacemaker & Defibrillator
- Electrosurgery

Operation of ECG Recorder

Operation of Defibrillator

Introduction of LASER Therapy

Medical Imaging & Electronic Instruments

SKILLS Imparting:

Computer software based Skills

- Using software like Labview and MatLab
- Image Processing
- Pattern Recognition
- Artificial Intelligence

Computer Application in Medicine:

- Informatics & Hospital Information System
- Clinical Imaging & Computer based Patient Records
- Healthcare Information Infrastructure & Computer Networking
- Telemedicine

Medical Imaging & Electronic Instruments

Instrument Facility Highlights: 1/3

Ultrasonography machine

12-Lead ECG Recorder Trainer

Vital Sign Patient Monitor

Defibrillator

Laser Therapy Unit Trainer

Medical Imaging & Electronic Instruments

Instrument Facility Highlights: 2/3

Equipment Trainer Circuit Boards : Beda Precision

- Ultra Sound Training Boards:
- 3011US Input /Output Sensor
- 3012 A-mode detector
- 3013 US CW/Pulse mode
- 2310 Stereo Amplifier

Medical Imaging & Electronic Instruments

Instrument Facility Highlights: 3/3

Equipment Trainer Circuit Boards : Beda Precision

- 3011 ECG / EEG Amplifier
- 3012 Defibrillator / Pacemaker
- 3013 Electro-surgery

PCs with Software facilities

- Labview 7.1
- Matlab 2008

Medical Imaging & Electronic Instruments

List of Experiments

BMIS 484 Advanced Biomed Electronic Instruments

- **Practical Lessons on:**
 - ECG MACHINE
 - EEG MACHINE
 - DEFIBRILATOR
 - PACEMAKER
 - ESU MACHINE
 - PATIENT MONITORING SYSTEM

1D5

**Biomed Instruments
Design Workshop**

Biomed Instruments Design Workshop

INTRODUCTION

This Lab facilitates three main skills development:

1. **Electronic Skills**
2. **Designing and fabricating PCB**
3. **Circuit Designing & Instrument Prototype development**

This lab is equipped with all the necessary hand tools, measurement tools , soldering de-soldering tools and others tools useful in a workshop.

It has 12 PC having PCB designing software and all the hardware required for PCB making.

It has various general purpose electronic components, IC programmer all other facilities required for prototype circuit development and testing.

Biomed Instruments Design Workshop

Courses Conducted:

MET 244 / BMTS 245 Electrical Skills

BMIS 475 Biomed Instruments Design

BMIS 592 Digital Instruments Design

BMTS 491 Project

Biomed Instruments Design Workshop

SKILLS Imparting:

Knowhow of various hand tools & skills to use

Identification of electronic components

- Identify the types, Reading their values & specifications

Soldering & De-soldering skills

Use of Software for PCB Layout designing

PCB Fabrication by UV/Chemical Technique

Making prototype circuits and testing

- Develop a circuit design and check by software simulation
- Study datasheets of components to choose & compare
- Develop it on prototype board & on designed PCB

Biomed Instruments Design Workshop

Instrument Facility Highlights: 1/4

PC with Softwares for PCB Design

- Multisim
- Layout Editor

PC with Softwares for Microcontroller Programming

- Microcode Studio

Biomed Instruments Design Workshop

Instrument Facility Highlights: 2/4



PCB milling machine
Protomat S42



PCB Etching Tri Tank



PCB UV Exposure
machine



PCB cutter



PCB Drilling
Workstation



SMD Rework Station

Biomed Instruments Design Workshop

Instrument Facility Highlights: 3/4

Electronic
Skills
Training
Tools

- Breadboards & Wire kits
- Discrete Electronic Components
- Breadboard Power supply (+15 -15V)
- Digital Multimeters
- IC / Device programmer
- Soldering Iron & Desoldering Pump
- Magnifying Glass Table lamp
- Tool KIT bags

Biomed Instruments Design Workshop

Instrument Facility Highlights: 4/4

Function generator 13MHz

Power supplies

- AC/DC Power supply 0 – 24V 4A
- Power supply 0 – 12 V 3A

Digital storage Oscilloscopes 2 & 4 channel 200MHz

Hardware Facilities

- Vise
- Welding station

1D6

Radiology Lab

Radiology Lab

INTRODUCTION

This Lab facilitates the skills development in Radiologic Imaging. The following types of Radio-Imaging courses are conducted in this lab:

- 1. X-ray & X-ray Imaging**
- 2. CT Scan (Computed Tomographic Imaging)**
- 3. Basics of Nuclear Imaging and Radio Pharmaceuticals**

The Lab has X-ray Apparatus, mini CT scanner, Radioactive source, Scintillation counter, GM counter etc. to train on the modalities of imaging.

Radiology Lab

Courses Conducted:

BMIS 472 Basic Diagnostic Imaging Systems

BMIS 482 Advanced Imaging Systems

BMIS 485 Reverse Engineering in BME

Radiology Lab

SKILLS Imparting:

CT Scan (Computed Tomographic Imaging)

- Knowledge of the working principle its controls and Operation
- Different Generations of CT
- Use of CONTRASTS in imaging
- Comparative study with modalities MRI & Gamma Camera

X-Ray Imaging

- Design and construction of X-Ray Tube/Generator
- X-Ray Properties
- Knowledge of the working principle its controls and Operation
- Imaging Aspects and Fluoroscopy

Basics of Nuclear Imaging and Radio Pharmaceuticals

Radiology Lab

Instrument Facility Highlights: 1/2

CT Scan(mini) CereTom

Radiation Detector (Scintillation)

G-M- Counter

Activity Counter

Nuclear Lab Station

Radiology Lab

Instrument Facility Highlights: 2/2

Radioactive source

Calibrated absorber set

Film Densitometer

Regulated EHT Power Supply (0-5KvDc)

High Voltage Power Supply 25KV & 1.5KV

Radiology Lab

List of Experiments

BMIS 485 Reverse Engineering in BME

- **White Box and Black Box Reverse Engineering of:**
 - 1. Incubator,
 - 2. Short Wave Diathermia
 - 3. Patient Monitor / ECG
 - 4. Suction Apparatus
 - 5. Infusion pump
 - 6. Sterilizing Unit (Steam Sterilizer / Hot Air Oven)
 - 7. Spectrometer
- **Black Box Reverse Engineering of (Any one):**
 - CT Scanner
 - Ultrasonogram
 - Endoscope

1D7

Bio-Physics Lab

Bio-Physics Lab

INTRODUCTION

Understanding that most biomedical equipment has a base of physics this Lab facilitates the skills development in Basic & Applied Physics related to Biomedical field. This Lab explore the **concepts of Physics applied in Medical Equipment**. Student will understand the theoretical concepts of physics by verifying through experiments. They shall realize the physics behind the medical equipment.

This lab has facilities for experimenting in many fields of physics like Precision Measurement, Basic Physics, Fluidics, Pneumatic s, Optics, Electromagnetism, LASER, High Energy Radiation.

Bio-Physics Lab

Courses Conducted:

MET 234 Bio-Physics

MET 242 Physics for Medical Equipment

BMTS 244 Physics for Biomedical Equipment

Bio-Physics Lab

SKILLS Imparting:

Consolidation of different physical concepts by practical application

- Precision Measurements using calipers & micrometer
- Verification of Hooke's Law
- Verification of Bernoulli's Theorem
- Viscosity Experiments

Pneumatic control circuits

X-Ray experiments

Optics Experiments

- Lens Experiments
- Interferometer Experiment
- Polarimeter Experiments

Bio-Physics Lab

SKILLS Imparting:

Modern Physics Experiments

- Photoelectric-Effect Experiment
- Vacuum Gas Discharge Tube Experiment
- Wilson Cloud Chamber Experiment

LASER based experiment

Radioactivity Experiments

Electromagnetism Experiments

Bio-Physics Lab

Instrument Facility Highlights: 1/3

X-Ray Apparatus 55481 by LD

Pneumatic Controls Trainer Panel with Air Compressor

Viscositymeter

Bernouli Theorem Apparatus by Gunt Hamburg

Vacuum Discharge Tube with Vacuum Pump

Wilson Cloud Chamber by LD

Bio-Physics Lab

Instrument Facility Highlights: 2/3

Optical Bench with Lenses for Optic Experiment

Precision Interferometer

Photoelectric Effect Experiment Setup

He-Ne LASER / LASER motion sensor

Polarimeter

Teslameter

Bio-Physics Lab

Instrument Facility Highlights: 3/3

Mobile Cassy Sensor 524009 by LD

Bernoulli Theorem Apparatus by Gunt Hamburg

Hooke's Law Apparatus

Free Fall Apparatus

Precision Measuring Tools

- Vernier Calipers (Manual & Digital)
- Micrometer (Manual & Digital)
- Electronic Balance

1D8

Biomedical Instruments

Lab

Biomedical Instruments Lab

INTRODUCTION

This Lab facilitates the skills development in various types of Biomedical Instruments. This Lab imparts these three skills

1. Knowhow about **Biomedical & Biomechanical Devices**
2. Knowhow about **Clinical Lab Instruments**
3. **Medical Instruments Management & Troubleshooting**

This lab is equipped with various types of medical instruments , clinical lab instruments used in hospital to provide a hands on experience on these instruments to help them understand their function, principle of operation and its controls. It also has some trainer boards based training module in medical electronics and simulation based instruments training facility.

Here the students will learn the basic troubleshooting , maintenance & servicing of medical instruments.

Biomedical Instruments Lab

Courses Conducted:

BMTS 365 Biomed Mechanical Instruments 2

BMIS 474 Instruments Management & Maintenance

BMIS 483 Optical & Laboratory Instruments

BMIS 486 Molecular Sensors and nano-devices

Biomedical Instruments Lab

Skills Imparted:

Principle of working, Operation and Maintenance related training for Biomed Electro-Mechanical Instruments:

- Non-invasive BP Measurement
- Ventilator & Humidifier
- Autoclave
- Hot Air Sterilizer
- Infusion Pumps
- Infant Incubator
- Spirometer
- Water Distillers

Biomedical Instruments Lab

Skills Imparted:

Principle of working, Operation and Maintenance related training for Biomedical Instruments:

- Vital Sign Patient Monitor
- Gas Flow Analyser
- Short-Wave Therapeutic Diathermy (Magnetron Based)
- Audiometer for ENT Diagnosis

Computerized Simulation based Teaching

- Ventilator
- Spirometer
- Dialysis Machine
- Hospital Gas Distribution System

Biomedical Instruments Lab

Skills Imparted:

Optical & Laboratory Instruments: Principal of working, operation & maintenance

- Microscope
- Colorimeter
- Spectrophotometer
- Flame Photometer
- Blood Gas Analyzer
- Gluco-strip Reader
- Haemoglobin Reader
- Endoscope

Biomedical Instruments Lab

Skills Imparted:

Circuit Trainer based Learning

- 3015 Hospital Bed
- Centrifuge
- Hemodialysis
- ECG / EEG Amplifier
- Defibrillator / Pacemaker
- Electro-surgery

Biomedical Instruments Lab

Instrument Facility Highlights: 1/6

Infant Incubators & its circuit Trainer Layout

ICU Ventilator with Humidifier

Basic Ventilator with Circuit Trainer Layout

Infusion Pump with Circuit Trainer Layout

Hot Air Sterilizer with Circuit Trainer Layout

ECG Recorder with Circuit Trainer Layout

Biomedical Instruments Lab

Instrument Facility Highlights: 2/6

Vital Sign Patient Monitor

Gas Flow Analyzer

Endoscope with Light Source

Audiometer for ENT Diagnosis

Short-Wave Therapeutic Diathermy (Magnetron Based)

Biomedical Instruments Lab

Instrument Facility Highlights: 3/6

Equipment Trainer Circuit Boards : Beda Precision

- 3015 Hospital Bed
- 3016 Centrifuge
- 3025 Hemodialysis
- 3011 ECG / EEG Amplifier
- 3012 Defibrillator / Pacemaker
- 3013 US Electro-surgery

Biomedical Instruments Lab

Instrument Facility Highlights: 4/6

Suction Units (portable & ICU)

Flash Autoclave (Desktop)

Basic & Automated Water Distiller

Vaporizer

Biomedical Instruments Lab

Instrument Facility Highlights: 5/6

Clinical
Laboratory
Technology
Facilities

- Colorimeter
- Spectrophotometer
- Flame Photometer
- Blood Gas Analyzer
- pH TDS Meter
- Binocular Microscopes

Patient
Point Care

- Blood Glucose Strip Readers
- Hb micro-cuvette Reader

Biomedical Instruments Lab

Instrument Facility Highlights: 6/6

Equipment
Service &
Repair
Facilities

- Analog & Digital Oscilloscope
- Tool Kits & Bags
- Digital Multimeters
- Humidity & Temperature Meter
- Power Supplies
- Soldering Iron & Desoldering Pumps
- Magnifying Glass Table Lamp
- Scrap Equipment for Training

Biomedical Instruments Lab

List of Experiments

BMTS 365 Biomed Mechanical Instruments 2

Practical Lessons for the following

- Suction Apparatus (Aspirator)
- Ventilator(Artificial Respirator) & Humidifier
- Sterilization and Types of Sterilization
- Spirometer
- Infant Incubator. (including the accessories)

Biomedical Instruments Lab

List of Experiments

BMIS 474 Instruments Management & Maintenance

- **General Maintenance Guidelines for some medical Instruments:**
 - **Preventive Maintenance:** Cleaning, Dusting, Greasing & Oiling, Calibrating, Replacing disposable items, wear & tear items etc
 - Autoclave, Syringe Pump, Centrifuge, Ventilator and more
- **Troubleshooting Skills:**
 - Use of various measurement tools and its use.
 - **Checking Power supply related problems:** Cables, Locating and checking fuse, checking resettable fuse, Surge protection capacitors, RF filter, Thermal fuse, Transformer , bridge rectifier, Filter capacitors, Zener diode etc.
 - **Checking of components:** Resistors, Capacitor, Transformer, Inductor, Diodes, LED, Transistor etc.
 - **Troubleshooting Techniques & Methods:** Checking voltages at important points & Test points , Block module separation, Half circuit checking etc.

Biomedical Instruments Lab

List of Experiments

BMTS 483 Optical & Laboratory Instruments

1. **Optical Microscope:** Construction & Operation, Making Blood Slides and viewing under microscope
2. **Basics of Sample preparation:** Types of Biological Samples, Difference between Serum & Plasma, Introducing types of Blood Sample collection Tubes (Vacutainers), Use of Centrifuge in sample preparation and types of centrifuge, Use of Micropipettes in sampling.
3. **Colorimeter:** Components & Structure of Colorimeter, principle of Colorimeter & operation, reagents and chemicals, Standard solution, Calibration, Taking absorbance, Step by step method of Analyzing a sample, Types of biochemical assay (reaction) eg. End-point, 2-point and Kinetic,
4. **Spectrophotometer:** Difference between colorimeter and Spectrophotometer, Difference between different types of light sources, Difference between optical filter and mono-chromator, Structure of Spectrophotometer. General maintenance and common problems of the Instrument.
5. **Biochemistry Auto-analyzer:** Components, Structure and principle of operation, Basics of operating the machine, Basic service and maintenance of it.
6. **Flame-Photometer:** Principle of Flame photometer, its components, structure and operation
7. **Blood Cell Counter:** Principle of Coulter Cell Counter and its Operation, Its components and solution pack & reagents, Use it to measure blood cells, General maintenance and common problems of the Instrument.
8. **Blood Gas Analyzer:** Components of BGA, Basics of ISE Electrodes and Calibrating Solution and gas, Operation of the equipment, Sensors of the machine, General maintenance and common problems of the Instrument.
9. **ISE Electrolyte Analyzer:** Basics of ISE Electrodes and Calibrating Solution and gas, Operation of the equipment, Sensors of the machine, General maintenance and common problems of the Instrument.
10. **Endoscopy :** Light source, Use of fiber optic in endoscopy, Demonstration of its use and taking care of the endoscope.