

PROFESSIONAL TRAINING- 2023 REPORT

Submitted in partial fulfilment of the requirements for the award of bachelor of
technology degree in biomedical engineering

By

Harshini Joshitha.T (41240042)



DEPARTMENT OF BIOMEDICAL ENGINEERING

SCHOOL OF BIO AND CHEMICAL SCIENCES

SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY

(DEEMED TO BE UNIVERSITY)

Accredited with grade "A++" by NAAC

JEPPIAR NAGAR , RAJIV GANDHI SALAI,CHENNAI -600 119

OCT – 2023



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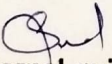
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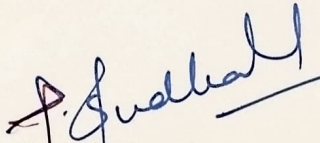
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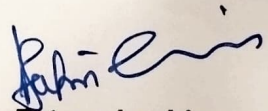
BONAFIDE CERTIFICATE

This is to certify that this professional training report is the bonafide work of **Harshini Joshitha. T (41240042)** who has completed the training program in **Kumarans Hospital, Kilpauk** as a part of professional development under our supervision from **29.05.2023 to 12.06.2023**.

This report also includes relevant insights and experiences gained from a virtual internship titled "**bio-electric signals training**" conducted from **19.06.2023 to 23.06.2023** which further contributed to the professional development of the student


Internal guide

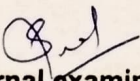

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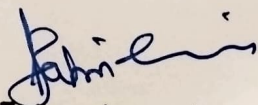

External guide

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KH / DR / OPD - 04



KUMARAN HOSPITALS & RELA INSTITUTE
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Date: 16.06.2023

TO WHOMSOEVER IT MAY CONCERN **INTERNSHIP CERTIFICATE**

To,

Ms. Harshini Joshitha T

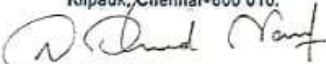
This is to certify that Ms. Harshini Joshitha T worked as a Intern in the Department of BME as a Biomedical Engineer in our Kumaran Hospital 120 beds [NABH NABL-Accredited]. She has accurate observation and learning. She is disciplined, very sincere and compassionate. She takes responsibility and completes her work. I am sure she will do well in any hospital where she joins.

Employed from : 29.05.2023
Employed Till : 12.06.2023
Designation : BME

We wish her all success in all her future endeavors

For Kumaran Hospital Pvt Ltd

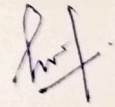
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DECLARATION

I **Harshini Joshitha. T** hereby declare that the professional training report completed by me during my professional training at Kumaran Hospitals and medicuore under the guidance of **Dr. A. Sabarivani, M.Tech., Ph. D.** and **Ms. Sindu Divakaran** is submitted in partial fulfilments of the requirements for the award of Degree in Bachelor of Technology in Biomedical Engineering

SIGNATURE OF THE CANDIDATE



DATE: 03.10.2023

PLACE: CHENNAI

ACKNOWLEDGEMENT

I wish to express my most sincere and profound gratitude to our beloved **Founder Chancellor Col.Dr. JEPPIAR,M.A. ,B.L.,Ph.D.**, for providing me an opportunity to educate myself.

I am also pleased to acknowledge sincere thanks to our **Chancellor Dr. MARIAZEENA JOHNSON , B.E.,M.B.A.,M.Phil.,PhD.** and President **Dr. MARIE JOHNSON, B.E., M.B.A., M.Phil., PhD.** and our beloved Vice Presidents **Mr.J. ARUL SELVAN, Ms. MARIA BERNADETTE TAMILARASI, Ms. MARIA CATHERINE JAYAPRIYA** of Sathyabama Institute of Science and Technology, Chennai, for their unwavering support to carry out my research work.

I am truly thankful to our Vice Chancellor **Dr.T.SASIPRABA, M.E., Ph.D.**, to our Pro Vice Chancellor **Dr. E. LOGASHANMUGAM , M.E., Ph.D.**, our beloved registrar **Dr. S.S. RAO MBA., Ph.D.**, our Director of Administration **Dr.G.SUNDARI M.E., Ph.D.** for their kind encouragement and support.

I would like to extend my thanks to **Dr.B.SHEELA RANI ,M.S., Ph.D.**, Director (research),Our Dean of school of Bio and Chemical sciences **DR. RAMESH KUMAR, M.Sc., Ph.D.** our head of the department **Dr. T. Sudhakar M.Sc., Ph.D.**, and our professional training guides **Ms. SINDU DIVAKARAN** and **Dr.A.SABARIVANI ,M.Tech., Ph.D.** Thank you for being a part of this educational journey with us.

Im genuinely thankful for the oppurtunities offered to me by **Mr.Vasanth Kumar, BME engineer** at kumarans hospital, his mentorship, guidance and patience created a welcoming and conducive learning environment

And I wish to express my thanks to all the Teaching and Non-Teaching staff members of the department of biomedical engineering who were helpful in many ways for the completion of the report.

ABSTRACT

This report provides a comprehensive overview of my internship experience in the field of biomedical engineering at Kumaran Hospital, located in Kilpauk, Chennai from 29.05.2023 to 12.06.2023. I had the privilege of working alongside a dedicated team of healthcare professionals under the guidance of Mr. Vasanth Kumar, gaining firsthand insights into the pivotal role of biomedical engineering in modern healthcare.

This internship encompassed a range of activities including the maintenance, their working and designs. Additionally, from 19.06.2023 to 23.06.2023, I delved into virtual internship about "bio-electric signals" under the guidance of Dr. Geetha Balasubramaniam. I had the opportunity to apply my theoretical knowledge acquired during my academic coursework into real world scenarios

This report reflects on the broader implications of biomedical engineering in enhancing patient care and healthcare delivery, underscoring the significance of this field in the evolving landscape of healthcare technology

In conclusion, my internship at Kumaran's Hospital not only provided a platform for practical learning but also ignited a passion for the field of biomedical engineering. It is my hope that this report serves as a testament to the valuable experiences gained during the internship and the contribution of biomedical engineers to healthcare

CONTENTS

CONTENTS	PAGE No:
I. INTRODUCTION	
1.1. OVERVIEW	1
II. OFFLINE INTERNSHIP	
2.1. DIAGNOSTIC LAB	2
2.2. ENDOSCOPY ROOM	5
2.3. INSIGHTS FROM CATH LAB	8
2.4. ANAESTHESIA DEPARTMENT	11
2.5. ICU & OT	14
2.6. DIAGNOSTIC IMAGING UNIT	20
III. VIRTUAL INTERNSHIP	
3.1. VIRTUAL CLASSES	26
3.2. FUTURE SCOPES DISCUSSION	29
IV. CONCLUSION	30
V. REFERENCES	31

LIST OF FIGURES

Fig: 2.1: Basic Cell Counter Device	pg.4
Fig: 2.2: Incubator in diagnostic lab	pg.4
Fig: 2.3. Endoscopic probes	pg 5
Fig.2.4. Endoscopy monitor	pg.7
Fig 2.5. Cath Lab Patient Bed And C- Arm	pg.8
Fig 2.6. Power Injector	pg.9
Fig.2.7. Graph Representing Cases Handled By Cath Lab	pg.10
Fig 2.8. Divisions Of Anaesthesia	pg.11
Fig 2.9. Anaesthesia Ventilator	pg.12
Fig.2.10. Administration Of Anaesthesia In Cath Lab	pg.13
Fig.2.11 Defibrillator	pg.14
Fig.2.12 . Calibration Of Syringe Pump	pg.15
Fig.2.13 Placement Of The Electrodes	pg.16
Fig.2.14. Electronic Tourniquet	pg.17
Fig.2.15 Workflow Of Hotline Fluid Warmers	pg.18
Fig.2.16.Ultrasound Machine	pg.20
Fig.2.17. X Ray Film Development Process	pg.21
Fig 2.18. Xray Tube And Patient Bed & X Ray Film Processor	pg.22
Fig.2.19. CT machine	pg.23
Fig.2.20 Computed tomography working process	pg.24
Fig.2.21. Working Mechanism Of Magnetic Resonance Imaging	pg.25
Fig.2.22. Medcuore Training	pg.26
Fig2.23 Physiological Signals Slide	pg.27

LIST OF TABLES

Table 2.1: Diagnostic Lab Equipment	pg.3
Table2.2. Endoscopy Applications	pg.7
Table 2.3 Equipment Of Cathlab	pg.10
Table2.4: Equipment And Models Of ICU & OT Room	pg.11
Table 2.5. Equipment And Models Of OT Room	pg.19

I. INTRODUCTION

1.1. OVERVIEW OF PRACTICAL TRAINING

This report documents my enriching journey through a comprehensive practical training program that has broadened my horizons in the field of biomedical engineering. Over the course of this training, I had the privilege of experiencing two distinct but equally valuable components: an offline internship conducted at Kumarans Hospital and a Virtual internship specializing in bioelectric signals

The first part of this report delves into my offline internship at Kumarans Hospital, where I had the unique opportunity to immerse myself in the real-world workings of a modern healthcare facility. During this period, I ventured into the halls of diagnostic lab, where diagnostics are the first step to unravelling the mysteries of ailments, to the endoscopy lab, where intricate procedures offer crucial insights into patient conditions.

I had the privilege of witnessing the Cath lab, Anaesthesia Unit and ICU where I learned about the high stakes of intervention and care. Radiology with its advanced imaging techniques, illuminated the power of visualization in healthcare whereas the Emergency Department taught the essence of swift, decisive action in critical moments. The Ultrasound unit exposed the science behind prenatal care and diagnostic precision.

In the second section of this report, I will discuss my virtual internship, which focused on the fascinating realm of bioelectric signals under the guidance of Dr. Geetha Balasubramaniam, M.Phil., Ph.D. These virtual experiences allowed me to delve into the bioelectric signals of our body, its potential impacts and the future scopes of the biomedical engineering field. This report is a testament to the experiences, knowledge, and skills gained throughout this transformative period of my professional development.

II. OFFLINE INTERNSHIP

(Venue: Kumaran's hospitals Kilpauk, Chennai)

Duration: 29.05.2023-12.06.2023)

2.1. DIAGNOSTIC LAB

Diagnostic testing plays a crucial role in healthcare for several reasons. It is a fundamental component of modern medicine, influencing decisions regarding patient care, treatment plans, and overall healthcare management

2.1.1 Sample Collection and Handling

Proper sample collection and handling are essential because they directly impact the quality and integrity of test results. Errors or contamination during this phase can lead to inaccurate diagnoses and treatment decisions. Samples can include blood, urine, tissue, swabs, saliva and various other bodily fluids or substances, depending on the type of test being conducted. Trained healthcare professionals or technicians follow specific guidelines for collecting samples. This may involve venipuncture, sterile swabbing of a site, or using specialized collection containers. The samples must be handled and stored in appropriate conditions to maintain their stability and prevent degradation.

2.1.2 Testing Protocols and Procedures

The diagnostic labs adhere to standard protocols for each type of test. These protocols outline the steps to follow, reagent requirements, equipment calibration and safety precautions. Automated analysers, microscopes, and molecular diagnostic instruments. Laboratories have established workflows that include sample preparation, analysis, result reporting. Highly trained laboratory professionals follow these workflows meticulously to minimize errors.

Table 2.1: Diagnostic Lab Equipment

Instrument	Model	Uses
Haematology analyser	TransAsia(xx8001)	Blood cell parameter measurements
Biochemical analyser	TransAsia (erba)	Measures parameters like glucose, bicarbonates and potassium
Electrolyte analyser	TransAsia (easy light+)	Measures electrolytes like sodium and bodily fluids
Urine analyser	TransAsia (Lara smart)	Measures creatinine, bacterial infections
Coagulometer	TransAsia (ECL 105)	Measures the ability of blood by assessing coagulation factors /dosages
Eliza plate washer	TransAsia (Liza scan)	Immunoassays/diagnostic tool for AIDS
Serum analyser	TransAsia (vesmatic easy)	Measures the liquid portion of the blood after clotting – serum plasma
ABG machine/ blood gas analyser	Alere EPOC	Measures the amounts of oxygen and carbon dioxide as well as acidity (ph.) of the blood is measured

2.1.3 Basic Cell Counter Equipment

Also known as haematology analyser is the most basic diagnostic lab equipment used- as blood cell count and blood profile are the most common tests. they count leucocytes, red cells and platelets in blood and also checks the level of haemoglobin and haematocrit in the blood. It is usually the preliminary test required by physicians to assess patient health. Common models are: Mindray, Macura, Abbott



Fig: 2.1: Basic Cell Counter Device

2.1.4 Incubator

An incubator is an equipment used to grow and maintain microbiological cultures or cell cultures. The incubator maintains optimal temperature, humidity and other conditions such as carbon dioxide and content of atmosphere inside



Fig: 2.2: Incubator in diagnostic lab

2.2. ENDOSCOPY ROOM

Endoscopy is a critical medical procedure that involves the insertion of a flexible or rigid tube equipped with a camera and other specialized instruments known as endoscope, into the body's natural openings

2.2.1. Key components

The key components involved are:

- Optics: high resolution cameras and advanced optics to provide detailed images of internal structures
- Illumination: adequate lighting for visualization
- Instrumentation: customized tools or devices attached to endoscopy procedures such as tissue biopsy or surgical interventions



Fig: 2.3. Endoscopic probes

2.2.2. Components

2.2.2.1 *Olympus endoscopes*

In the realm of medical equipment and technology, Olympus stands as a notable maker, offering innovative solutions for healthcare professionals. Among their range of instruments are endoscopes and colonoscopes, which serve the crucial function of enabling healthcare providers to view and assess internal blockages or diseases within the alimentary canal and rectum. These devices play an indispensable role in diagnosing and treating a wide array of gastrointestinal conditions, facilitating early detection and intervention.

2.2.2.2 *Goldway 960 patient monitor*

In the realm of patient care and monitoring, the Goldway 960 patient monitor takes centre stage. Designed to provide comprehensive patient data, this monitor displays vital information such as ECG (Electrocardiogram), non-invasive blood pressure (NI BP), invasive blood pressure (I BP), and SP2O (Peripheral Capillary Oxygen Saturation). This real-time data is essential for healthcare providers to continuously monitor a patient's condition, enabling swift responses to changes and ensuring the utmost safety and care.

2.2.3. *Legend Patient table*

To enhance patient comfort and facilitate precise positioning during medical procedures, the Legend patient table, another product in the medical equipment landscape, proves to be invaluable. Crafted to be robust yet adjustable, this table allows for ease of patient positioning, ensuring that medical professionals can perform procedures with precision and efficiency.

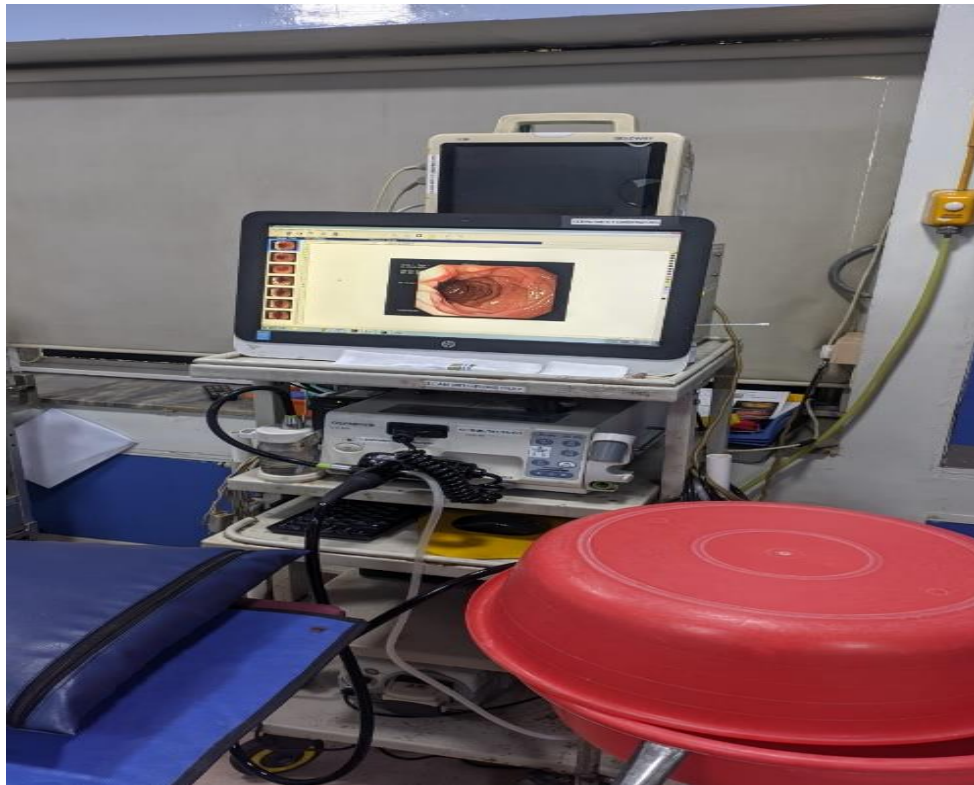


Fig.2.4. Endoscopy monitor

2.2.4. Endoscopy Uses

Endoscopy is a versatile medical procedure used to visualize and diagnose conditions in various body parts, from the digestive system to the respiratory tract, allowing for early detection and minimally invasive treatments

Table2.2. Endoscopy Applications

Branch of medicine	Type of endoscopy
Gastroenterology	Gastrointestinal Endoscopy (EGD)
Pulmonology	bronchoscopy
Gynaecology	Hysteroscopy
Urology	Cystoscopy
ENT	Laryngoscopy
Orthopaedics	Arthroscopy

2.3. INSIGHTS FROM CATH LAB

The Catheterization Laboratory, or Cath Lab, at Kumarans Hospital is a specialized facility dedicated to diagnosing and treating cardiovascular conditions. Equipped with state-of-the-art technology and staffed by skilled cardiologists and healthcare professionals, it is a hub for cardiac catheterization procedures, angioplasty, and stent placement, ensuring prompt and effective care for patients with heart-related issues.

2.3.1. Catheterization Table

The Catheterization Table, manufactured by GE Healthcare, serves as a pivotal component in the Catheterization Laboratory (Cath Lab). Its primary purpose is to provide a stable and adjustable platform for medical professionals during angiographic procedures and dye contrast administration.

2.3.2. C - Arm

The C-arm, crafted by GE Healthcare, is a sophisticated medical imaging device that generates highly powerful X-rays. It is employed extensively in various medical procedures, particularly within the Catheterization Laboratory (Cath Lab), to provide real-time imaging guidance during surgeries and interventions.

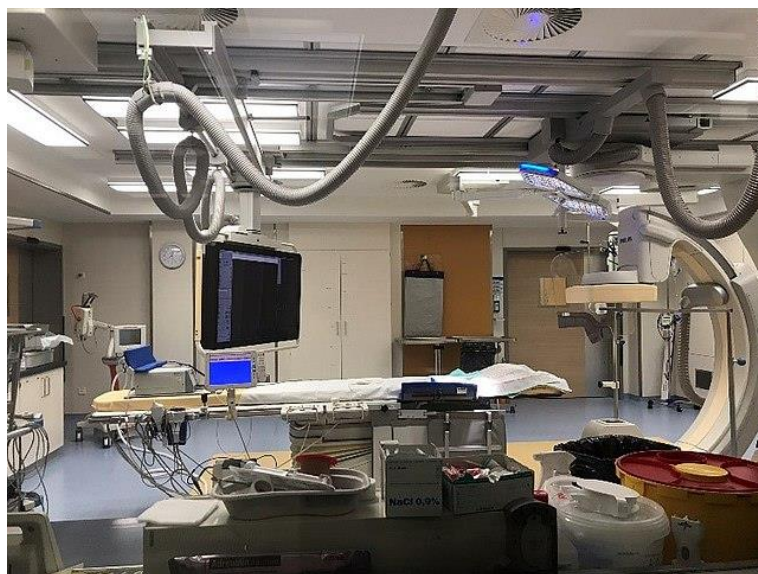


Fig 2.5. Cath Lab Patient Bed And C- Arm

2.3.3. GE Healthcare Defibrillator

It offers manual defibrillation in joules through controlled shocks. It comes in various types, including paediatric, external, and automatic extensive defibrillators, enhancing its versatility and applicability in emergency situations.

2.3.4. The Mindray Anesthesia Ventilator (Wato Ex 20)

It serves a crucial role in the operating room, delivering controlled anesthesia and ensuring patients' oxygenation and ventilation needs are met. This precision instrument is indispensable for safe and effective anesthesia administration during surgical procedures.

2.3.5. The Control And Console Room

The Control and Console Room acts as the central command centre during cardiac interventions. It provides direct visibility and control over haemodynamic monitoring, fluoroscopy, IVUS (Intravascular Ultrasound), and real-time images, facilitating the coordination of complex cardiac procedures and ensuring patient safety.

2.3.6. Power Injector

A power injector is a specialized medical device used for administering contrast media or radiopaque dye into the patient's bloodstream.



Fig 2.6. Power Injector

Table 2.3 Equipment Of Cathlab

Cath lab equipment	Maker
C arm	GE healthcare
Fractional flow monitor	St. Jude medical
GE monitor	GE healthcare
Defibrillater	GE healthcare
Anaesthesia ventilator	Mindray wato ex 20

2.3.7. Most Common Conditions Treated In Cath Lab

- Coronary Artery Disease (CAD): Including angioplasty and stent placement
- Acute Myocardial Infarction (Heart Attack): Urgent catheterization to treat blocked arteries

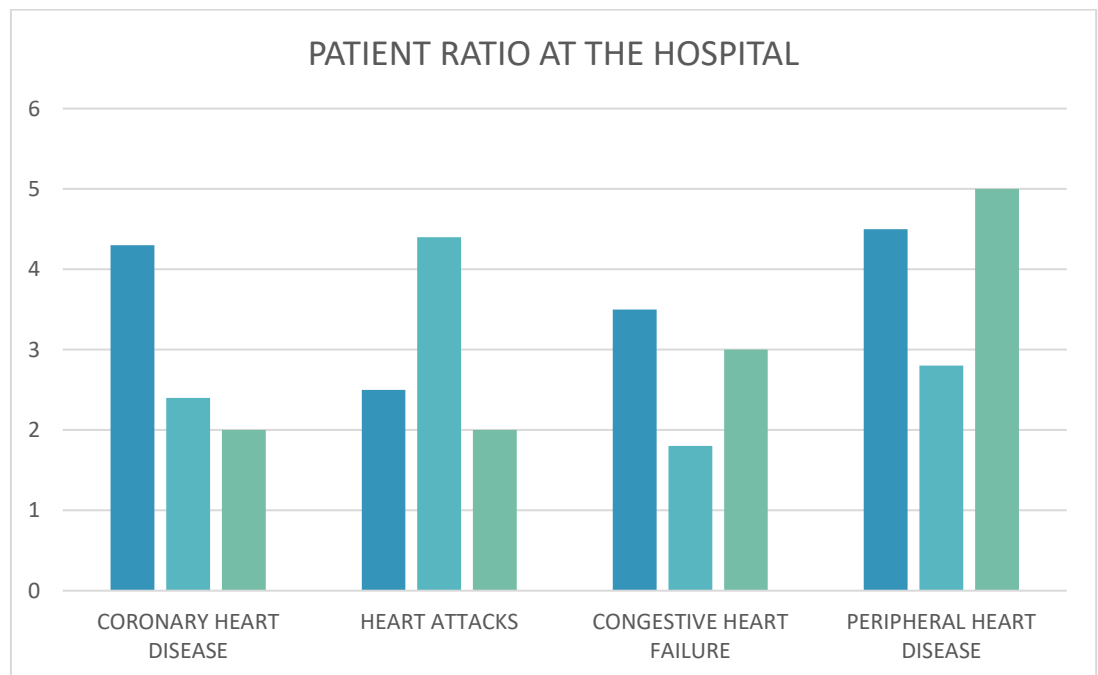


Fig.2.7. Graph Representing Cases Handled By Cath Lab In Last 3 Months (Dark Blue- Adult Female, Blue- Adult Male, Green-Minors)

2.4 ANAESTHESIA DEPARTMENT

The anaesthesia department is a specialized branch of medicine that focuses on providing anaesthesia and related perioperative care to patients undergoing surgical procedures or other medical interventions. Anaesthesia is a medical technique used to induce a temporary state of unconsciousness or loss of sensation to prevent pain and discomfort during surgery or other procedures.

2.4.1 Anaesthesia divisions

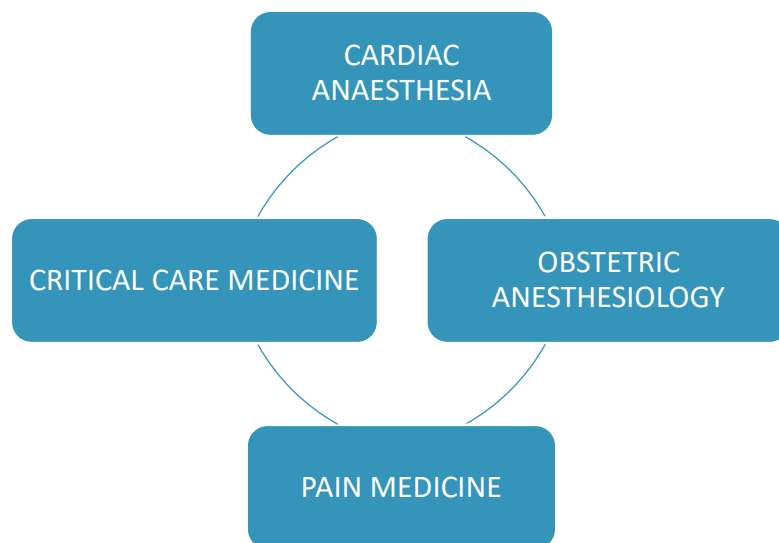


Fig 2.8. Divisions Of Anaesthesia

2.4.2 Components Of Anaesthesia

- Anaesthesia ventilator
- Anaesthesia monitor
- Vaporizer
- Cannister
- Bellows
- Flow sensors
- Anaesthetic drugs
- Monitors
- Airway management equipment

2.4.3. Anaesthesia Ventilator :

A medical device that assists with the mechanical ventilation of patients during surgery by delivering controlled and regulated breaths of air or oxygen.

2.4.4. Anaesthesia Monitor:

A vital tool used during anesthesia to continuously track and display a patient's vital signs, including heart rate, blood pressure, oxygen saturation, and end-tidal carbon dioxide levels.

2.4.5. Vaporizer :

A device that converts liquid anaesthetic agents into vapor for precise delivery to the patient, ensuring a consistent and safe level of anesthesia during surgery.



Fig 2.9. Anaesthesia Ventilator

2.4.6. Canister

A canister or canister system is often used to capture and safely dispose of waste gases and volatile anaesthetic agents, protecting healthcare workers from exposure.

2.4.7. Bellows

Part of the anesthesia machine, bellows provide a reservoir for gases and help maintain a steady flow of oxygen or air to the patient during ventilation.

2.4.8. Flow Sensors

These sensors are used to monitor and control the flow of gases, ensuring accurate delivery of oxygen and anaesthetic agents to the patient.



Fig.2.10. Administration Of Anaesthesia In Cath Lab

2.4.9. Anaesthetic drugs

Medications administered by an anaesthesiologist to induce and maintain anaesthesia, ensuring a patient remains unconscious, pain-free, and stable during surgery.

2.5. Intensive Care Unit and OT

The Intensive Care Unit (ICU) is a specialized department within a hospital that provides critical care and monitoring for patients with severe or life-threatening conditions. It is equipped with advanced medical technology, including ventilators, cardiac monitors, and infusion pumps, to support patients who require close monitoring

2.5.1 Equipment Of ICU

Central to ICU care are patient monitors that continuously track vital signs, mechanical ventilators for patients with compromised respiratory function, and infusion pumps for precise medication and fluid delivery. Defibrillators stand ready for cardiac emergencies, while ECG machines and pulse oximeters aid in cardiac and oxygenation assessment.



Fig.2.11 Defibrillator

2.5.2 Syringe pump

Its primary purpose is to deliver precise quantities of fluids and nutrition to patients, ensuring accuracy in both dosage and delivery rates. This equipment plays a crucial role in healthcare settings, where maintaining precise control over intravenous therapy is essential for effective patient care.

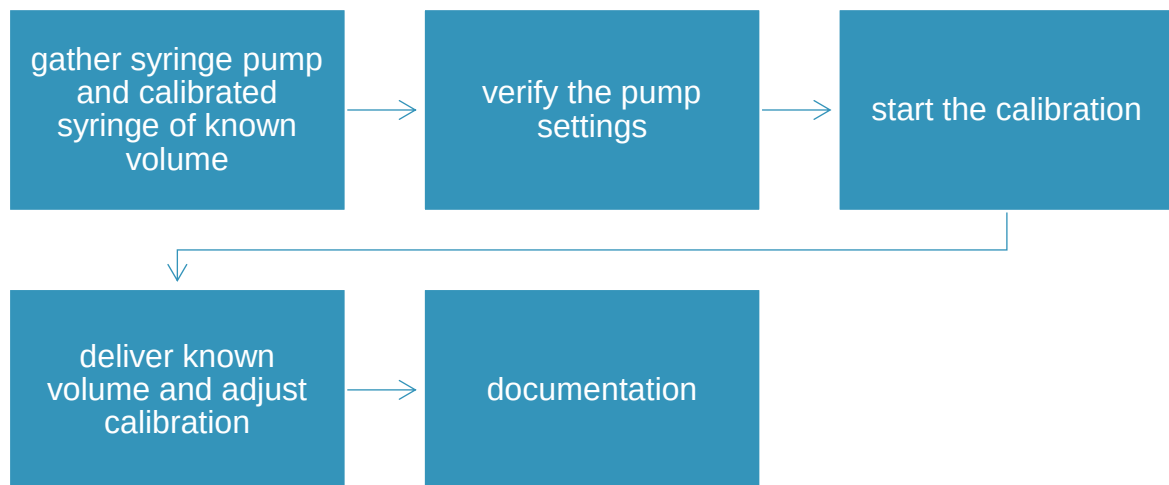


Fig.2.12 . Calibration Of Syringe Pump

2.5.3. Portable ECG Machine

An instrument to detect and produce a graphical representation of the electrical activities of the heart. Shows PQRST waveform and out of 12 electrodes only 10 electrodes are used

2.5.3.1. Leads Of ECG – An Overview

The 12-Lead ECG (Electrocardiogram) is a diagnostic tool that provides information about the electrical activity of the heart from multiple perspectives. It consists of electrodes placed on specific locations of the body to record electrical signals

2.5.3.2. Leads Of ECG - Explanation

1. Lead I: Records the electrical activity between the right arm (negative electrode) and the left arm (positive electrode).
2. Lead II: Records the electrical activity between the right arm (negative electrode) and the left leg (positive electrode).
3. Lead III: Records the electrical activity between the left arm (negative electrode) and the left leg (positive electrode).
4. aVR: Records the electrical activity between the right arm (positive electrode) and the average of the left arm and left leg (negative electrode).
5. aVL: Records the electrical activity between the left arm (positive electrode) and the average of the right arm and left leg (negative electrode).
6. aVF: Records the electrical activity between the left leg (positive electrode) and the average of the right arm and left arm (negative electrode).
7. V1-V6: These chest leads are placed on specific locations on the chest to record the electrical activity from different perspectives across the heart.
8. augmented(3) + chest (6) + earth (1) = 10 electrodes

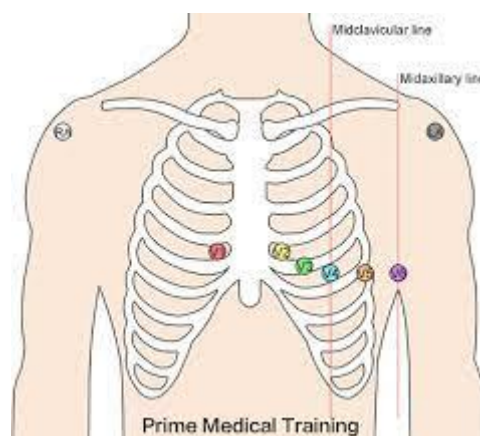


Fig.2.13 Placement Of The Electrodes

2.5.4. OT Room

Operation Theatre, also known as an Operating Room (OR) or Surgery Suite, is a specialized medical facility designed for surgical procedures. It is equipped with various instruments and equipment to provide a sterile and controlled environment for surgery conditions.

2.5.4.1 OT table

Electric and hydraulic patient beds are two common types of hospital beds used for patient care. Electric beds are powered by electricity and typically come with a remote control that allows healthcare staff or patients themselves to adjust the bed's height, headrest, and footrest positions for comfort and medical requirements. Hydraulic beds, on the other hand, operate using hydraulic systems that allow for manual adjustments by healthcare providers. Both types of beds can be equipped with remote controls or manual modes to facilitate tilting and positioning of patients as needed for medical treatment and comfort during their stay in healthcare facilities.

2.5.4.2. Electronic tourniquet

A tourniquet is a medical tool used to stop the flow of blood temporarily, often during surgery or to control severe bleeding from an injury.



Fig.2.14.Electronic Tourniquet

2.5.4.3. Hotline fluid warmer

A hotline fluid warmer is a medical device used to heat and maintain the temperature of intravenous (IV) fluids and blood products before they are administered to a patient. It helps prevent complications associated with infusing cold fluids, such as hypothermia or adverse reactions.

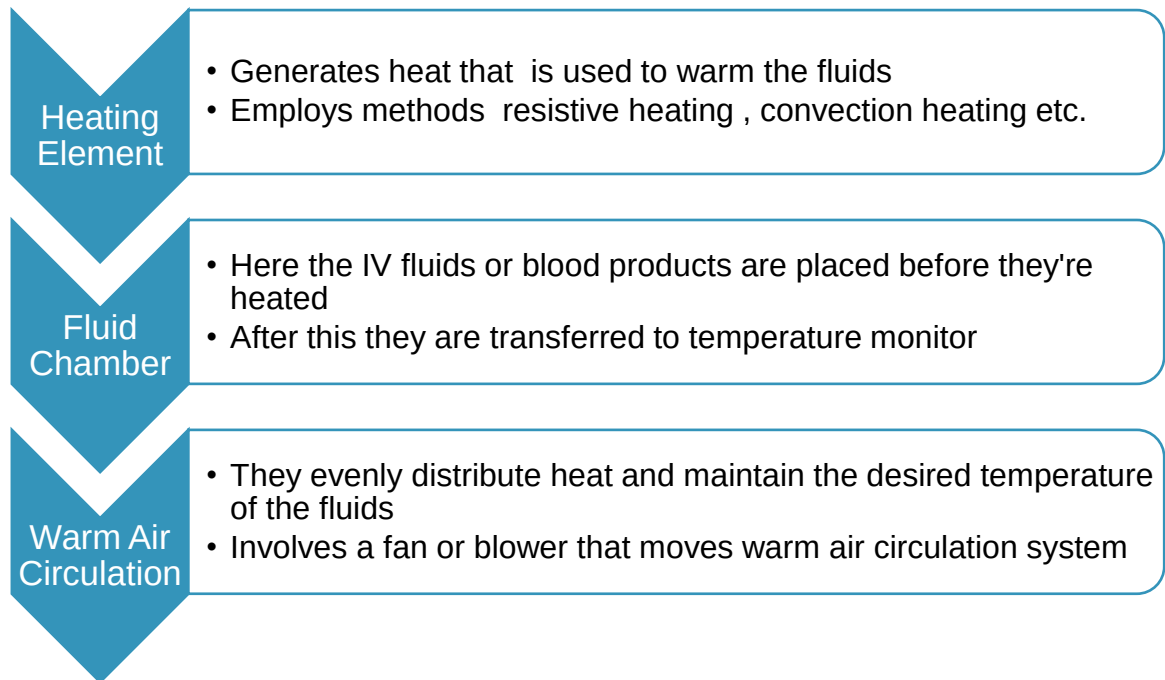


Fig.2.15 Important Components And Workflow Of Hotline Fluid Warmers

2.5.4.4 Diathermy/electronic surgery machine

Diathermy is a medical technique that uses high-frequency alternating current (AC) to generate heat within body tissues. This heat can be used for various medical purposes, including cutting and coagulating tissues during surgical procedures

- Monopolar electrode
 - To remove current from patient safely
 - Placed in muscle region
- Bipolar electrode
 - Provide coagulation
 - No pads are required and bipolar forceps is used

2.4.Table : Equipment And Models Of ICU & OT Room

Patient monitor	Mindray
Ventilator	Mindray (Vela)
Defibrillator	GE Healthcare (B650)
Syringe pump	Fresenius Kabi
ECG	Mindray beneheart R12
Blood gas analyser	Gem 3500
Dialysis machine	Fresenius Medicare (40085)
Patient beds	Legend

2.5. Equipment And Models Of OT Room

OT table	Legend
Electronic tourniquet	Macktronic 25000
Diathermy	Excel 350 mcds
Hotline fluid warmer	Level 1
Syringe pumps	Agilia 30000
Infusion pumps	Mindray benefusion
Nasogastric tube	M9 Mindray
Ventilator	Mindray

2.6.DIAGNOSTIC IMAGING UNIT :

2.6.1. Ultrasound

An ultrasound unit is a medical device used for diagnostic imaging through the use of high-frequency sound waves. It is commonly known as an ultrasound machine or ultrasound scanner.

Its key components are:

- Transducer
- Monitor
- Control Panel
- Gel Dispenser
- Printer (optional)
- Image Storage (optional)



Fig.2.16.Ultrasound Machine

2.6.1.1. Probes Of Ultrasound

- Convex probe – curved array probe with curved transducer
- Linear probe – emits and receives sound waves in linear fashion
- Echo probe – general purpose tube used for variety of vibrations
- Endo cavity probe – used as transvaginal or transrectal imaging probe

2.6.2. X ray room

Used to view the internal anatomy of the patients in 2D using x rays produced when fast moving electrons get hit on a cathode film and scatter

2.6.2.1. Parts Of An X Ray Machine

- Xray tube - high energy x rays are produced here which is narrowed down or focussed using the collimator. Limited movement is present
- X RAY CASSETTES : rectangular or square shaped devices which protects the sensitive x ray film from exposure to light,dust and provides a light tight seal. They have a labelling area in the front and are cleaned with disinfectants
- Image processor : uses various chemical tanks to develop x ray films after exposure

2.6.2.2. Xray film development procedure

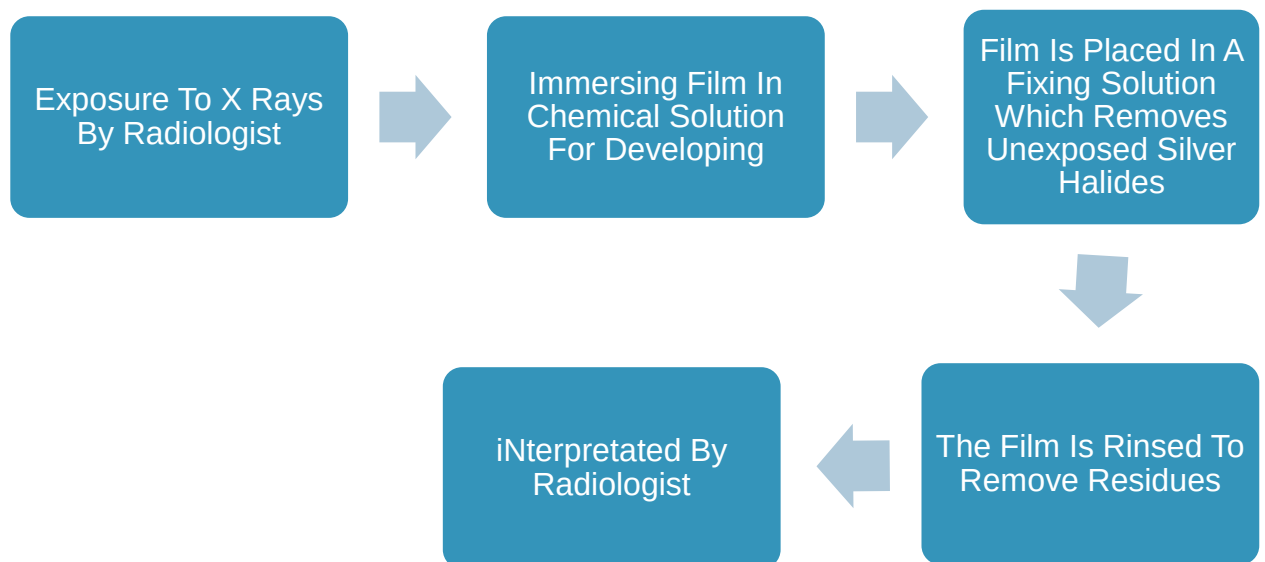


Fig.2.17. X Ray Film Development Process

2.6.2.3. Components of x ray machine

An X-ray machine comprises several key components working in concert to generate diagnostic images. The X-ray tube is the primary source, emitting X-ray beams through the patient's body. A collimator controls the X-ray beam's size and shape. The image receptor, traditionally a film cassette or digital detector, captures the X-ray image. The control panel allows operators to adjust exposure settings, while a high-voltage generator powers the X-ray tube. Lead-lined protective barriers and a lead apron safeguard against radiation exposure. Lastly, a computer system processes and displays the X-ray images, enabling healthcare professionals to diagnose and plan treatments effectively.



Fig 2.18. Xray Tube And Patient Bed (Left) & X Ray Film Processor (Right)

2.6.3. Computed tomography -CT

Definition: produces detailed images of body by combining x rays and computed processing techniques

Parts: large gantry, patient table, x ray tube with detector array

Slices: 16 slice CT (captures 16 slices of images simultaneously)

Additional components: room temperature monitor, thermohydrometer, vessel contrast injector, dehumidifier

Diagnoses: mainly for trauma, tumours and cancer

Power source: lower doses of radiation from x rays



Fig.2.19. CT machine

2.6.4. Working of CT scan

The CT (Computed Tomography) imaging process begins with the patient lying on a motorized table that moves through a donut-shaped gantry containing the X-ray source and detector array. The X-ray source emits a fan-shaped beam of X-rays that passes through the body, and the detector measures the X-rays that exit the patient from various angles. This data is collected as attenuation profiles and sent to a computer. Using a mathematical technique called back-projection, the computer reconstructs cross-sectional images, or "slices," of the body.

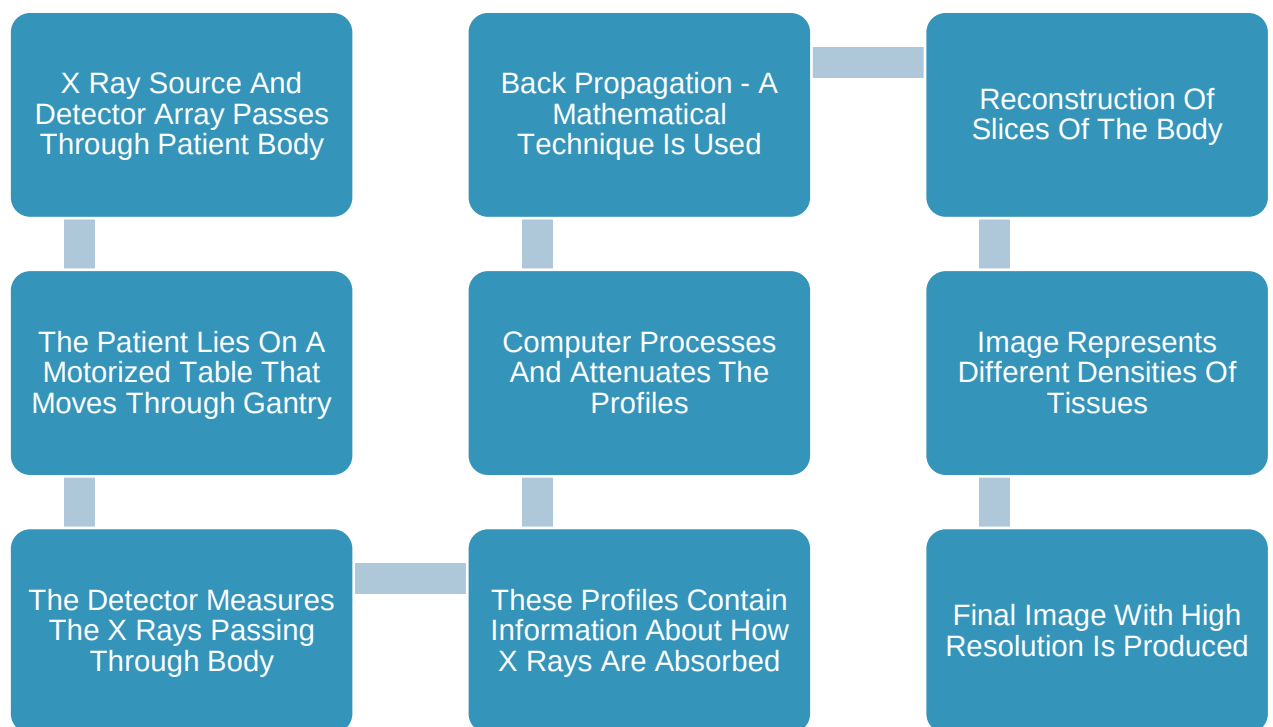


Fig.2.20 Computed tomography working process

2.6.5. MRI mechanism

The MRI (Magnetic Resonance Imaging) imaging process involves several steps. First, the patient lies on a motorized table and enters the MRI machine, which contains a strong magnetic field. Within this magnetic field, hydrogen nuclei in the patient's body align themselves. Then, RF (radiofrequency) coils emit short bursts of RF energy, disrupting the hydrogen nuclei's alignment. After the RF pulse is turned off, the hydrogen nuclei return to their aligned state, emitting radiofrequency signals in the process.

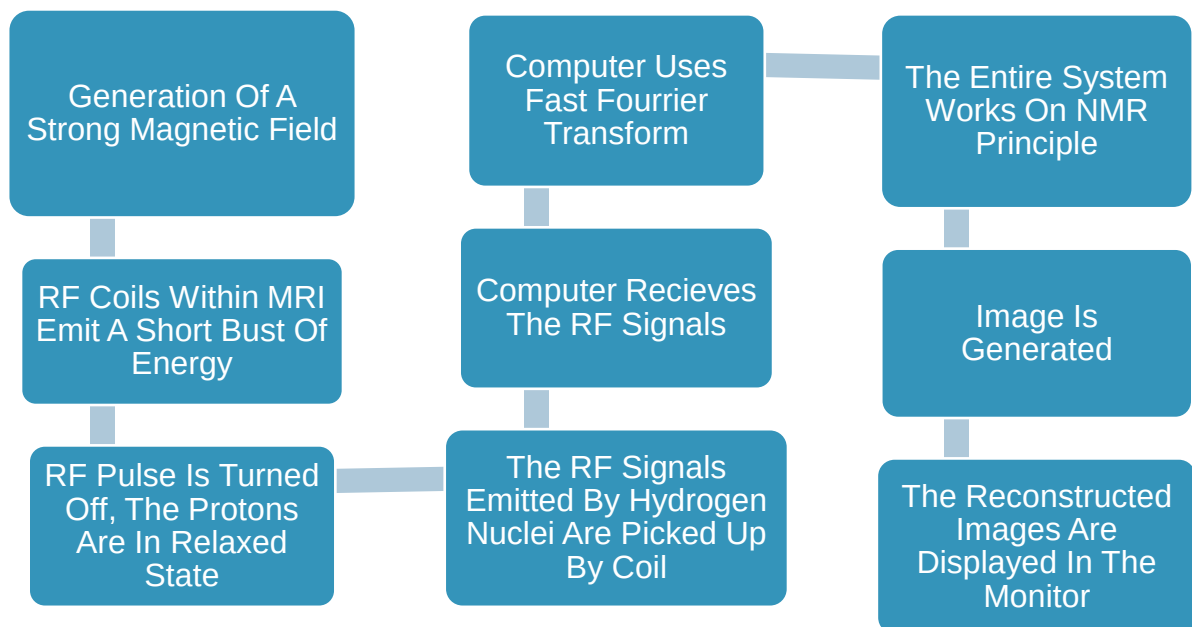


Fig.2.21. The Working Mechanism Of Magnetic Resonance Imaging

2.6.6. summary - offline internship

This internship provided me with a profound understanding of healthcare practices and allowed me to develop essential skills in communication and patient care. It was a valuable opportunity to explore potential career paths in the medical field.

III. VIRTUAL INTERNSHIP

(Conducted By : Medcuore Medical Solutions Pvt. Limited)

3.1. VIRTUAL CLASS ON BIOELECTRIC SIGNALS :

Dr. Geetha Balasubramaniam. M.Phil., Ph.D, an esteemed expert in the field of bio signals, illuminated our virtual internship with a profound understanding of the intricate physiological indicators that the human body generates. Through her guidance, we delved into the captivating world of bio signals, learning how these signals, such as electrocardiograms (ECG), electromyograms (EMG), and electroencephalograms (EEG), offer invaluable insights into the functioning of the human body.



3.1.1. Physiological signals

Measuring physiological signals is a fundamental aspect of healthcare and medical research. It involves capturing and quantifying various physiological parameters that provide insights into the body's functioning. To do this, specialized medical equipment and sensors are used. For instance, to measure vital signs like heart rate, blood pressure, and oxygen saturation, devices such as electrocardiograms (ECG or EKG), sphygmomanometers, and pulse oximeters are employed. To assess brain activity, electroencephalography (EEG) utilizes electrodes placed on the scalp. Other techniques include electromyography (EMG) to measure muscle activity and respiratory rate, and spirometry for lung function. Furthermore, wearable devices like fitness trackers and smartwatches have become increasingly popular for continuous monitoring of physiological signals.

Physiological Parameter	Range of Measurement & Units	Measurement method or Transducer Used
Blood Flow	0 to 300 mL/s	Ultrasound Doppler flowmeter
Blood Pressure—Arterial	20 to 400 mmHg	Sphygmomanometer
Blood Pressure—Venous	0 to 50 mmHg	Semiconductor strain gauge
Blood pH	6.8 to 7.8	pH electrode
Cardiac Output	3 to 25 L/min	Thermal dilution method
Heart Rate	25 to 300 beats per min	ECG or arterial BP Waveform
Electrocardiography (ECG)	0.5 to 4 mV	Skin electrodes
Electroencephalography (EEG) -Scalp	5 to 300 μ V	Scalp electrodes
Electromyography (EMG)	0.1 to 5 mV	Needle electrodes
Oxygen Saturation	85 to 100%	Differential light absorption
Respiratory Rate	5 to 25 breath/min	Skin electrodes
Tidal Volume	50 to 1,000 ml/breath	Spirometer
Temperature—Body	32 to 40°C	Thermistor

Fig2.23 Physiological Signals Slide

3.1.2. Demo- classes and examination

To further assess and recognize the knowledge gained during these demo classes, a Google Form examination was conducted. This examination serves as a means to evaluate students' comprehension and retention of the material presented by Geetha Mam.

Those who have successfully passed the exam are eligible to receive e-certificates, a testament to their dedication and understanding of the subject matter. This initiative not only motivates students to actively engage in the demo classes but also acknowledges their commitment to continuous learning and skill development.

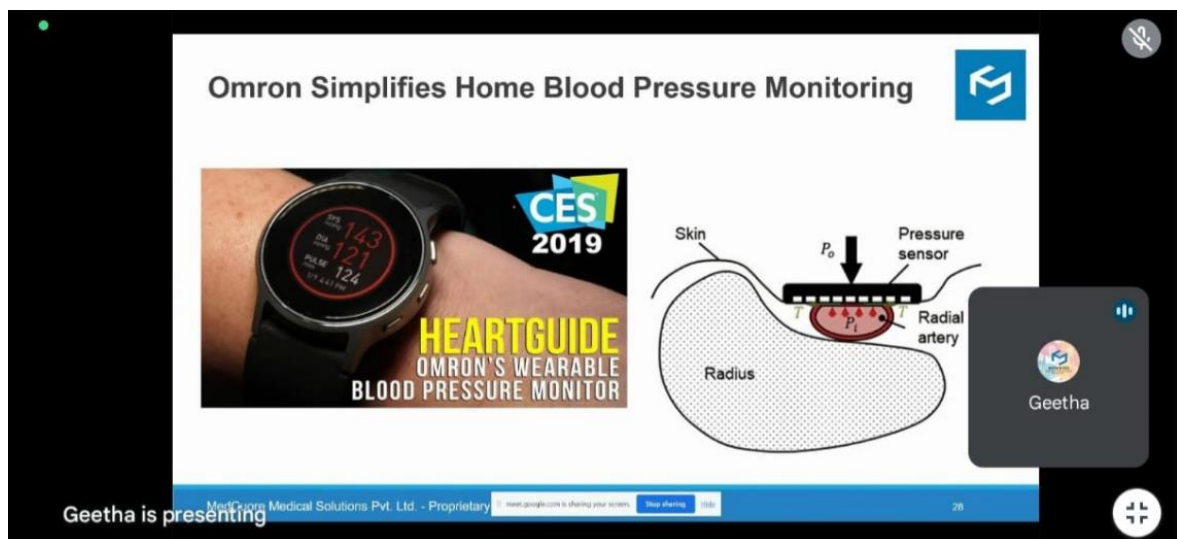
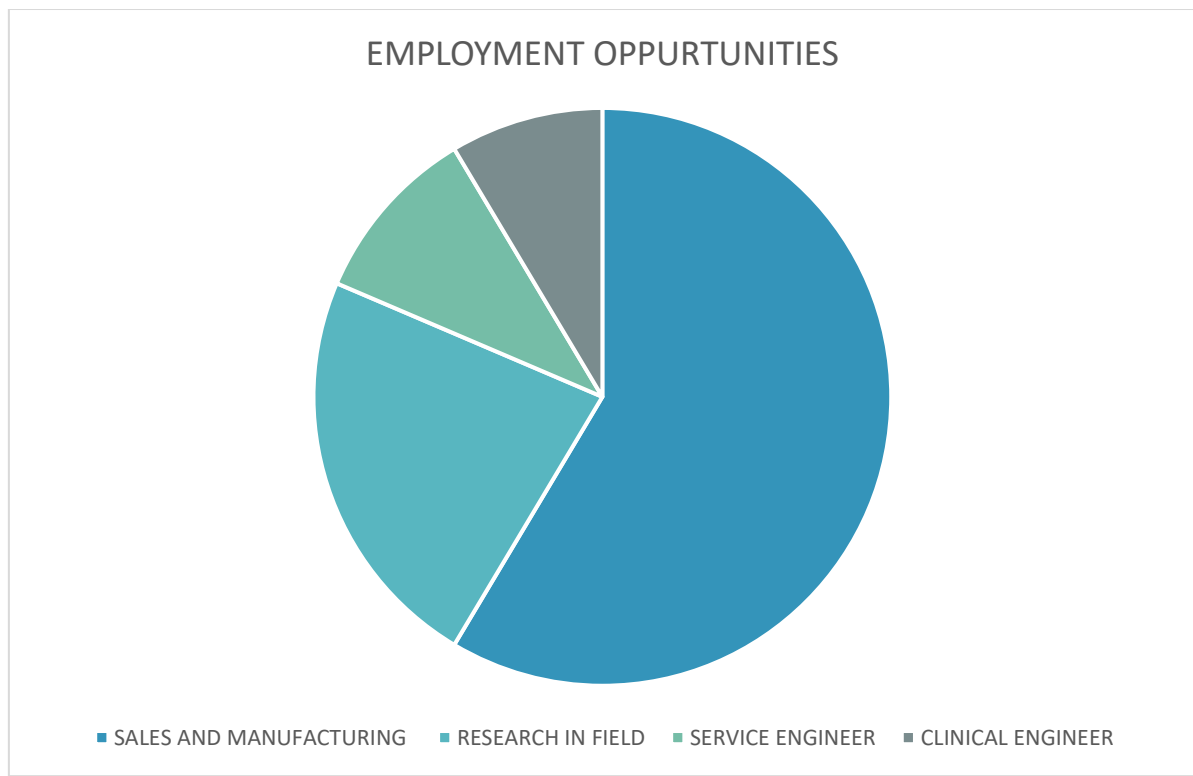


Fig 2.24. Demo classes presentation

3.3. FUTURE SCOPES

In our insightful discussions with mentors, we explored the promising future scopes within the field of Biomedical Engineering (BME). The conversations delved into various aspects, including placement prospects, the strategic utilization of internships to enhance practical knowledge, and the wide array of job opportunities across different sectors within BME. We also discussed the advantages of engaging in cutting-edge research within the field and how it contributes to innovation.

3.3.1. *Employment Opportunities*



3.3.2. *Further Discussions*

Furthermore going abroad, skills like repairing, marketing, innovation are taught to be very useful.

IV. CONCLUSIONS

In conclusion, my offline internship experience has been an enriching journey through various departments within the healthcare sector, guided by Mr. Vasanth Kumar at Kumarans Hospital. The diagnostic lab exposed me to the meticulous world of diagnostics, while the endoscopy room provided hands-on experience in minimally invasive procedures. The insights gained from the Cath lab expanded my knowledge of cardiovascular procedures, and my time in the anesthesia department highlighted the critical role of anesthetists in surgical care. Immersion in the ICU and OT settings underscored the importance of patient care and safety. Additionally, my exposure to the diagnostic imaging unit enhanced my understanding of cutting-edge imaging technologies.

On the other hand, the virtual internship, under the mentorship of Dr. Geetha at Medcuore Solutions Company, allowed me to attend informative classes on bioelectric signals, opening up new horizons in the field of medical electronics. Furthermore, the discussions on future scopes in healthcare broadened my perspective on emerging trends and opportunities. In combination, these experiences have not only deepened my appreciation for the diverse facets of healthcare but have also equipped me with a comprehensive understanding of the dynamic healthcare industry. I would like to express my heartfelt gratitude to my internal and external guides for their invaluable supervision throughout this enriching journey.

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