

PROFESSIONAL TRAINING- I REPORT

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

By

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(41240048)



DEPARTMENT OF BIOMEDICAL ENGINEERING

SCHOOL OF BIO AND CHEMICAL ENGINEERING

SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY

(DEEMED TO BE UNIVERSITY)

Accredited with grade "A++" by NAAC

JEPPIAR NAGAR, RAJIV GANDHI SALAI, CHENNAI -600 119

OCTOBER – 2023



SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY

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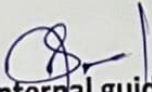
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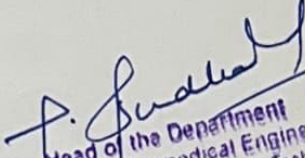
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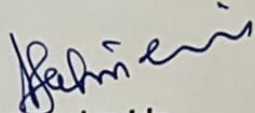
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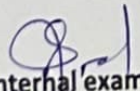
BONAFIDE CERTIFICATE

This is to certify that this Professional training report is the bonafide work of **ANTONY USHA ANU RETHI. A (41240048)** who carried out the reports entitled "**PROFESSIONAL TRAINING ON MEDICAL EQUIPMENT**" under my supervision from Date 20/05/2023 to 04/06/2023

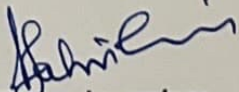

Internal guide


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External guide


Internal examiner

Submitted for the Viva Voce Examination held on 03/10/2023


External examiner



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TO WHOM SO EVER IT MAY CONCERN

This is to certify that **Miss. ANTONY USHA ANU RETHILA**, Sathyabama Institute of Science and Technology, Chennai has completed Training in Bio-medical department with effect from 20/05/2023 to 04/06/2023.

Vasantham Health centre (P) LTD is a 110 bedded Multispecialty Hospital with CCU, ICU, NICU, Medical and Surgical care units, Cardiology, Pediatrics, Orthopedics, Obstetrics and Gynecology Departments.

I wish her all success in his future endeavors.

Er. A. Brathib Jawahar, B.E, MBA,

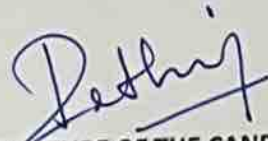
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DECLARATION

I, **ANTONY USHA ANU RETHI.A (41240048)** hereby declare that the **PROFESSIONAL TRAINING-1** done by me at **"VASANTHAM HEALTH CARE HOSPITAL"** is submitted in partial fulfillment of the requirements for the award of Bachelor of Technology degree 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.

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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.

I wish to express my thanks to all Teaching and Non-teaching staff members of the Department of Biomedical engineering who were helpful in many ways for the completion Of the report.

I would like to express my sincere and deep sense of gratitude to my training guide **Dr.M.ASIK AMEEN.,M.S(ORTHO)** and all the staff for their constant guidance and supervision during the period of my professional training and for providing me the necessary technical inputs for the completion of my training.

I extend my thanks to my family members for their unconditional love,belief and care.

ABSTRACT

The overall objective of training experience in biomedical engineering at VASATHAM HEALTH CENTRE. I learned a lots about the biomedical instruments with essential skills and knowledge required in the healthcare technology .The trainees are well educated and explain a lot in the field of biomedical .A wide array of medical devices, including diagnostic equipment and imaging technology .

The biomedical engineers learn about the regulatory requirements governing medical devices. The biomedical engineers receive guidance their professional skills. This includes interview preparation. Biomedical engineers will learn how to effectively communicate and collaborate with multidisciplinary teams to solve complex healthcare challenges.

Biomedical engineering is a discipline that applies principles and methods from engineering, science, and technology to understand, define, and solve problems in biology and medicine. These attorneys don't want to invest money to obtain a complete chart until they're sure that medical malpractice has occurred.

Supports patient diagnosis and treatment by installing, testing, calibrating and repairing biomedical equipment; training users; maintaining safe operations. Approves new equipment by conducting tests, ensuring adherence to codes and making modifications.

Overall, the professional training in biomedical engineering at VASATHAM HEALTH CENTRE aims to produce well-rounded biomedical engineers who are prepared to make meaningful contributions to the healthcare industry.

The program's comprehensive curriculum and practical experiences ensure that graduates are equipped with the skills, knowledge, and ethical awareness needed to excel in this critical field of healthcare technology.

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I.INTRODUCTION:

The internship taken place VASANTHAM HEALTH CENTRE which is located in NAGERCOIL. The internship headed by the chairman of the hospital who is DR.VASANTHAM .The Vasantham Health Centre is a 110 bedded multi-specialty hospital with CCU,ICU, NICU, Medical and surgical care units and Cardiology,Pediatrics, Orthopaedics etc..Cardiology is one of specialty where in vasantham healthcare centre shine and also is great to get all our medical needs.

Biomedical instrumentation is engineering concerned with devices and mechanics used to measure, evaluate, and treat biological systems. It focuses on using multiple sensors to monitor the physiological characteristics of a human or an animal. Biomedical instrumentation helps physicians diagnose the problem and provide treatment. To measure biological signals and design medical instruments, an understanding of electronics and measurement concepts and techniques is required. Biological signals, or biosignals, are space, time, or space-time records of a biological event such as a beating heart or contracting muscle.

The report includes overview of biomedical instruments. The hospital has high leading technology with dedicated highly skilled doctors and staff. I had a perfect reference from this hospital through my internship.

Biomedical Instrumentation helps physicians to diagnose the problem and provide treatment. This professional training is based on what I have learned from the trainees .

Through this report I hope to share that I'll be best part in the field of biomedical engineering Built around well-defined objectives, this internship should allow me to acquire skills and knowledge

2.1 SPHYGMOMANOMETER:

It is a device used to measure blood pressure composed of an inflatable cuff to collapse and then release the artery under the cuff in a controlled manner, and a mercury or aneroid manometer to measure the pressure. Manual sphygmomanometers are used with a stethoscope when using the auscultatory technique.

It consists of an inflatable rubber cuff, which is wrapped around the upper arm and is connected to an apparatus that records pressure usually in terms of the height of a column of a mercury or a dial. An arterial blood pressure reading consists of two numbers, which typically may be recorded as x/y. The x is the systolic pressure, and y is the diastolic pressure.

Systole refers to the contraction of the ventricles of the heart, when blood is forced from the heart into the pulmonary and systemic arterial circulation, and diastole refers to the resting period, when the ventricles expand and receive another supply of blood from the atria. At each heartbeat, blood pressure is raised to the systolic level, and between beats, it drops to the diastolic level. As the cuff is inflated with air, a stethoscope is placed against the skin at the crook of the arm. As the air is released, the first sound heard marks the systolic pressure; as the release continues, a dribbling noise is heard. This marks the diastolic pressure, which is dependent on the elasticity of the arteries.

Sphygmomanometer:



Fig:2.1.1

There are 3 types of sphygmomanometers that are used to gauge human blood

- Mercury sphygmomanometer

- Aneroid sphygmomanometer
- Digital sphygmomanometer

Estimation blood pressure ranges (mmHg)

This blood pressure is made up of two numbers: systolic and diastolic:

- Systolic
- Diastolic

Systolic pressure is the pressure when the ventricles pump blood out of the heart. Diastolic pressure is the pressure between the heart beats when the heart is filling with blood.

<i>AGE</i>	<i>SYSTOLIC RANGE</i>	<i>DIASTOLIC RANGE</i>
Adolescent (14-18 years)	90-120	50-80
Adult (19-40 years)	95-135	60-80
Adult (41-60 years)	110-145	70-90
Older adult(61 and older)	95-145	70-90

A combination of local endothelial derived factors, sympathetic nervous system changes in renal hemodynamics and endocrine secretions are responsible for the control of BP in normal human beings.

Adrenaline is a hormone that increases blood pressure. Adrenaline is known as an emergency hormone for the human body .This hormone is secreted by the adrenal

Digital sphygmomanometer:



Fig:2.1.2

A sphygmomanometer typically consists of several components. Here's a basic breakdown:

Cuff: The cuff is usually made of fabric and wraps around the upper arm. It has an inflatable bladder inside.

Inflatable Bladder: This is the part of the cuff that inflates to exert pressure on the arm. It's connected to the bulb used to pump air into the cuff.

Bulb: The bulb is a hand-held pump that is squeezed to inflate the cuff.

Pressure Release Valve: A valve on the bulb or the connecting tubing allows for controlled release of pressure from the cuff.

Manometer: This is the pressure gauge that measures the pressure in the cuff. In traditional mercury sphygmomanometers, it's a column of mercury in a graduated tube. Aneroid sphygmomanometers use a dial with a needle.

Stethoscope: Often used in conjunction with a sphygmomanometer to listen for the sounds of blood flow. It's placed over the brachial artery in the elbow crease.

2.2X-RAYS:

X-rays use invisible electromagnetic energy beams to produce images of internal tissues bones and organs on film or digital media. Standard x-rays are performed for many reasons including diagnosing tumors or bone injuries. X-rays are made by using external radiation to produce images of the body, its organ and purposes. X-rays pass through body structure for diagnostic purposes. when the body undergoes x-rays, different parts of the body allow varying amounts of the x-ray beam to pass through. The soft tissues in the body such as blood skin, fat, and muscle allow most of the x-ray to pass through and appear dark grey on the film or digital media. A bone or tumor ,which is more dense than soft tissue , allows few of the x-ray to pass through and appears white on the x-ray. When a break through the broken area and appears as a dark line in the white bone

X-ray technology is used in other types of diagnostic procedures ,such as arteriograms , computed tomography scans , and fluoroscopy. Radiation during pregnancy may lead to birth defects . Always tell your radiologists or doctor if you suspect you may be pregnant. X-rays can be performed on an outpatient basis , or as part of inpatient care. Although each facility may have specific protocols in place, generally an X-ray procedure follows this process;

X-rays:



Fig:2.2.1

X-rays are typically generated using an X-ray tube. In the tube, a stream of electrons is accelerated and directed toward a metal target (usually tungsten). When the high-speed electrons collide with the target, they undergo a rapid deceleration, and this process produces X-rays.

X-ray Beam Formation:

The X-rays produced form a divergent beam. A collimator is often used to shape and limit this beam to the specific area of interest.

Interaction with Matter:

When the X-ray beam passes through a substance (like the human body in medical imaging), it interacts with atoms. There are several ways X-rays interact with matter, but two main processes are:

Photoelectric Absorption:

X-ray photon is completely absorbed by an inner-shell electron, ejecting the electron from its orbit.

Compton Scattering:

X-ray photon interacts with an outer-shell electron, causing the electron to be *ejected, and the X-ray to change direction.*

Detection of X-rays:

After passing through the body, the remaining X-rays (those not absorbed or scattered) reach a detector. In medical imaging, this detector is often a digital sensor that converts the X-rays into electrical signals.

Image Formation:

The electrical signals from the detector are processed by a computer, which creates a visual representation of the internal structures based on the differences in X-ray absorption. Dense structures like bones absorb more X-rays, appearing white on the image, while softer tissues allow more X-rays to pass through, appearing darker. This process is fundamental to various applications, including medical imaging, security screening, and industrial inspection. It provides a non-invasive way to visualize the internal structures of objects and organisms.

X-ray machine:



Fig:2.2.2

X-rays photons carry enough energy to ionize atoms and disrupt molecular bonds. This makes it a type of ionizing radiation and thereby harmful to living tissue.

A very high radiation dose over a short amount of time causes radiation sickness, while lower doses can give an increased risk of radiation -induced cancer.

In medical imaging this increased cancer risk is generally greatly outweighed by the benefits of the examination.

Electric current provides power for the x-ray tube. The low voltage circuit that connects to the cathode, allows generation of electrons through thermionic emission. The high voltage circuit accelerates the electrons from the cathode to the tungsten target.

When the electrons hit the target, their kinetic energy is transformed in its majority to heat, and a tiny fraction converts into an x-ray. The main controls of the x-ray tube are the kilovoltage that controls the quality of the beam, the milli-amperage and exposure time control the quantity of the beam. The distance between the source of the x-ray and the target controls the beam intensity. The radiographic image reflects the differential densities .

2.3 SUCTION DEVICE:

A suction apparatus, also known as an aspirator, is a medical device used to eliminate fluids or gases like mucus, vomit, blood, saliva, serum, or other secretions from the body cavities of a patient. These cavities may include the lungs, mouth, or even the skull.

There are four ways to suction your child's airway:

- Nasal suction (suctioning in the nose)
- Oral suction (suctioning the mouth)
- Nasopharyngeal and oropharyngeal suction (suctioning the throat)
- Deep suctioning.

Suction is the result of air pressure differential between areas. Removing air from a space results in a pressure differential. Suction pressure is therefore limited by external air pressure. Even a perfect vacuum cannot suck with more pressure than is available in the surrounding environment.

Suction device:



Fig:2.3.1

When a suction cup is sealed against a surface and air is squeezed out of the cup, a low pressure region is created inside the suction area. It's actually the atmospheric pressure OUTSIDE the cup, pressing down on the low pressure area INSIDE the cup, that creates the suction by this the suction device work . In suction device a tube is used which is known as Endotracheal tube (ETT) . The Endotracheal tube suction is necessary to clear secretions and to maintain airway patency, and to therefore optimise oxygenation and ventilation in a ventilated patient. ETT suction is a common procedure carried out on intubated infants.

The basic formula $F=Px A$ is used to calculate the force of the suction cup with: F is holding force (or the vacuum force of the suction cup) P is pressure.

<i>Age</i>	<i>Pressure</i>
Neonate	60-80 mmHg
Infant	80-100 mmHg
Older child	100-120 mmHg
Adult	100-150 mmHg

A suction pump works by atmospheric pressure; when the piston is raised, creating a partial vacuum, atmospheric pressure outside forces water into the cylinder, whence it is permitted to escape by an outlet valve. Atmospheric pressure alone can force water to a maximum height.

The type of suctioning equipment you use often depends on the type of suctioning you intend to do:

- Manual Suction Units
- Makeshift Suction Devices
- Wall-Mounted Suction
- Emergency Portable Suction

Clearing Airway:

Suction pumps are crucial for clearing the airways of patients. This is particularly important in emergency situations or when dealing with patients who have difficulty clearing their own airways.

Fluid Removal:

During surgical procedures or medical treatments, suction pumps efficiently remove blood, saliva, mucus, or other fluids, providing a clear field for medical professionals to work.

Sterility:

They help maintain a sterile environment by removing unwanted substances, preventing contamination during medical procedures.

Versatility:

Suction pumps come in various sizes and types, making them versatile and suitable for different medical settings and procedures.

2.4 INFUSION PUMP:

Infusion pump is a medical device used to deliver fluids into a patient's body in a controlled manner. There are many different types of infusion pumps, which are used for a variety of purposes and in a variety of environments. Infusion pumps may be capable of delivering fluids in large or small amounts, and may be used to deliver nutrients or medications – such as insulin or other hormones, antibiotics, chemotherapy drugs, and pain relievers. Some infusion pumps are designed mainly for stationary use at a patient's bedside. Others, called ambulatory infusion pumps, are designed to be portable or wearable. These pumps are commonly used in hospitals, clinics, and even at home for patients requiring long-term infusion therapy. Imagine it as a reliable, automated nurse for administering fluids.

Infusion pump:



Fig:2.4.1



Fig:2.4.2

A number of commonly used infusion pumps are designed for specialized purposes. These include:

Enteral pump -A pump used to deliver liquid nutrients and medications to a patient's digestive tract.

Patient-controlled analgesia (PCA) pump - A pump used to deliver pain medication, which is equipped with a feature that allows patients to self-administer a controlled amount of medication, as needed.

Insulin pump - A pump typically used to deliver insulin to patients with diabetes. Insulin pumps are frequently used in the home. Infusion pumps may be powered electrically or mechanically. Different pumps operate in different ways.

For example:

In a syringe pump, fluid is held in the reservoir of a syringe, and a moveable piston controls fluid delivery.

In an elastomeric pump, fluid is held in a stretchable balloon reservoir, and pressure from the elastic walls of the balloon drives fluid delivery.

In a peristaltic pump, a set of rollers pinches down on a length of flexible tubing, pushing fluid forward.

In a multi-channel pump, fluids can be delivered from multiple reservoirs at multiple rates.

A "smart pump" is equipped with safety features, such as user-alerts that activate when there is a risk of an adverse drug interaction, or when the user sets the pump's parameters outside of specified safety limits.

Pump Mechanism: This is the core of the infusion pump, responsible for moving fluids. There are various types of pump mechanisms, including peristaltic pumps, syringe pumps, and piston-driven pumps.

Motor: Most infusion pumps are powered by electric motors. The motor drives the pump mechanism to push or pull the fluid through the tubing.

Control System: This includes the user interface and the programming that allows healthcare professionals to set the desired infusion rate, volume, and other parameters. Modern infusion pumps often have digital interfaces and may be programmable for different medications and infusion protocols.

Sensors: To ensure accuracy and safety, infusion pumps are equipped with sensors. These sensors monitor factors like fluid flow rate, air in the tubing, and occlusions (blockages).

Power Source: Infusion pumps typically use batteries for portability, and some models can also be plugged into a power source. The reliability of the power source is critical to prevent interruptions in infusion.

2.5RADIOLOGY:

Radiology, also known as diagnostic imaging, is a series of tests that take pictures or images of parts of the body. The field encompasses two areas which are diagnostic radiology and interventional radiology, that both use radiant energy to diagnose and treat diseases. While there are several different imaging exams, some of the most common include x-ray, MRI, ultrasound, CT scan and PET scan.

A radiologist will look at the outcome of a certain imaging test to find a relevant image that evaluates and supports a diagnosis. These individuals are usually medical doctors (MDs) with highly specialized training focused on the interpretation of medical imaging. Radiologic technologists also aid in this process, as they use and manage the machines in the course of producing an image. After a patient undergoes imaging tests, radiologists will give reports of their interpretations to the referring clinical doctors.

Every sector within the health care field relies on radiology, including:

- Surgery
- Pediatrics
- Obstetrics

- Oncology
- Trauma-response
- Emergency medicine
- Infectious disease

Radiology:



Fig:2.5.1

Diagnostic radiology uses these imaging results to identify a wide range of problems, from broken bones to heart conditions and blood clots. Interventional radiology also uses imaging such as CT scans, MRI and ultrasounds to guide medical procedures. Patients are typically awake during these procedures, whether it's treating cancer, back pain, or liver and kidney problems. In some cases, interventional radiology eliminates the need for surgery and scopes. Radiology is used for a wide range of conditions, and is classified depending on the type of radiology and the exact imaging test used.

The various imaging exams include:

Radiographs:

Radiologists are specialist medical doctors trained to interpret x-rays and other medical imaging tests. They diagnose and carry out treatments using ultrasound, x-rays, CT scans, MRIs and other imaging technology. A radiologist interprets the findings of your imaging to assist in making a diagnosis. X-rays to look at bones, the chest or the abdomen.

CT (Computed Tomography):

CT, refers to a computerized x-ray imaging procedure in which a narrow beam of x-rays is aimed at a patient and quickly rotated around the body, producing signals that are processed by the machine's computer to generate cross-sectional images, or slices. These slices are called tomographic images and can give a clinician more detailed information than conventional x-rays. Once a number of successive slices are collected by the machine's computer, they can be digitally stacked together to form a three-dimensional (3D) image of the patient that allows for easier identification of basic structures as well as possible tumors or abnormalities. A CT captures multiple x-ray angles of the patient using a doughnut-shaped machine, then creates computer-processed images.

MRI (Magnetic Resonance Imaging):

Magnetic resonance imaging (MRI) is a medical imaging technique that uses a magnetic field and computer-generated radio waves to create detailed images of the organs and tissues in your body. Most MRI machines are large, tube-shaped magnets. When you lie inside an MRI machine, the magnetic field inside works with radio waves and hydrogen atoms in your body to create cross-sectional images — like slices in a loaf of bread. The MRI machine also can produce 3D images that can be viewed from different angles.

Mammograms:

A mammogram is an X-ray picture of the breast. Doctors use a mammogram to look for early signs of breast cancer. Regular mammograms can find breast cancer early, sometimes up to three years before it can be felt.

Ultrasound:

An ultrasound uses sound waves to create moving images that display on a monitor, commonly used for echocardiograms and examining the womb during pregnancy.

Fluoroscopy:

X-rays that make moving images of the body in real time. This imaging is crucial for many procedures, especially those involving the gastrointestinal tract.

2.6 VENTILATOR:

A ventilator is a medical device that helps people breathe when they are unable to do so on their own. It delivers air into the lungs, usually through a tube that is placed into the trachea (windpipe). Ventilators are used in various medical settings, such as intensive care units (ICUs), operating rooms, and emergency departments. They are crucial for supporting patients with respiratory failure or those undergoing surgery who require assistance with breathing. Ventilators can be set to provide different levels of support, including controlling the rate and depth of breaths or assisting with each breath the patient takes.

Ventilator:



Fig:2.6.1

There are several ways a person can receive ventilator support. These include:

- Face mask ventilators
- Mechanical ventilators
- Manual resuscitator bags
- Tracheostomy ventilators
- Face mask ventilator:

Face mask ventilators:

A face mask ventilator is a non invasive method of supporting a person's breathing and oxygen levels. To use one, a person wears a mask that fits over the nose and mouth while air blows into their airways and lungs.

Mechanical ventilator:

Mechanical ventilators are machines that take over the breathing process entirely. Doctors use these when a person cannot breathe on their own. Mechanical ventilators work via a tube in a person's throat, pumping air into the lungs and transporting carbon dioxide away.

Manual resuscitator bags:

Manual resuscitator bags are pieces of equipment that allow people to control the airflow of their ventilator with their hands. These devices consist of an empty bag, or "bladder," that a person squeezes to pump air into the lungs.

Tracheostomy ventilator:

People who have undergone a tracheostomy will require a ventilator. A tracheostomy is a procedure where a doctor creates an opening in the windpipe and inserts a tube, which allows air to flow in and out. This enables a person to breathe without using their nose or mouth. People who have undergone tracheostomies can also receive ventilator support through this opening. Instead of inserting a ventilator through the mouth, doctors insert it directly into the windpipe.

The basic principle behind the working of a ventilator involves assisting or completely taking over the breathing process for a patient. Here's a simplified breakdown:

Air Intake: The ventilator takes in air from the environment.

Oxygen Mix: In some cases, the ventilator may mix the incoming air with additional oxygen to ensure the patient receives an adequate supply.

Pressure Generation: The ventilator creates a flow of air at a controlled pressure. This pressure is essential for moving the air into the patient's lungs.

Delivery to Patient: The pressurized air is delivered to the patient's lungs through a tube or breathing circuit. This can be done through an endotracheal tube (inserted into the trachea) or through a mask, depending on the patient's condition.

Monitoring and Control: The ventilator continuously monitors various parameters, such as the patient's respiratory rate, tidal volume (the amount of air inhaled and exhaled in one breath), and oxygen levels. These parameters are often set and adjusted by healthcare professionals based on the patient's needs.

Exhalation: The ventilator may also assist in the exhalation process by controlling the release of air and preventing the lungs from overinflating.

2.7 OXYGEN CONCENTRATOR:

An oxygen concentrator is a medical device that gives you extra oxygen. Your doctor may prescribe one for you if you have a health condition that causes your oxygen level to drop too low.

It can help some people who have trouble breathing due to conditions like:

- Asthma
- Lung cancer
- COPD
- The flu
- COVID-19

An oxygen concentrator isn't the same thing as an oxygen tank, which delivers liquid or gas oxygen. Instead, the concentrator is a machine that pulls in the air around you and filters out the nitrogen. A thin tube runs from the device to your face, giving you purified oxygen through two open prongs below your nostrils. Some people use a facemask to get a higher concentration and flow of oxygen. There are two types of concentrators; a bigger model you can use at home, and a lighter, portable model you can use on the go.

Tubing or facemask: Wash once a week with warm water and mild dish soap. Clean it more often if you get sick. Let it air dry, and don't let water get in the tube. If the tubing looks damaged, get a replacement from your oxygen supplier.

Humidifier bottle: If you use one, clean it every 3 days with warm water and mild dish soap. Rinse it with hot water. You can also soak it in a mix of vinegar and water for a few minutes to clear out any leftover bacteria. Dry the bottle with a paper towel, then air dry it.

Concentrator filter: Clean it once a month. Take it out and dunk it into a clean container that's filled with water and mild dish soap. Scrub with a washcloth to get rid of any dirt or dust, then rinse it under water to remove any soap residue. Lay the filter on a dry, clean towel and let it air dry completely before you put it back in the concentrator.

Oxygen concentrator:



Fig:2.7.1

The concentrators run on electrical power and thus supply an unlimited amount of oxygen. Portable concentrators can be used in an “on-the-go” mode with a battery pack, resulting in up to 12 h of continuous use for some models.

There are many parts that make up a portable oxygen concentrator. A compressor and sieve bed filter are a couple of the main parts. The compressor compresses air that is filtered into the concentrator, then delivers the air in a continuous stream.

The compressed air moves to the sieve bed filters. The sieve bed filter plays an important role, as it is the device that removes the nitrogen from the air. A material called Zeolite, which is a six-sided microscopic cube with holes on each side, is in the sieve bed and this is what removes the nitrogen from the air.

Oxygen concentrator in human use:



Fig:2.7.2

Two sieve beds are located in the concentrator. After air is first compressed in the concentrator, it is forced into the first sieve bed. Oxygen is sent into the product tank. The first sieve bed then gets filled up with nitrogen. Next, the gas flow is switched, and the compressed air is moved to the second sieve bed. The first sieve bed's compressor is sent to the outside room, and the air from the product tank goes back into the first sieve bed.

The drop in pressure from the first sieve bed and the weakening of oxygen makes the Zeolite release nitrogen. The Oxygen and Nitrogen come back together and are released in the room as regular air. The air is then compressed and sent to the second sieve where Oxygen is moved through it to the Product Tank. The whole cycle starts over again with the first sieve after a few seconds.

Other important parts are the cooling system that keeps the portable oxygen concentrator from overheating, and the nasal cannula that delivers the purified oxygen after the oxygen has been passed through all the sieve bed filters. The cannula helps improve oxygen absorption.

2.8DEFIBRILLATOR:

Defibrillator is a device that provides an electric shock to your heart to allow it to get out of a potentially fatal abnormal heart rhythm, or arrhythmia, ventricular tachycardia (with no pulse) or ventricular fibrillation and back to a normal rhythm. Both of these arrhythmias happen in your heart's ventricles .

People who have the above arrhythmias can get help in a hospital or a place that has an automated external defibrillator available. However, if you have a high risk of a life-threatening heart rhythm, you may need your own defibrillator that's with you all the time. A shock from a personal defibrillator can be painless or feel as if someone kicked you in the chest.

People who are at high risk for a life-threatening heart rhythm may have these defibrillator types:

A wearable cardioverter defibrillator you wear like a vest under your clothes. The sensors make contact with your skin, and the device can send a shock after sensing an abnormal rhythm.

An implantable cardioverter defibrillator (ICD). Like an internal watchdog for arrhythmias, an ICD can send the right amount of charge when it's needed. While it's similar to a pacemaker in its ability to keep the heart beating, a defibrillator has the added ability to provide a shock to the heart when a fatal rhythm is detected.

Defibrillator:



Fig:2.8.1



Fig:2.8.2

You should continue giving CPR while waiting for a defibrillator to be ready to use. Before you deliver the shock, make sure no one is touching the person who's about to receive the shock (or their bed). If you're using an automated external defibrillator (AED), it can review your heart's rhythm to decide if it needs a shock. An AED charges itself and provides verbal instructions on how to use it.

A first responder or healthcare provider will do the following:

- Put two defibrillator paddles or sticky pads (connected to the defibrillator) on your chest. One paddle or pad goes below your right shoulder and the other below your left nipple. To prevent burns, conducting material is already in the pads. However, your provider will need to put conducting material on your chest before using paddles.
- For sticky pads, push a button on the machine to give the shock. For handheld paddles, push the button on each paddle at the same time.

A defibrillator makes your heart muscle stop moving briefly so your heart can create an electrical impulse that starts a normal rhythm. In essence, defibrillation restarts your heart.

To use a defibrillator, follow these simple steps:

Step 1: Turn the defibrillator on by pressing the green button and follow its instructions.

Step 2: Peel off the sticky pads and attach them to the patient's skin, one on each side of the chest, as shown in the picture on the defibrillator.

Step 3: Once the pads have been attached, stop CPR and don't touch the patient. The defibrillator will then check the patient's heart rhythm.

Step 4: The defibrillator will decide whether a shock is needed and if so, it will tell you to press the shock button. An automatic defibrillator will shock the patient without prompt. Don't touch the patient while they are being shocked.

Step 5: The defibrillator will tell you when the shock has been delivered and whether you need to continue CPR.

Step 6: Continue with chest compressions until the patient shows signs of life or the defibrillator tells you to stop so it can analyse the heartbeat again.

Anyone can use a defibrillator and you don't need training. Once you turn it on, it will give clear instructions on how to attach the defibrillator pads. The device checks the heart rhythm and will only tell you to shock if it's needed. You can't shock someone accidentally.

Defibrillator processing:

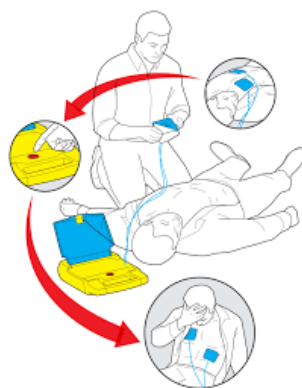


Fig:2.8.3

2.9BIOCHEMISTRY MACHINE:

Biochemistry Analyzer is a medical laboratory equipment used extensively in clinical laboratories. It is designed to conduct tests to measure chemicals at

various stages of the biological processes on a wide range of test samples from blood, plasma, serum, and cerebrospinal fluid to urine.

The performance of biochemistry analyzers can be evaluated based on several criteria such as operation method (automatic or semi-automatic), speed (number of samples analyzed by the analyzer per hour), and random access mode (to allow random and continuous sample loading and obtain results of different patients as quickly as possible). When choosing a biochemistry analyzer it is important to check whether assay automation is needed, the accuracy level of measurements, capacity (maximum number of samples that can be analyzed at a time), and speed of testing.

Biochemistry machine:



Fig:2.9.1



Fig:2.9.2

A biochemistry analyzer is commonly used in different medical settings and laboratories by healthcare providers or medical practitioners to diagnose and treat various health concerns and identify critical problems including health issues.

Biochemical analyzers can be used in hospital laboratories to perform various tests like albumin tests, sugar level tests, or to detect levels of enzymes and creatinine in the blood. In clinics, some types of biochemical analyzers can be used to determine the antigen-antibody interactions in the biochemical reactions.

There are high-precision biochemistry analyzers that can be used in the pharmaceutical industry to diagnose fatal diseases. So, it can be applied to various areas of life sciences including cellular metabolism, protein synthesis, genetics, clinical laboratories, and even pharmaceuticals.

Biochemical analyzers can even be used by medical researchers for studying the structure and detecting and determining the diverse functions of different biomolecules within the cells such as lipids, enzymes, nucleic acids, etc.

Thus, this fully-featured medical equipment has become the backbone of medical research and the pharmaceutical industry by helping in drug investigations/development, advancing clinical research, and diagnostic or therapeutic product development approaches.

It has simply met the needs of lab professionals, physicians, and even patients.

The use of a biochemistry analyzer provides a lot many benefits:

- It has made possible to detect and monitor the diseases by analysis of chemical reactions and biological processes taking place inside the patient body within less time.
- It allows timely and accurate sample analysis and quality laboratory testing.
- It speeds up the analysis of complex biochemical reactions.
- It helps to streamline routine laboratory activities.
- It provides the best quality, reliable diagnostic information by providing test reports as soon as possible.
- It helps in performing different kinds of tests at affordable rates.
- It increases the efficiency of test centers, medical facilities, and diagnostic centers (small, medium, or large).

Overall, the working principle of a biochemistry analyzer is based on the interaction between the biological sample and specific reagents, and the detection and measurement of the resulting chemical reactions.

2.10ELECTROCARDIOGRAM:

An electrocardiogram (ECG or EKG) records the electrical signal from the heart to check for different heart conditions. Electrodes are placed on the chest to record the heart's electrical signals, which cause the heart to beat. The signals are shown as waves on an attached computer monitor or printer.

An electrocardiogram is a painless, non-invasive way to help diagnose many common heart problems.

Normal ECG values for waves and intervals are as follows: RR interval: 0.6-1.2 seconds. P wave: 80 milliseconds. PR interval: 120-200 milliseconds.

Electrocardiogram:



Fig:2.10.1

A health care provider might use an electrocardiogram to determine or detect:

- Irregular heart rhythms (arrhythmias)
- If blocked or narrowed arteries in the heart (coronary artery disease) are causing chest pain or a heart attack
- Whether you have had a previous heart attack
- How well certain heart disease treatments, such as a pacemaker, are working

You may need an ECG if you have any of the following signs and symptoms:

- Chest pain
- Dizziness, lightheadedness or confusion
- Heart palpitations
- Rapid pulse
- Shortness of breath

The American Heart Association doesn't recommend using electrocardiograms to assess adults at low risk who don't have symptoms. But if you have a family history of heart disease, your health care provider might suggest an as a screening test, even if you have no symptoms. If symptoms tend to come and go, they may not be detected during a standard ECG recording. A health care provider might recommend remote or continuous ECG monitoring.

Electrocardiogram:

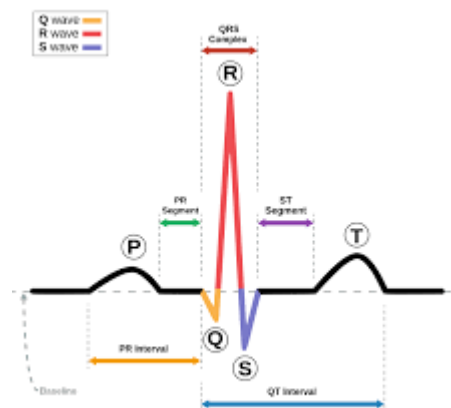


Fig:2.10.2

ECG results can give a health care provider details about the following:

Heart rate: Usually, heart rate can be measured by checking the pulse. An ECG may be helpful if your pulse is difficult to feel or too fast or too irregular to count accurately. An ECG can help identify an unusually fast heart rate (tachycardia) or an unusually slow heart rate (bradycardia).

Heart rhythm: An ECG can detect irregular heartbeats (arrhythmias). An arrhythmia may occur when any part of the heart's electrical system doesn't work properly.

Heart attack: An ECG can show evidence of a previous heart attack or one that's currently happening. The patterns on the ECG may help determine which part of the heart has been damaged, as well as the extent of the damage.

Blood and oxygen supply to the heart: An ECG done while you're having symptoms can help your health care provider determine whether reduced blood flow to the heart muscle is causing the chest pain.

Heart structure changes: An ECG can provide clues about an enlarged heart, heart defects and other heart problems.

ECG waveforms:

P-waves: atrial depolarisation. YQRS complexes (<120 ms): ventricular depolarisation. If first deflection is down it is a Q-wave, if the first deflection is up it is an R-wave .T-waves: ventricular repolarisation U-waves: sometimes seen, origin disputed. May be pathological if follows abnormal T-wave.

III CONCLUSION:

On the whole, this internship was a useful experience. I have gained new knowledge and studied about biomedical instruments. I achieved several of my learning in biomedical instruments, however for some the conditions did not permit .I got insight into professional practice.I learned more about the medicines and medical instruments such as x-rays, CT scan, biochemistry.....There is still a lot to discover and to improve .The methods used at the moment are still not standardized and a consistent method is in development . The internship was also good to find my strengths and weaknesses are. This help me to define what skills

and knowledge I have to improve in the coming time. It would be better that the level of analytical skills is sufficient knowledge. At last this internship has given me a motivation to pursue a career in public health administration.

