



**CHANDIGARH
UNIVERSITY**

Discover. Learn. Empower.

INSTITUTE-UNIVERSITY INSTITUTE OF ENGINEERING

ACADEMIC UNIT-II

Computer Science Engineering

Subject Name-Biology For Engineers

Subject Code- 20SZT148



**MEDICAL INSTRUMENTATION AND
TECHNIQUES**

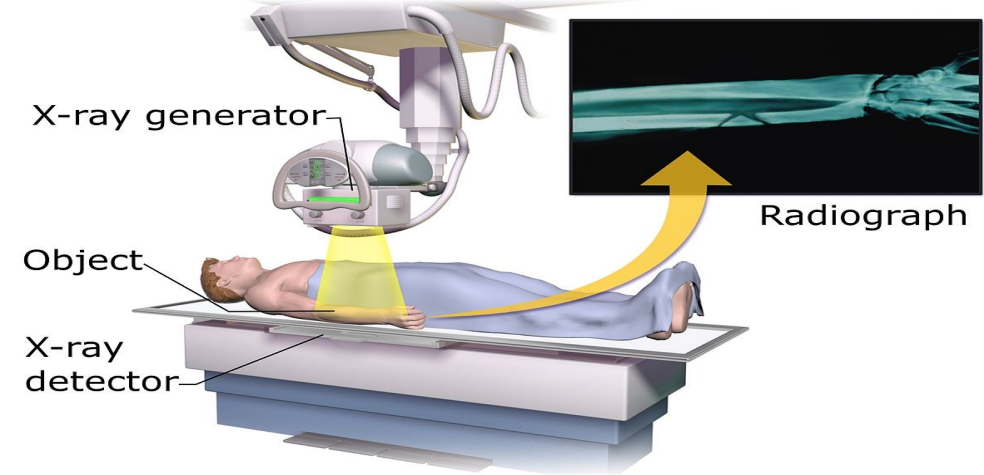
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MEDICAL INSTRUMENTATION AND TECHNIQUES

Course Outcome

CO Number	Title	Level
CO1	It gives an idea about the about the basic cell biology.	Understanding
CO2	It deals with the idea of uses of biology in engineering.	Understanding
CO3	It provide knowledge about the uses of softwares in biology field.	Remembering

Projectional radiography



Will be covered in this
lecture

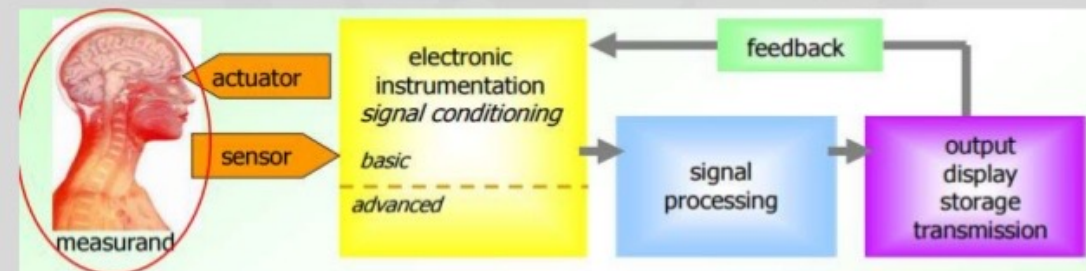
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https://en.wikipedia.org/wiki/X-ray_machine

MEDICAL INSTRUMENTATION AND TECHNIQUES

- Bioinstrumentation or Biomedical Instrumentation is an application of biomedical engineering, which focuses on the devices and mechanics used to measure, evaluate, and treat biological systems.
- It focuses on the use of multiple sensors to monitor physiological characteristics of a human or animal. A medical device is any device intended to be used for medical purposes.

Biomedical Instrumentation : Biomedical Instrumentation is the field of creating such instruments that help us to measure, record and transmit data to or from the body



COMPONENT OF MAN INSTRUMENT SYSTEM

Wednesday, March 30, 2016

4

<https://www.slideshare.net/PrincyRandhawa/biomedical-instrumentation-60215990>

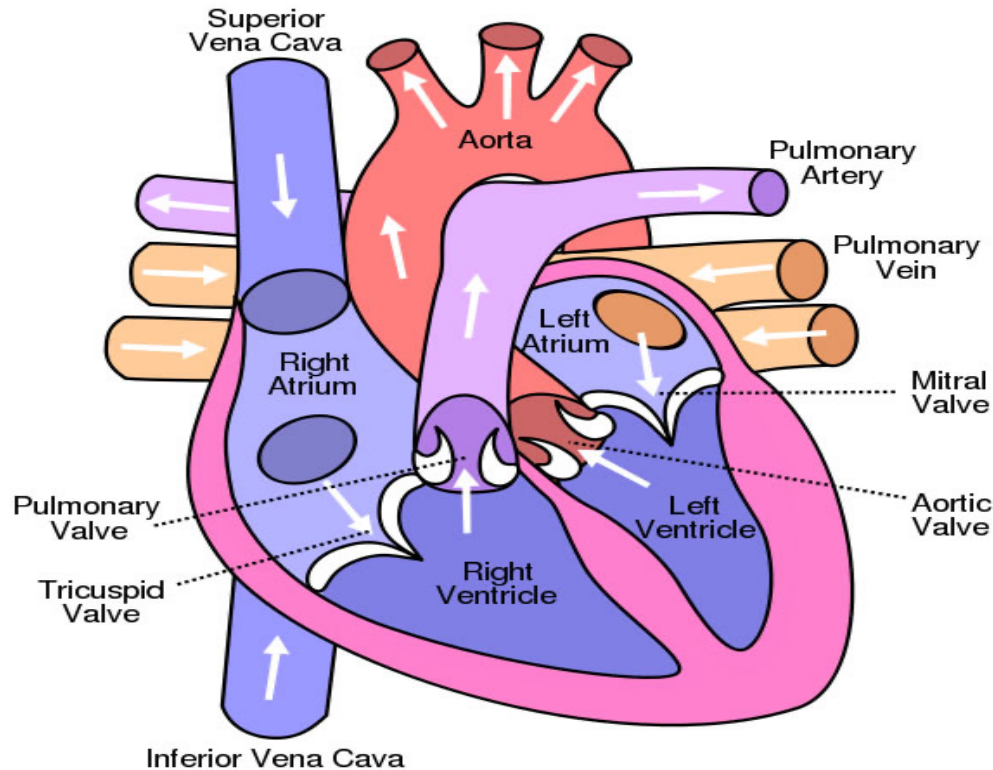
MEDICAL INSTRUMENTATION AND TECHNIQUES

- Medical devices benefit patients by helping health care providers diagnose and treat patients and helping patients overcome sickness or disease, improving their quality of life.
- Instrument engineers manage, design, and install the machines or control systems used in highly technical fields.
- Many industrial and manufacturing plants use instrumentation systems to monitor their facilities.
- These instruments measure temperature, pressure, radiation, voltage, and other variables. Instrumentation is further classified into many types such as electrical instrumentation, industrial instrumentation, electronics instrumentation, mechanical instrumentation

ECG

- This is the graphic records of the variations in electrical potential caused by electrical activity of the heart muscle and detected at the body surface, as a method for studying the action of the heart muscle.
- As the cardiac impulse passes through the heart, electrical currents spread into the tissues surrounding the heart, and a small proportion of these spreads all the way to the surface of the body.
- If electrodes are placed on the skin on opposite sites of the heart, electrical potentials generated by these currents can be recorded; the recording is known as an electrocardiogram and abbreviated as ECG or EKG.

ECG



<https://www.sciencekids.co.nz/pictures/humanbody/heartdiagram.html>

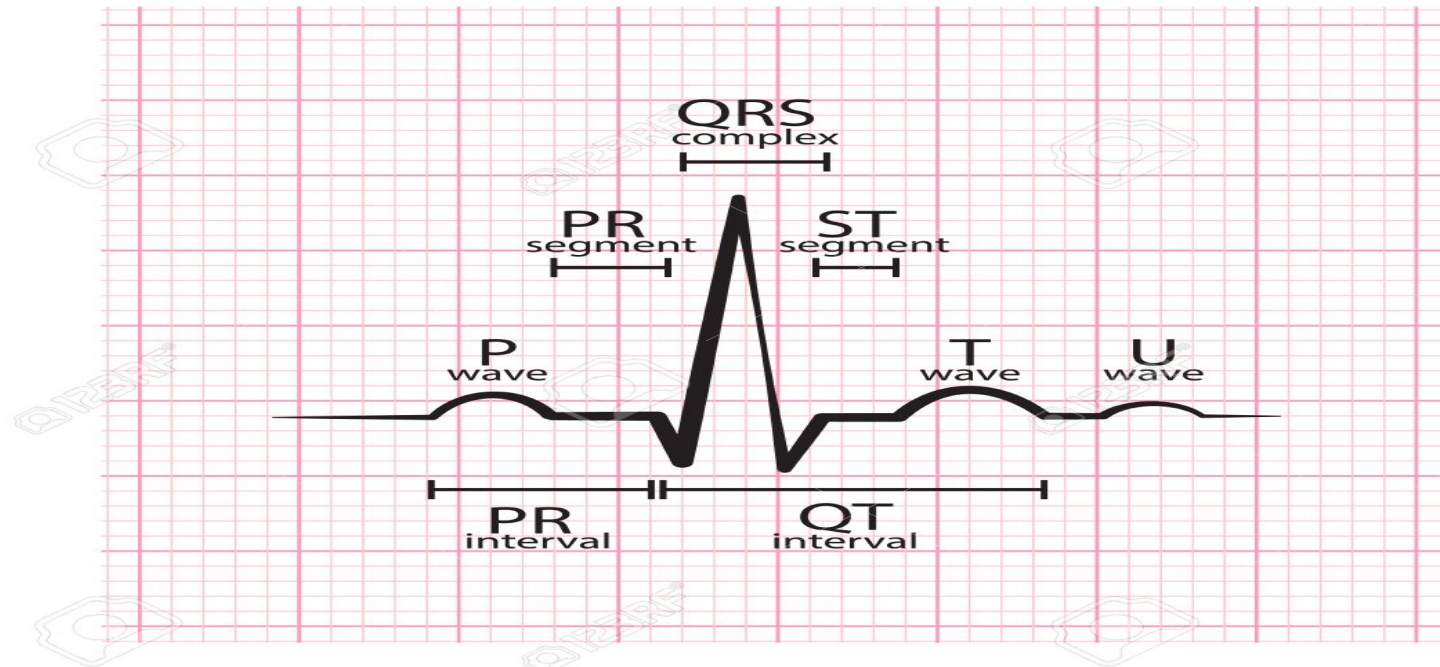
- The right atrium receives blood from the veins and pumps it to the right ventricle.
- The right ventricle receives blood from the right atrium and pumps it to the lungs, where it is loaded with oxygen.
- The left atrium receives oxygenated blood from the lungs and pumps it to the left ventricle. The left ventricle pumps oxygen-rich blood to the rest of the body. The left ventricle's vigorous contractions create our blood pressure.

CHARACTERISTICS OF NORMAL ECG

- The normal ECG is composed of ‘P’ wave, a ‘QRS’ complex, and a ‘T’ wave. The QRS complex is often three separate waves, the Q wave, the R wave and the S wave.
- The P wave is caused by electrical potentials generated as the atria depolarize prior to contraction.
- The QRS complex is caused by potentials generated when the ventricles depolarize prior to contraction, that is as the depolarization wave spreads through the ventricles. Therefore, both the P waves and the components of the QRS complex are “**depolarization waves.**”
- The T wave is caused by potentials generated as the ventricles recover from the state of depolarization. This wave is known as “repolarization wave.” Thus, the electrocardiogram is composed of both depolarization and repolarization waves.

NORMAL ECG GRAPH

NORMAL ECG



https://www.123rf.com/photo_55067903_stock-vector-normal-ecg-electrocardiogram-p-wave-pr-segment-pr-interval-qrs-complex-qt-interval-st-segment-t-wave.html

WHY ECG DONE

- An electrocardiogram is a painless, noninvasive way to help diagnose many common heart problems in people of all ages.
- Your doctor may use an electrocardiogram to determine or detect:
 - Abnormal heart rhythm (arrhythmias)
 - If blocked or narrowed arteries in your 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

WHY ECG DONE

- 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
- Weakness, fatigue or a decline in ability to exercise

PROCEDURE OF ECG

- A technician will attach 10 electrodes with adhesive pads to the skin of your chest, arms, and legs. If you're a guy, you may need to have your chest hair shaved to allow a better connection.
- During the test you'll lie flat while a computer creates a picture, on graph paper, of the electrical impulses that move through your heart. This is called a "resting" EKG, although the same test may be used to check your heart while you exercise.
- It takes about 10 minutes to attach the electrodes and complete the test, but the actual recording takes only a few seconds.
- Your doctor will keep your EKG patterns on file so that he can compare them to tests you get in the future.

EMG

- Electromyography (EMG) is a diagnostic procedure that evaluates the health condition of muscles and the nerve cells that control them.
- These nerve cells are known as motor neurons. They transmit electrical signals that cause muscles to contract and relax.
- An EMG translates these signals into graphs or numbers, helping doctors to make a diagnosis.
- A doctor will usually order an EMG when someone is showing symptoms of a muscle or nerve disorder.
- These symptoms may include tingling, numbness, or unexplained weakness in the limbs. EMG results can help the doctor diagnose muscle disorders, nerve disorders, and disorders affecting the connection between nerves and muscles.

WHY EMG DONE

Your doctor may perform an EMG if you're experiencing symptoms that may indicate a muscle or nerve disorder. Some symptoms include:

- tingling
- numbness
- muscle weakness
- muscle pain or cramping
- paralysis
- involuntary muscle twitching (or tics)



<https://www.crortho.com/services-emg.php>

WHY EMG DONE

- The results of an EMG can help your doctor determine the underlying cause of these symptoms. Possible causes could include:
- muscle disorders, such as muscular dystrophy
- disorders that affect the ability of the motor neuron to send electrical signals to the muscle, such as myasthenia gravis
- radiculopathies
- peripheral nerve disorders that affect the nerves outside the spinal cord
- nerve disorders, such as amyotrophic lateral sclerosis (ALS)

PROCEDURE OF EMG

- There are two components to an EMG test: the nerve conduction study and needle EMG. The nerve conduction study is the first part of the procedure.
- It involves placing small sensors called surface electrodes on the skin to assess the ability of the motor neurons to send electrical signals.
- The second part of the EMG procedure, known as needle EMG, also uses sensors to evaluate electrical signals.
- The sensors are called needle electrodes, and they're directly inserted into muscle tissue to evaluate muscle activity when at rest and when contracted.
- The nerve conduction study is performed first. During this portion of the procedure, your doctor will apply several electrodes to the surface of your skin, usually in the area where you're experiencing symptoms.

PROCEDURE OF EMG

- These electrodes will evaluate how well your motor neurons communicate with your muscles. Once the test is complete, the electrodes are removed from the skin.
- After the nerve conduction study, your doctor will perform the needle EMG. Your doctor will first clean the affected area with an antiseptic.
- Then, they will use a needle to insert electrodes into your muscle tissue. You may feel slight discomfort or pain while the needle is being inserted. The needle electrodes will evaluate the electrical activity of your muscles when contracted and when at rest. These electrodes will be removed after the test is over.
- During both parts of the EMG procedure, the electrodes will deliver tiny electrical signals to your nerves. A computer will translate these signals into graphs or numerical values that can be interpreted by your doctor. The entire procedure should take between 30 and 60 minutes.

CONCLUSION

- An electrocardiogram (ECG) is a medical test that detects cardiac (heart) abnormalities by measuring the electrical activity generated by the heart as it contracts.
- Any irregularity in the heart rhythm or damage to the heart muscle can change the electrical activity of the heart so that the shape of the ECG is changed.
- Electromyography (EMG) is a diagnostic procedure that evaluates the health condition of muscles and the nerve cells that control them.
- These nerve cells are known as motor neurons.
- They transmit electrical signals that cause muscles to contract and relax.

ASSESSMENT PATTERN

Assessment Pattern	Total Marks
1 st Hourly Test	36
2 nd Hourly Test	36
Surprise Test	12
Assignment (3)	10
Tutorial sheet	12
End Semester Examination	60

APPLICATIONS

- Improving quality of life is one of the main benefits of integrating new innovations into medicine. Medical technologies like minimally-invasive surgeries, better monitoring systems, and more comfortable scanning equipment are allowing patients to spend less time in recovery and more time enjoying a healthy life.
- To Improve Diagnosis and Treatment for Patients.
- To Support Remote Monitoring of Chronic Diseases.
- To Improve Patient Safety and Drug Management.
- To Facilitate Better Long Term Disease Management.
- To Decrease Costs While Improving Patient Care Outcomes.

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THANK YOU

For queries
Email: subject_code_2020@gmail.com