AM RECEIVER shows the block diagram of AM receiver with a superheterodyne technique. As shown in Fig. Q.37.1 antenna pick up the weak radio signal and feeds it to the RF amplifier. The RF amplifier provides some initial gain and selectivity.*The output of the RF amplifier is applied to the input of the mixer. The mixer also receives an input from local oscillator. *The output of the mixer circuit is difference frequency (fo - fg)commonly known as IF (Intermediate Frequency). The signal at this intermediate frequency contains the same modulation as the original carrier. *This signal is amplified by one or more IF amplifier stages and most of the receiver gain is obtained in these IF stages. *The highly amplified IF signal is applied to detector circuits to recover the original modulating information. * Finally, the output of detector circuit is fed to audio and power amplifier which provides a sufficient gain to operate a speaker. • Another important circuit in the superheterodyne receiver are AGC and AFC circuit. • AGC is used to maintain a constant output voltage level over a wide range of RF input signal levels. • It derives the d.c. bias voltage from the output of detector which is proportional to the amplitude of the received signal. This d.c. bias voltage is feedback to the IF amplifiers and sometimes to the RF amplifier, to control the gain of the receiver. As a result, it provides a constant output voltage level over a wide range of RF input signal levels. *AFC circuit generates AFC signal which is used to adjust and stabilize the frequency of the local oscillator.

FM receive r• R.F. Amplifier Stage: Since F.M. signal has a larger bandwidth it is likely to encounter more noise. Hence to reduce the noise figure of the receiver, an RF amplifier stage is used. The RF amplifier stage matches the antenna to the receiver. • Mixer Stage: With the help of local oscillator, this stage down converts the incoming carrier frequency to IF, which is 10.7 MHz for F.M. receiver. L.F.Amplifier Stage: In the I.F. amplifier stages, the most of the gain of receiver is developed. • Limiter Stage: To remove the amplitude variations of the signal is the main function of the limiter. At the output of the limiter stage, we get a constant amplitude signal, even though the amplitude of input signal may be varying.*. FM Demodulators: FM demodulators, change the frequencydeviation of the incoming carrier into an AF amplitude variation (identical to the one that originally caused the frequency variation).

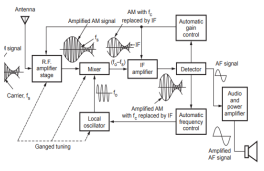
The LVDT, which stands for Linear Variable Differential Transformer, is a type of electromechanical transducer used to measure linear displacement or position. It is widely used in various industrial applications and precision measurement systems. The LVDT is a robust and reliable device that provides accurate and repeatable measurements.

The basic working principle of an LVDT involves the use of a transformer with a movable ferromagnetic core. The transformer has three coils wound on a cylindrical bobbin, which is typically made of non-magnetic material. The three coils are:

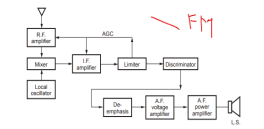
1. Primary Coil: This coil is supplied with an alternating current (AC) voltage, usually at a fixed frequency.
2. Two Secondary Coils: These are placed symmetrically on either side of the primary coil and are connected in series but with opposite polarities. When the core is in the central or null position, equal voltages are induced in both secondary coils, and their outputs cancel each other out.

Here's how the LVDT works:

1. Null Position: When the core is in its central or null position, equal magnetic flux links both secondary coils, resulting in equal and opposite voltages induced in the secondary windings. This balanced condition is known as the null position, and the output voltage of the LVDT is zero.
2. Core Displacement: When the core moves from the null position due to an applied force or displacement, the magnetic coupling between the core and the secondary coils changes. This causes an imbalance in the induced voltages in the two secondary coils.
3. Output Voltage: The output voltage of the LVDT is the difference between the voltages induced in the two secondary coils. The magnitude and polarity of this output voltage are proportional to the displacement of the core from its null position. As the core moves back and forth, the LVDT provides an output voltage that represents the linear displacement.



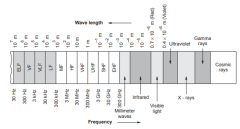
Am



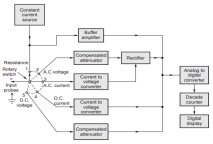
Biosensor -A biosensor is a device that measures biological or chemical reactions by generating signals proportional to the concentration of an analyte in the reaction. It includes a combination of biological detecting elements like sensor system and a transducer.*A typical biosensor is represented in Fig 11.14.1. It consists of the following components:1. Analyte2. Bioreceptor3.Transducer
• Analyte : A substance of interest that needs detection. For instance, glucose is an 'analyte' in a biosensor designed to detect glucose. •Bioreceptor : A molecule that specifically recognizes the analyte is known as a bioreceptor. Enzymes, cells, aptamers, deoxyribonucleic acid (DNA) and antibodies are some examples of bioreceptors. The process of signal generation (in the form of light, heat, pH, charge or mass change, etc.) upon interaction of the bioreceptor with the analyte is termed bio-recognition.• Transducer : In a biosensor the role of the transducer is to convert the bio-recognition event into a measurable signal.*
Biosensors are employed in applications such as disease monitoring, drug discovery, and detection of pollutants, disease-causing micro-organisms and markers that are indicators of a disease in bodily fluids (blood, urine, saliva, sweat). -WORKING PRIN-
• Biosensors are operated based on the principle of signal transduction. These components include a bio-recognition element, a biotransducer and an electronic system composed of a display, processor and amplifier.
*The bio-recognition element, essentially a bioreceptor, is allowed to interact with a specific analyte. The transducer measures this interaction and outputs a signal. The intensity of the signal output is proportional to the concentration of the analyte. The signal is then amplified and processed by the electronic system.

Em eprectrum :
In wireless communication, electromagnetic waves are used as a media of transfer of information. Thus in such a communication, the information signal is converted into the electromagnetic signal before transmission.
The electromagnetic (EM) waves consist of both electric and magnetic fields and they can travel a long distance through space. The range of all possible frequencies of EM waves is called the electromagnetic (EM) spectrum*ig. 12.8.1 shows the electromagnetic spectrum. The electromagnetic spectrum, shown in the Fig 12.8.1 extends from just below the frequencies used for modern radio (at the long-wavelength end) to gamma radiation (at the short-wavelength end).* In the midrange includes most commonly used radio frequencies for two-way communications, television and other applications.
*The infrared and visible light are at the upper and of the EM spectrum

<- should be selected to suit its output type: Discrete or Analog
.7. Cost and availability: General factors involved in selection are cost and availability.8.Simplicity, reliability and low maintenance : A sensor should be selected acc. to its simplicity, reliability andmaintenance cost.



types of transducer : Piezoelectric Transducers: These transducers generate electrical charges when subjected to mechanical stress, such as pressure or vibrations. Conversely, they can also change shape when an electric field is applied to them. They are used in microphones, ultrasound devices, vibration sensors, and actuators. Thermocouples: Thermocouples are temperature transducers that produce a voltage proportional to the temperature difference between two junctions made of different metals. They are widely used for temperature measurements in industrial processes, heating, and cooling systems. Photodetectors: These transducers convert light energy into electrical signals. Photodiodes and phototransistors are common examples used in light sensors, optical communication, and electronic control circuits .Pressure Transducers: Pressure transducers measure pressure and convert it into an electrical signal. They are employed in pressure measurement systems for industrial processes, weather monitoring, and hydraulic systems.Ultrasonic Transducers: Ultrasonic transducers emit and receive ultrasonic waves. They are used in ultrasonic sensors, distance measurement devices, and medical imaging equipment like ultrasound machines.



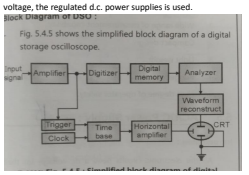
Criteria of sensor : 1. Nature of measurement : The selection of sensor will naturally depend upon the nature of quantity to be measured.2. Sensing range : Sensors should be selected acc. to their sensing range.3. Response speed: As per the requirements of application sensor must be selected according to response speed.
4.Required resolution and sensitivity: As per the requirement of application, sensor should be selected according to required resolution and accuracy.
5. Repetition accuracy: Repetition accuracy of the sensor should be considered while selecting the sensor.6. Outputtype: Depending on the application the sensor <-

refer Fig. 5.4.5 to understand the **working of DSO**. The input amplifier attenuates and amplifies the analog input signal as per requirement.*The amplified analog signal is applied to the digitizer. The digitizer has two blocks; a sampler and an Analog to Digital (A to Digital) converter. The sampler samples the amplified analog signal at regular intervals to produce its sampled version which is a discrete signal and represents the input waveform faithfully.*The A/D converter converts each sampled value into an equivalent digital word. Thus the input signal is digitized.*The digitized signal is stored in the semiconductor memory.*The analyzer circuit fetches the stored waveform from the memory and analyzes it to produce a variety of different information.*The Waveform reconstruction block reconstructs the waveform from the digital information in a rapid and repeatitive manner and applies it to the pair of vertical deflecting plates.*The sweep or time base signal is a saw tooth waveform that is amplified by the horizontal amplifier and applied it to the horizontal deflecting plates as shown.*The CRT displays the stored digitized waveform. **Advantages of DSO** :1. Digitized signals can be stored for a very long time.2. Signal processing is possible. 3.Cursor measurement is possible.4. It is capable of displaying X-Y plots, p-V diagram, BH curves. **Applications of Dso**-1.For measurements of AC voltage as well as AC currents.2. Measurement of frequency, time period, inductance, capacitance etc.3. In radars.4. Medical applications

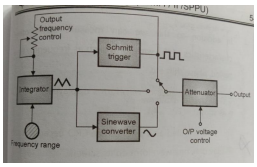
Function g :It shows that the output of an integrator is connected to the inputs of Schmitt trigger as well as a sine wave generator.*The square wave output of the Schmitt trigger is connected to the input of the integrator which produces a triangular wave at its output. *A rotary switch SW is used for selecting one of the functions (square, sine or triangular) to the output stage which is generally an attenuator. *The sine wave converter is a wave shaping circuit using diodes which converts the triangular wave to a sine wave. The Schmitt trigger converts the triangular wave from the integrator into a square wave. *The attenuator provides the output voltage control in steps as well as fine control. It provides various ranges of output voltage and smooth variation of voltage within the selected range. *The minimum output frequency range is from 20 Hz to 20 kHz (audio frequency range) but the modern function generators cover a much wider frequency range (0.01 Hz to 3 MHz).Fig. 5.3.3 shows the front panel controls of a typicalfunction generator.

powerscope :-The block diagram of powerscope is shown in Fig. Q.8.1. the• The input signal is attenuated by a factor of 20 by the input attenuators. Further reduction in sensitivity is provided by the differential compensated attenuators.

• The input stage consists of matched pair of FETS operating as source followers, driving a pair of emitter followers giving a current gain required to drive a main amplifier. The vertical deflection system provides calibrated deflection factors from about 50 mV/div to 200 V/div, for both the channels.*The trace is switched between the two channels at a rate of 100 kHz in CHOP mode and alternating between sweeps in ALT mode. in CHOP mode, additional blanking is provided to eliminate the switching transients. ALT or CHOP automatically selected by time/div control. mode gets--Triggering circuit provide stable sweep triggering which extends beyond the bardwidth of the vertical de lection system.• The horizontal deflection system has calibrated sweep rates from 0.5 s/div to 0.2µs/div. X10 magnifier extends fastest rate to 20 ns/div.• Variable sweep control provides continuous reduction of sweep rate. Triggering is automatic internal/externa or line sourcesT.V. signals can be filtered using T.V. synchronous circuit. The signals are used to look LINE or FRAME pulses easily and hence it is very useful in T.V. troubleshooting applications.• XY mode and Z-modulation are added features. The calibrator output provides calibration check and probe compensation facility.• The output signals from Y_1 and Y_2 are connected to storage C.R.O. To eliminate the effects of variations in line voltage, the regulated d.c. power supplies is used.



Function generator (below)



Principle of operation:stain gauge
*Strain gauge is a passive, resistive transducer which converts the mechanical elongation and compression into a proportional resistance change.
*This change in resistance takes place due to variation in length and cross sectional area of the gauge wire, when an external force acts on it.
*The variation in resistance is converted into variations in voltage by connecting the strain gauge in a Wheatstone bridge.
***Sensitivity or Gauge factor**:
The characteristics of a strain gauge are described in terms of its sensitivity which is also called as gauge factor, of the strain gauge.
The Gauge Factor (G.F.) is defined as the unit change in resistance per unit change in length of the strain gauge wire.

GSM: The block diagram of GSM (Global System for Mobile Communications) represents the key functional components and their interconnections in a GSM network. Here's a concise explanation of each block:
*Mobile Station (MS): The MS refers to the mobile device used by the end-user, such as a cell phone or GSM-enabled smartphone.*Base Transceiver Station (BTS): The BTS is responsible for establishing communication with the mobile station by transmitting and receiving radio signals. It handles tasks like modulation, coding, and transmission of data. Base Station Controller (BSC): The BSC manages multiple BTS units and handles call setup, handover decisions (when a mobile moves from one BTS coverage area to another), and resource allocation.* Mobile Switching Center (MSC): The MSC is the central part of the GSM network responsible for call routing and switching. It connects mobile calls to other mobiles or to the Public Switched Telephone Network (PSTN).Home Location Register (HLR): The HLR is a database that stores subscriber-related information such as the current location, service profile, and authentication key. It is used for call routing and authentication purposes.Visitor Location Register (VLR): The VLR is a temporary database that stores information about roaming subscribers who are currently in a specific area covered by a particular MSC. It reduces the need to query the HLR frequently for roaming users. Authentication Center (AuC): The AuC is responsible for subscriber authentication and security functions. It stores authentication and encryption parameters used to verify the identity of subscribers.
Coaxial cable, often simply referred to as "coax," is a type of transmission line used for transmitting high-frequency electrical signals. It consists of a central conductor, which is typically a copper or copper-coated wire, surrounded by an insulating material called the dielectric. The dielectric is then encased in an outer conductor, usually made of a woven copper mesh or a metallic foil, which serves as the shield. The outer conductor is further covered by an insulating sheath, providing protection and durability to the cable. Characteristics :-High-frequency transmission: Coaxial cables are designed to handle high-frequency signals effectively, making them suitable for applications such as cable television (CATV), satellite communication, broadband internet, and data networking.

Signal integrity: The design of coaxial cables provides excellent signal integrity and minimal signal loss over long distances. This makes them suitable for applications where signal quality is crucial.
Noise immunity: The outer shielding of coaxial cables provides good immunity against electromagnetic interference (EMI) and radio frequency interference (RFI). It helps maintain signal quality even in environments with high levels of electrical noise.

Core: The core is the innermost section of the fiber optic cable, and its primary function is to carry the light signals containing data. It is made of optically pure glass or plastic and is designed to enable total internal reflection, ensuring that the light signals travel within the core without significant signal loss.Cladding: Surrounding the core is the cladding, which serves to confine the light signals within the core. It has a slightly lower refractive index than the core, enabling total internal reflection by reflecting the light signals back into the core when they encounter the core-cladding boundary at a specific angle. Buffer Coating: The buffer coating is a protective layer around the cladding, providing mechanical protection to the delicate core and cladding. Made of a tough polymer material, the buffer coating helps prevent damage from bending and external stresses during installation and handling.
Strength Members: Some fiber optic cables include strength members to provide additional support and tensile strength. Typically made of aramid fibers or fiberglass, these strength members prevent the cable from stretching or breaking when subjected to pulling forces during installation or harsh environmental conditions.Jacket: The outermost layer of the fiber optic cable is the jacket or sheath. It acts as the primary protective covering for the entire cable, safeguarding it against physical damage, moisture, and environmental factors. The jacket's durability ensures the longevity and reliability of the fiber optic cable.

Instrumaintation
Measurand: Most of the times input to the instrumentation system is the physical quantity such as temperature, pressure, displacement, force, etc. Such non-electrical input quantity is called measurand. Transducer: A transducer converts the non-electrical input measurand into a proportional electrical signal such as voltage or currentSignal Conditioning Element: The signal conditioning element processes the output of the transducer and makes it suitable for control, recording and display. Data Transmission Element: The data transmission element provides the transmission path required for sending the signal from signal conditioning element to the other stages of the instrumentation system .Data Presentation Element: The transmitted data may be used for monitoring, controlling or analysing purposes.Controller, Recorder, Printer and Display Units: Controllers are used to make the corrective action and control certain parameters. On the other hand, recorder, printer and display units are used to monitor the variations in the certain parameters.