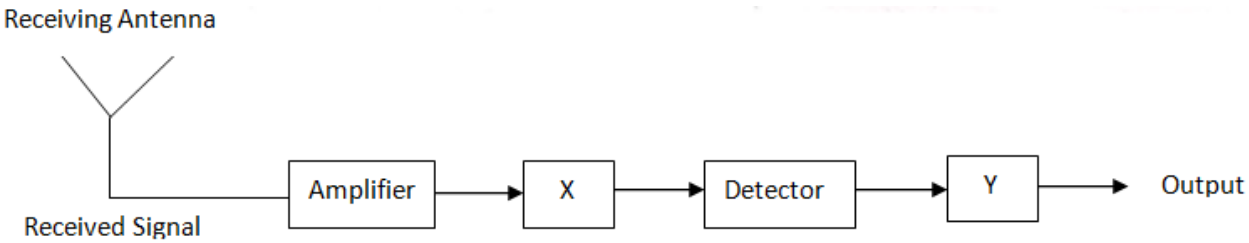
Q15. Block diagram of a receiver is shown in the figure:



(a) Identify 'X' and 'Y'.
(b) Write their functions.

Answer: (a)
X is intermediate frequency amplifier
Y is audio frequency amplifier

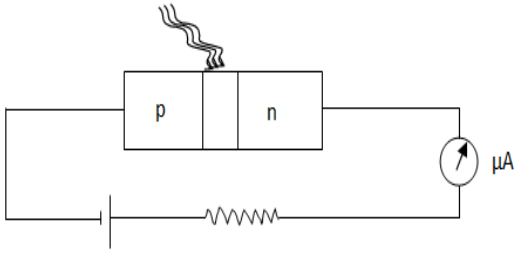
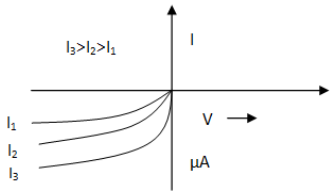
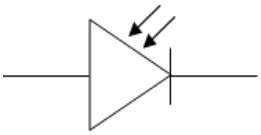
(b) Function of X (IF amplifier): The stages of an intermediate frequency amplifier are tuned to a fixed frequency that does not change as the receiving frequency changes. Typically, the IF centre frequency is chosen to be less than the desired reception frequency. The choice has some performance advantages e.g. it is easier and less expensive to get high selectivity at a lower frequency, secondly it is easier and less expensive to get high gain at a lower frequency. Usually the intermediate frequency is lower than the reception frequency, but in some modern receivers (e.g. scanners and spectrum analyzers) a higher IF frequency is used to minimize problems with image rejection or gain the benefits of fixed-tuned stages. The fixed frequency simplifies optimization of the IF amplifier Intermediate-Frequency (IF) amplifiers are used to raise the signal level to a level that can be used by the decision making circuits to properly utilize the received information. While raising the signal level, they must also remove adjacent channel interference and images with filters so that only the desired signal passes. The constant frequency of the down converted signal is called the intermediate frequency (IF), and it is this signal that is processed by the intermediate-frequency amplifier.

Audio frequency Amplifier: An amplifier is used to increase the amplitude of a signal waveform, without changing other parameters of the waveform such as frequency or wave shape.

Q16. Explain, with the help of a circuit diagram, the working of a photo-diode. Write briefly how it is used to detect the optical signals.

Answer:

Photodiode: It is a p-n junction with transparent window which allows light photons to incident on it. A photo diode is operated in reverse bias condition.

Circuit diagram:	**V-I Characteristics**:	**Symbol**:
		

Working: When a photon of sufficient energy enters the depletion region of a semiconductor diode, it may strike an atom with sufficient energy to release the electron from the atomic structure. This creates a free electron and a hole (i.e. an atom with a space for an electron). The electron is negatively charged, while the hole is positively charged. The electrons and holes may remain free, or other electrons may combine with holes to form complete atoms again in the crystal lattice. However it is possible that the electrons and holes may remain free and be pulled away from the depletion region by an external field. In this way the current through the diode will change and a photocurrent is produced.

It is found that the current is proportional to the amount of light entering the intrinsic region. The more light, the greater the numbers of hole electron pairs that are generated and the greater the current flowing.

When not exposed to light the photo diode follows a normal V-I characteristic expected of a diode. In the reverse direction virtually no current flows, but in the forward direction it steadily increases, especially after the knee or turn on voltage is reached. This is modified in the presence of light. When used as a photo-diode it can be seen that the greatest effect is seen in the reverse direction. Here the largest changes are observed. This property is used in detecting optical or light signal.