

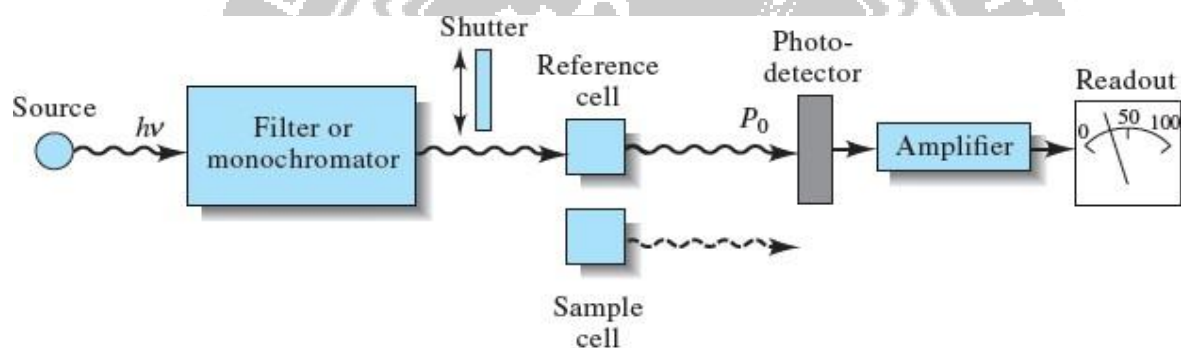
## 2.3 TYPES OF INSTRUMENTS:

Four general types of spectroscopic instruments:

- single beam,
- double beam in space,
- double beam in time, and
- multichannel.

Single-Beam Instruments :

- Figure below is a schematic of a single-beam instrument for absorption measurements.



(a)

In (a), a single-beam instrument is shown. Radiation from the filter or monochromator passes through either the reference cell or the sample cell before striking the photo detector. It consists of a tungsten or deuterium lamp as source, a filter or a monochromator for wavelength selection, matched cells that can be placed alternately in the radiation beam, transducers, an amplifier, and a readout device. Normally, a single-beam instrument requires a stabilized voltage supply to avoid errors. Single-beam instruments vary in their complexity and performance characteristics.

The simplest and least expensive single-beam instruments consists of a battery-operated tungsten bulb as the source, a set of glass filters for wavelength selection, test tubes for sample holders, le-beam design. Figure below illustrates a double beam-in-space instrument using a photovoltaic cell as the transducer, and an analog meter as the readout device. The sophisticated, computer-controlled instruments with a range of 200 to 1000 nm or more. These spectrophotometers have interchangeable tungsten and deuterium lamp sources, use rectangular silica cells, a high-resolution grating monochromator with variable slits. Photomultiplier tubes used as transducers, and the

output is often digitized, processed, and stored in a computer so that it can be printed or plotted in several forms.

### Double-Beam Instruments:

Many modern photometers and spectro photometers are based on a double-beam instrument.

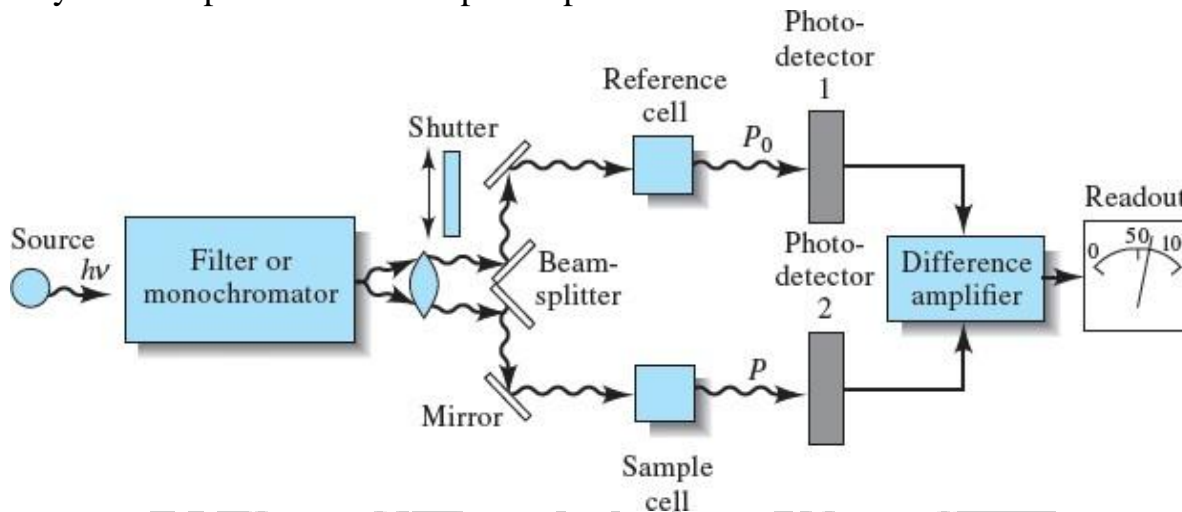


Fig (b), a double-beam-in-space instrument is shown. Here, radiation from the filter or Monochromator is split into two beams that simultaneously pass through the reference and sample cells before striking two matched photo detectors. In the double-beam-in-time instrument

- Two beams are formed in space by a V-shape mirror called a beam splitter.
- One beam passes through the reference solution to a photo detector, and the second simultaneously traverses the sample to a second, matched detector.
- The two outputs are amplified, and their ratio (or the logarithm of their ratio) is determined electronically or by a computer and displayed by the readout device.
- When the instrument is a manual instrument, the measurement is made in two steps.
- In the first step, zero adjustment is made with a shutter placed between selector and beam splitter.
- In the second step, the shutter is opened and the transmittance or absorbance is displayed directly.

