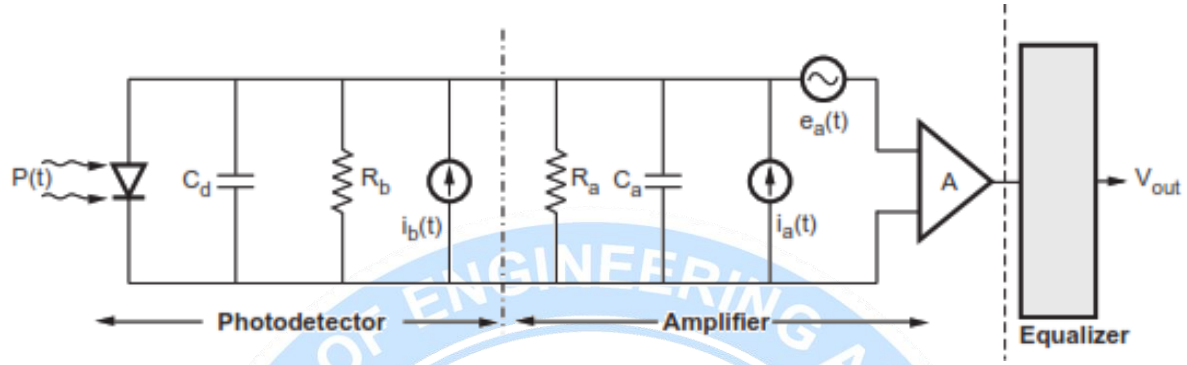
4.4 Receiver Configuration

- Configuration of typical optical receiver is shown in Figure. It has three basic stages



Photodetector parameters

1. PIN or APD type
2. Gain M = 1
3. Quantum efficiency r|
4. Capacitance Cd
5. Bias resistance Rb
6. Thermal noise current $i_b(t)$ generated by Rb-
7. Voltage appearing across resistor R_a causes current to flow in amplifier.

Amplifier parameters –

1. Input impedence R_a
2. Shunt input capacitance C_a
3. Transconductance g_m (Amp/volts)
4. Input noise current i_a (t) because of thermal noise of R_a
5. Input noise voltage source $e_a(t)$

- Equalizer is frequency shaping filter used to nullify the effects of signal distortion and ISI.

Expression for Mean Output Current from Photodiode

Assumptions :

1. All noise sources are Gaussian in statistics.
2. All noise sources are flat in spectrum.
3. All noise sources are uncorrelated (statistically independent).

- Binary digital pulse train incident on photodetector is given by -

$$P(t) = \sum_{n=-\infty}^{\infty} b_n \, h_p (t - nT_b)$$

where, P(t) is received optical power.

Tb is bit period.

b_n is amplitude parameter representing n^{th} message bit.

$h_{p(t)}$ is received pulse shape.

• At time t, the mean output current due to pulse train P(t) is -

$$\langle i(t) \rangle = \frac{nq}{h\nu} M P(t)$$

Where, M is gain of photodetector

$\frac{nq}{h\nu}$ is responsivity of photodiode (R_0).

- Neglecting dark current, the mean output current is given as -

$$\langle i(t) \rangle = \Re_0 M \sum_{n=-\infty}^{\infty} b_n h_p (t - n T_b)$$