Unit-4

Lecture -4

Characteristics, Reponse Time

Characteristics of Photodetectors

- ***Internal Quantum Efficiency***

$$\eta_i = \frac{\text{Number of Collected electrons}}{\text{Number of Photons *Entering* detector}} = \left[1 - e^{-\alpha W}\right]$$

- ***External Quantum efficiency***

$$\eta_e = \frac{\text{Number of Collected electrons}}{\text{Number of Photons *Incident* on detector}} = \frac{i_{ph}/q}{P_o/h\nu} = \left(1 - R_p\right)\left[1 - e^{-\alpha W}\right]$$

- ***Responsivity***

$$R = \frac{\text{Photo Current (Amps)}}{\text{Incident Optical Power (Watts)}} = \frac{i_{ph}}{P_o} = \frac{q}{h\nu}\left(1 - R_p\right)\left[1 - e^{-\alpha W}\right]$$

- ***Photocurrent***

Fraction Transmitted into Detector

$$i_{ph} = q\left[\frac{P_o}{h\nu}\right]\left(1 - R_p\right)\left[1 - e^{-\alpha W}\right] = RP_o$$

Incident Photon Flux (#/sec)

Fraction absorbed in

Responsivity

Output current per unit incident light power; typically 0.5 A/W

$$R = \frac{\eta e}{h\nu} M$$

Photodiode Responsivity

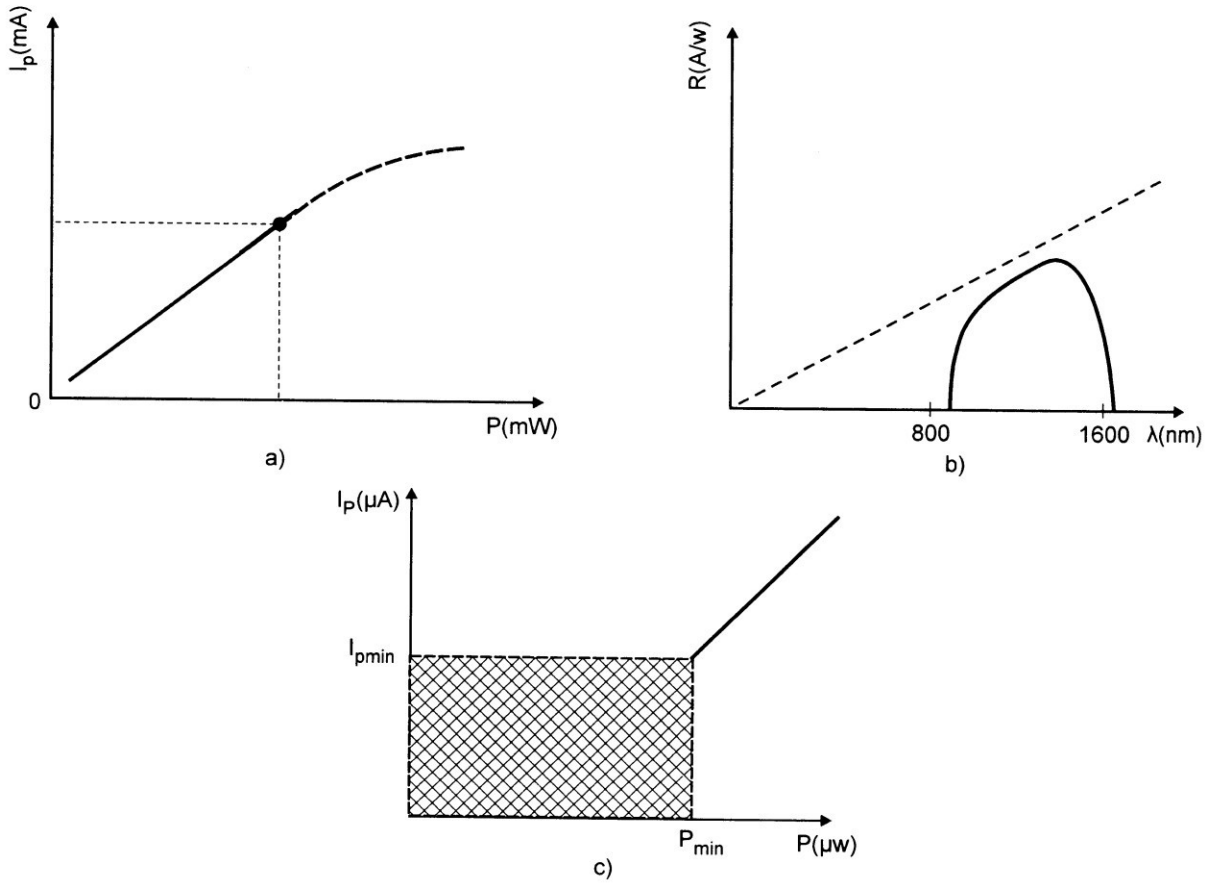

Figure 11.2 Responsivity of a photodiode: (a) Input–output characteristic; (b) responsivity vs. wavelength; (c) dark-current sensitivity.