CHAPTER 7

PRACTICE SET

Questions

Q7-1. The *transmission media* is located beneath the physical layer and controlled by the physical layer.

Q7-3. *Guided media* have physical boundaries, while unguided media are unbounded.

Q7-5. *Twisting* ensures that both wires are equally, but ***inversely***, affected by external influences such as noise.

Q7-7. The *inner core* of an optical fiber is surrounded by *cladding*. The core is denser than the cladding, so a light beam traveling through the core is reflected at the boundary between the core and the cladding if the incident angle is more than the critical angle.

Q7-9. In *sky propagation* radio waves radiate upward into the ionosphere and are then reflected back to earth. In *line-of-sight propagation* signals are transmitted in a straight line from antenna to antenna.

Problems

P7-1. See the following table (the values are approximate).

Distance	*dB at 1 KHz*	*dB at 10 KHz*	*dB at 100 KHz*
1 Km	−3	−5	−7
10 Km	−30	−50	−70
15 Km	−45	−75	−105
20 Km	−60	−100	−140

P7-3. We can use the table in P7-1 to find the power for different frequencies:

1 KHz	dB = –3	$P_2 = P_1 \times 10^{-3/10}$	= 100.23 mw
10 KHz	dB = –5	$P_2 = P_1 \times 10^{-5/10}$	= 63.25 mw
100 KHz	dB = –7	$P_2 = P_1 \times 10^{-7/10}$	= 39.90 mw

The table shows that the power is reduced 5 times, which may not be acceptable for some applications.

P7-5. As the table in P7-4 shows, for a specific maximum value of attenuation, the highest frequency decreases with distance. If we consider the bandwidth to start from zero, we can say that the bandwidth decreases with distance. For example, if we can tolerate a maximum attenuation of 50 dB (loss), then we can give the following listing of distance versus bandwidth.

Distance	**Bandwidth**
1 Km	100 KHz
10 Km	1 KHz
15 Km	1 KHz
20 Km	0 KHz

P7-7. We can use the formula $f = c / \lambda$ to find the corresponding frequency for each wave length as shown below (c is the speed of propagation):

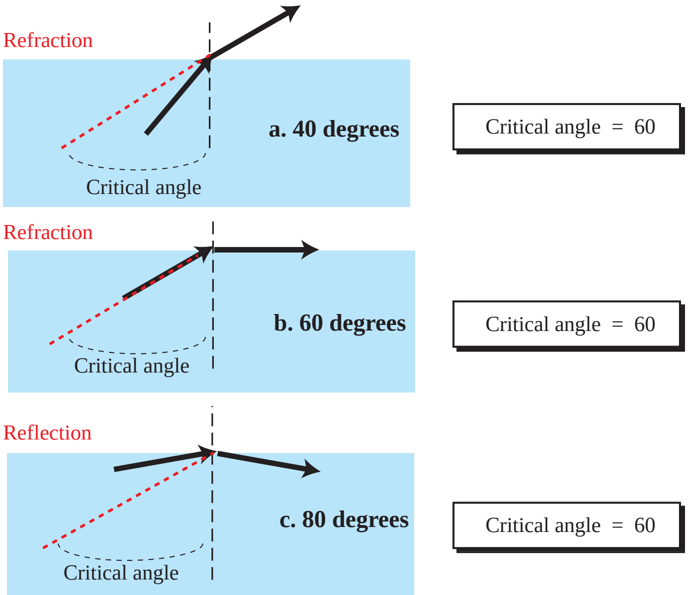
a. $B = [(2 \times 10^8)/1000\times10^{-9}] - [(2 \times 10^8)/ 1200 \times 10^{-9}] = 33$ THz

b. $B = [(2 \times 10^8)/1000\times10^{-9}] - [(2 \times 10^8)/ 1400 \times 10^{-9}] = 57$ THz

P7-9. See the following table (The values are approximate).

Distance	***dB at 800 nm***	***dB at 1000 nm***	***dB at 1200 nm***
1 Km	–3	–1.1	–0.5
10 Km	–30	–11	–5
15 Km	–45	–16.5	–7.5
20 Km	–60	–22	–10

P7-11. See the following figure.



a. The incident angle (40 degrees) is smaller than the critical angle (60 degrees). We have *refraction*.The light ray enters into the less dense medium.

b. The incident angle (60 degrees) is the same as the critical angle (60 degrees). We have *refraction*. The light ray travels along the interface.

c. The incident angle (80 degrees) is greater than the critical angle (60 degrees). We have *reflection*. The light ray returns back to the more dense medium.