1. $Ans = \frac{1500*5(Bytes\ in\ a\ RTT)}{\frac{50(RTT/2)}{1000(1ms)}} = 150000Byte/s$
2. Half-duplex System, Simplex System, Half-duplex System
3. $\Delta f = \frac{c\Delta\lambda}{\lambda^2} \Rightarrow \Delta f = \frac{3*10^8*0.1*10^{-6}}{10^{-6*2}} \Rightarrow \Delta f = 3*10^{13}hz = 30Thz$
4. $c = f\lambda \Rightarrow 3*10^8 = 10^9\lambda \Rightarrow \lambda = 0.3m$

   $180^\circ = \frac{\lambda}{2} = 0.15m$

$a_n = \frac{2}{1}\int_0^1 t\sin(2\pi nft)dt$

$= \frac{2}{1}\left(t\cdot\frac{\cos(2\pi nft)}{2\pi nf}\Big|_0^1 + \int_0^1 \frac{\cos(2\pi nft)}{2\pi nf}dt\right)$

$u = t$

$dv = \sin(2\pi nft)dt$

$\Rightarrow du = dt$

$v = \frac{-\cos(2\pi nft)}{2\pi nf}$

$= \frac{2}{1}\left(-\frac{\cos(2\pi nf)}{2\pi nf} + \frac{\sin(2\pi nft)}{(2\pi nf)^2}\Big|_0^1\right)$

$= 2\left(-\frac{\cos(2\pi n)}{2\pi n}\right)$

$= -\frac{1}{\pi n}$

$b_n = \frac{2}{1}\int_0^1 t\cos(2\pi nft)dt$

$= \frac{2}{1}\left(\frac{t\sin(2\pi nft)}{2\pi nf}\Big|_0^1 - \int_0^1 \frac{\sin(2\pi nft)}{2\pi nf}dt\right)$

$u = t$

$dv = \cos(2\pi nft)dt$

$\Rightarrow du = dt$

$v = \frac{\sin(2\pi nft)}{2\pi nf}$

$= \frac{2}{1}\left(\frac{\cos(2\pi nft)}{(2\pi nf)^2}\Big|_0^1\right)$

$= 2(0) = 0$

$c = \frac{2}{T}\int_0^T t\,dt$

$= \frac{2}{T}\cdot\frac{1}{2}t^2\Big|_0^T$

$= \frac{2}{T}\cdot\frac{T^2}{2}$

$2T = 1$

5. By Nyquist's theorem:
   $2Blog_2V = 2 * 6 * 10^6 * log_24 = 2.4 * 10^7 bits/s$
6. $T1 \rightarrow 1.544Mbps$ By Shannon's formula:
   $BitRate = Blog_2(1 + \frac{S}{N}) \Rightarrow 1.544 = 0.2log_2(1 + \frac{S}{N}) \Rightarrow 7.72 = log_2(1 + \frac{S}{N}) \Rightarrow 2^{7.72} - 1 = \frac{S}{N} \Rightarrow \frac{S}{N} \approx 209.839d.$