Name: Md. Rafi Mahafid
Roll: ~~1965~~ 1364

Answer to the Q.A.NO. 4

a) The sampling period is $T_s = 1/8000 = 125\mu s$.
There are 24 channels and 1 sync pulse. Hence the time allotted to each channel is

$$T_c = \frac{T_s}{25} = 5\mu s$$

The pulse duration is $1\mu s$, and so the time between pulse is $4\mu s$ (Ans.)

b) Assuming the use of sampling at the Nyquist rate (6.8kHz). The sampling period is

$$T_s = \frac{1}{0.8\times10^{-3}} = 0.147\times10^{-3} s = 147\mu s$$

correspondingly,

$$T_c = \frac{147}{25} = 6.68\mu s$$

Time between pulses = $5.68\mu s$ (Ans.)

Ans. to the Q.A.NO. 2

Given,

$f_s = 10MHz$

$$\left(\frac{S}{N}\right)_D = 10\log_{10}(3 \times 2^{2v} \cancel{3x})$$

$$= 10\log_{10} 3 + 10\log_{10} 2^{2v}$$

$$= 4.8 + 6.0v \text{ dB} \quad \text{---} (1)$$

The upper bound holds $S_1 = 1$. voice telephone system typically have $v=8$.

so, (1)

$$\left(\frac{S}{N}\right)_D = 4.8 + (6 \times 8) \text{ dB}$$

$$= 52.8 \text{ dB}$$

so, the signaling rate is $(SNR)_o \geq 45$dB

(Ans)

Ans. to the . Q.A.NO.3

Linear segment, in case of low level input,

$$Z(x) = \begin{cases} \frac{A|x|}{1+\ln A} & \text{for } 0 \le |x| \le \frac{1}{A} \end{cases}$$

and for log segment, heigh level inputs,

$$Z(x) = \begin{cases} \frac{1+\ln(A|x|)}{1+\ln A} & \text{for } \frac{1}{A} \le |x| \le 1 \end{cases}$$

Given,

$A = 87.6$

$m_p = 20V$

$L = 256$

The limit, $\frac{1}{A} = \frac{1}{87.6}$

$= 0.0114$

Step size, $\Delta = \frac{2m_p}{L} = \frac{2\times 20}{256} = 0.156\,V$

~~Ist Step~~

The smallest effective separation between levels will be the one closest to the origin

So, $\frac{255}{2} = 127.5 = 127$

let $x_i$ be the value of $x$ corresponding to

$$y = \frac{1}{127}$$

So,

$$y = \frac{A|x_1|}{1+\ln A} = \frac{1}{127}$$

$$\Rightarrow \frac{87.6|x_1|}{1+\ln 87.6} = \frac{1}{127}$$

$$\Rightarrow \frac{87.6|x_1|}{1+4.4727} = \frac{1}{127}$$

$$\Rightarrow |x_1| = 0.00049.$$

minimum $\Delta = m_p |x_1|$

$= 20 \times 0.00049$

$= 0.0098$

Simiarly the largest effective separation between levels will be the one closet to the end point of 127.

$$\frac{A|x_{127}|}{1+\ln A} = \frac{126}{127}$$

$$\Rightarrow \frac{87.6|x_{127}|}{1+\ln 87.6} = \frac{126}{127}$$

$\Rightarrow |x_{127}| = 0.061875$

minimum $\Delta = m_p (1 - |x_{127}|)$

$= 18.7625$ (Ans.)

Ans. to the Q. A. No. 1

Given that,

Bit rate, $R_b = 5.0 \times 10^6$ b/s

binary bit digit, n = 7

we know,

message frequency . $f_m = n \times bps$

$= 7 \times 50 \times 10^6$

$= 35 \times 10^7$ Hz

Max Message bandwidth $= \frac{1}{2} \cdot f_m$

$= \frac{1}{2} \times 35 \times 10^7$

$= 1.75 \times 10^8$ Hz (Ans)