

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 2617

Roll No.

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B. Tech.

(SEM. VI) THEORY EXAMINATION 2011-12

COMMUNICATION ENGINEERING

Time : 3 Hours

Total Marks : 100

Note : (1) Attempt *all* questions.

(2) All questions carry equal marks.

1. Attempt any *two* parts of the following : (10×2=20)

(a) What are the main elements of the communication system ?

Explain function of each element and sketch the block diagram of the communication system.

(b) A multitone modulation signal $m(t)$ consisting of three

frequency components is given by : $m(t) = A_1 \cos \omega_1 t + A_2 \cos \omega_2 t + A_3 \cos \omega_3 t$ where $\omega_3 > \omega_2 > \omega_1$ and $A_1 > A_2 > A_3$.

The signal $m(t)$ modulates a carrier $c(t) = A_c \cos \omega_c t$.

(i) Derive an expression for AM wave.

(ii) Draw a signal sided spectrum and find the bandwidth of the AM wave.

(c) Explain the synchronous detection method of SSB-SC signals. Prove that the balance modulator produces an output consisting of sidebands only with the carrier removed.

2. Attempt any *four* parts of the following : (5×4=20)

(a) A single tone FM signal is given by :

$$s(t) = 10\sin(16\pi(10^6)t + 20\sin 2\pi(10^6)t]$$

Find the modulation index, modulating frequency deviation, carrier frequency of power of the FM signal.

(b) What is the need multiplexing ? Compare the Time Division and Frequency Division Multiplexing.

(c) Draw the block diagram of phase cancellation SSB generation and explain how the carrier and unwanted sideband are suppressed.

(d) Draw the block diagram of balance frequency discriminator and explain it for demodulation of FM signal.

(e) Explain the working of super heterodyne receiver with the help of block diagram.

(f) Explain filter method for generation of VSB signal. Show that the sum of the shifted spectrum of the filter by $\pm\omega_c$ should be constant over the frequency range $|\omega| < \omega_m$.

3. Attempt any *two* parts of the following : (10×2=20)

(a) Explain the noise analysis of DSB-SC receiver using coherent detection and derive the expression of figure of merit. Explain how the use of pre-emphasis and de-emphasis filters improve the performance of the FM system.

(b) With the help of block diagram explain the working of Delta modulation. A linear delta modulator is designed to operate on speech signals limited to 3.4 kHz. The specifications of the modulator are as follows :

Sampling rate = $10 f_{\text{Nyquist}}$ where f_{Nyquist} is the Nyquist rate of the speech signal.

Step size $\Delta = 100$ mV

The modulator is tested with a 1-kHz sinusoidal signal. Determine the maximum amplitude of this test signal required to avoid slope overload.

(c) What are the advantages of pulse modulation over CW modulation? With the help of suitable waveforms explain the working of Pulse width modulation.

4. Attempt any *two* parts of the following : (10×2=20)

(a) Find the expression for FM wave and define modulation index. Draw the spectrum and explain how modulation index affect the bandwidth. In an FM system if β is doubled by halving the modulating frequency what will be the effect on the maximum deviation?

(b) Discuss the properties of matched filter. Consider the signal $s(t)$ shown in figure 1.

(i) Determine the impulse response of a filter matched to this signal and sketch it as a function of time.

(ii) Plot the match filter output as a function of time.

(iii) What is the peak value of the output?

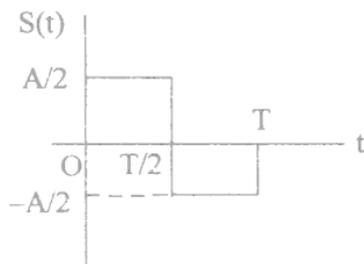


Figure 1

(c) Discuss Tapped Delay line equalization. Let the sequence $[x(nT)]$ denote the input applied to a tapped-delay equalizer. Show that inter-symbol interference is eliminated completely by the equalizer provided that its frequency response satisfies the condition

$$H(f) = \frac{T}{\sum_k X(f - k/T)}$$

Where T is the symbol

duration. As the number of taps in the equalizer approaches

infinite, the frequency response of the equalizer becomes a Fourier series with real coefficients and can therefore approximate any function in the interval $\{-\frac{1}{2}T, \frac{1}{2}T\}$.

5. Attempt any *two* parts of the following : **(10×2=20)**

- (a) Explain the cause of ISI and discuss the Nyquist criterion for distortion less Baseband Binary transmission. Design a binary baseband PAM system to transmit data at a bit rate of 3600 bits/sec with a bit error probability less than 10^{-4} . The channel response is given by :

$$H_c(f) = \begin{cases} 10^{-2} & \text{for } |f| < 2400 \\ 0 & \text{elsewhere} \end{cases}$$

The noise power spectral density is $G_n(f) = 10^{-14}$ watt/Hz.

- (b) (i) Define the following terms :
- (1) Mutual Information & Entropy
 - (2) Channel capacity and Rate of information.
- (ii) A discrete memoryless source has an alphabet of seven symbols whose probabilities of occurrence are as describe here :

{Symbol}	[s_0	s_1	s_2	s_3	s_4]
{Probabilities}	[0.25	0.25	0.125	0.125	0.125]

{Symbol}	s_5	s_6	s_7]
{Probabilities}	0.0625	0.625	0.0625]

Compute the Huffman code for this source, moving "combined" symbol as high as possible.

- (c) Write short notes on the following :
- (i) Digitization of Video
 - (ii) OFDM.