

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

PAPER ID : 3101

Roll No.

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B. Tech.

(SEM. VI) EXAMINATION, 2007

ANALOG & DIGITAL COMM.

Time : 3 Hours]

[Total Marks : 100

Instruction : Attempt all the questions. All questions carry equal marks.

1 Attempt any **four** parts of the following :

- (a) Write the expression for DSB-SC signal. 5
Describe synchronous detection and Quadrature null effect for the same.
- (b) Find the equation for SSB-SC signal for tone modulation that is modulating signal is $m(t) = \cos \omega_m t$. Draw spectrum and find the BW. 5
- (c) An AM signal is given by 5

$$\psi_{AM}(t) = 10 \cos(2\pi \cdot 10^6 t) + 5 \cos(2\pi \cdot 10^6 t) \cos(2\pi \cdot 10^3 t)$$

$$+ 2 \cos(2\pi \cdot 10^6 t) \cos(4\pi \cdot 10^3 t) \text{ Volts.}$$
 Find various frequency components present and corresponding modulation models.
- (d) Describe selectivity, sensitivity and fidelity of AM receivers. Mention the disadvantages of TRF receivers over superheterodyne.
- (e) Explain FDM system with the help of suitable diagram, also draw the spectrum of multiplexed signal.

- (f) Describe communication channels. Also give the suitable examples of time invariant channels, time varying channels, bandwidth limited channels and power limited channels.

2 Attempt any **four** parts of the following : $4 \times 5 = 20$

- (a) A carrier $A \cos \omega_c t$ is frequency modulated 5

by $f(t) = E_M \cos \omega_m t$. Find an expression for narrow band FM.

- (b) A single tone FM is represented by the equation 5

$$v(t) = 12 \cos(6 \times 10^8 t + 5 \sin 1250 t)$$

Determine carrier frequency, modulating frequency, modulation index, maximum deviation.

- (c) Explain parameter variation method for FM generation. 5

- (d) Classify various FM discriminators. Explain any one of them. 5

- (e) Draw the block diagram of FM transmitter using Indirect method of FM generation. 5

- (f) Show that the noise performance of an SSB system using synchronous detection is equivalent to the noise performance of both DSB systems. 5

3 Attempt any **two** questions of the following :

- (a) State and verify the sampling theorem for band limited signals, with the help of proper expressions and waveforms in time domain and frequency domain. 10

- (b) Describe Delta Modulation with the help of block diagram. Mention its advantages and disadvantages. How do disadvantages are overcome in Adaptive Delta Modulation ? 10

- (c) Consider an audio signal comprised of sinusoidal terms 10
 $x(t) = 3 \cos(500 \pi t)$
- (i) Determine $(\text{SNR})_{\text{db}}$ when this is quantized using 10 bit PCM.
- (ii) How many bits of quantization are needed to achieve an SNR of at least 40 db ?

4 Attempt any **two** of the following : 10

- (a) Explain QPSK on following points : 10
- (i) Transmitter
- (ii) QPSK waveforms
- (iii) Phasor diagram
- (iv) QPSK Receiver
- (b) Compare BPSK, DPSK, QPSK, FSK, ASK on following : 10
- (i) Waveforms
- (ii) Detection method used (coherent/non-coherent)
- (iii) Bandwidth required
- (iv) SNR
- (c) Derive the equations for probability of Error for Ask signal. 10

Attempt any **four** of the following :

- (a) 24 telephone channels, each band limited to 3.4 kHz, are TDM using PCM. Calculate BW of PCM for 128 quantization levels and on 8 kHz sampling frequency. 5

- (b) Derive the expression for the entropy of source. 5
- (c) Describe Mutual Information and Channel capacity of the communication system. 5
- (d) Show that the channel capacity of an ideal AWGN channel with infinite BW is given by 5

$$C_{\infty} = 1.44 \frac{S}{n} \text{ b/s}$$

where S is the average signal power and $\frac{\eta}{2}$ is PSD of white gaussian noise.

- (e) Apply Shannon Fano Coding for the following 5

$$[x] = [x_1, x_2, x_3, x_4, x_5, x_6, x_7, x_8]$$

$$[p] = [1/4, 1/8, 1/16, 1/16, 1/16, 1/4, 1/16, 1/8]$$

For binary system and find the coding efficiency.
