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

PAPER ID : 3101   Roll No. [ ][ ][ ][ ][ ][ ][ ][ ][ ]

B. Tech.

(SEM. VI) EXAMINATION, 2007

ANALOG & DIGITAL COMM.

Time : 3 Hours]   *[Total Marks : 100*

Note :   *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   5
tone modulation that is modulating signal is
$m(t) = \cos \omega_m t$. Draw spectrum and find the BW.

(c)   An AM signal is given by   5
ψ AM (t) 10 cos $(2\pi . 10^6 t)$ + 5 cos $(2\pi . 10^6 t)$
cos $(2\pi \ 10^3 t)$
+ 2 cos $(2\pi . 10^6 t)$ cos $(4\ \pi . 10^3 t)$ 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 : 4×5=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

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

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

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

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

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

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

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

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

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

(c) Consider an audio signal comprised of   10
sinusoidal terms

$x (E) = 3 \cos (500 \ \Pi \ t)$

(i) Determine $(SNR)_{db}$ 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 :

(i) Transmitter

(ii) QPSK waveforms

(iii) Phasor diagram

(iv) QPSK Receiver

(b) Compare BPSK, DPSK, QPSK, FSK,   10
ASK on following :

(i) Waveforms

(ii) Detection method used (coherent/non-coherent)

(iii) Bandwidth required

(iv) SNR

(c) Derive the equations for probability of   10
Error for Ask signal.

5   Attempt any **four** of the following :

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

(b) Derive the expression for the entropy of source. 5

(c) Describe Mutual Information and 5
Channel capacity of the communication system.

(d) Show that the channel capacity of an ideal 5
AWGN channel with infinite BW is given by

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

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

$$[x] = \left[x, x_2, x_3, x_4, x_5, x_6, x_7, x_8 \right]$$

$$[p] = \left[1/4, 1/8, 1/16, 1/16, 1/16, 1/4 \ 1/16 \ 1/8 \right]$$

For binary system and find the coding efficiency.