Printed Pages : 4 **TEC-606**

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

PAPER ID : 3101 Roll No.

B. Tech.

(SEM. VI) EXAMINATION, 2007-08

ANALOG AND DIGITAL COMMUNICATION ENGG.

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

Note : *Attempt **all** questions. All questions carry **equal** marks.*

1 Attempt any **four** parts of the following : **5×4=20**

(a) A modulating signal $e_m = E_m \cos w_m t$ amplitude modulates a carrier $e_c = E_c \cos w_c t$. Derive an expression for AM wave, draw the spectrum and find the bandwidth.

(b) Determine the power content of the carrier and each of the sidebands for an AM signal having percentage modulation of 80% and a total power of 2500 W.

(c) The input to an envelope detector is a single tone AM signal given by $x_{AM}(t) = A(1 + \mu \cos w_m t) w_c t$, where μ is a constant, $0 < \mu < 1$ and $w_c >> w_m$. Show that if detector output is to follow the envelope at all times, it is required that

$$RC \leq \frac{1}{w_m} \frac{\sqrt{1-\mu^2}}{\mu}.$$

(d) Explain any one method for generation of $SSB-SC$ signals.

(e) With help of block diagram, describe the working super heterodyne receiver.

(f) Four voice signals are amplitude modulated with carrier frequencies w_{c_1}, w_{c_2}, w_{c_3} and w_{c_4}. Find the BW of multiplexed signal and draw the spectrum.

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

(a) Find the expression for wideband FM. Draw its spectrum and find bandwidth.

(b) 6 MHz carrier is frequency modulated by a 7 kHz sine wave. The resultant FM has frequency deviation of 50 kHz. Determine highest and lowest frequencies attained by FM and modulation index of FM wave.

(c) Describe the indirect method for generation of FM. What are its advantages compared with direct method.

(d) Draw the block diagram of FM receiver and explain each block.

(e) Explain ratio detector, with its merits and demerits.

(f) Show that narrowband FM offers no improvement in SNR over AM.

3 Attempt any **two** questions of the following : **10×2=20**

(a) State the sampling theorem for band limited signals. Explain under sampling, over sampling and aliasing. Consider a signal

$M(t) = \cos w_0 t$. Draw the spectrum of sampled signal for a sampling rate of $f_s = 1.5\, f_0$. Comment on recovery of the signal.

(b) Describe quantization and derive an expression for SNR for a PCM system for a sinusoidal signal. A TV signal with 4.2 MHz BW, is transmitted using binary PCM with 512 quantization levels. Determine code word length and transmission bandwidth of the system.

(c) Explain DPCM with help of block diagram. Also mention the need of predictor.

4 Attempt any **two** of the following : **10×2=20**

(a) Describe DPSK on :
  (i) Transmitter / Generator
  (ii) DPSK waveforms
  (iii) DPSK receiver
  (iv) BW of DPSK.

(b) Compare BPSK, DPSK, QASK, FSK, MFSK on following points :
  (i) Equation of transmitted signal
  (ii) Bits per symbol
  (iii) Minimum euclidean distance between signal points
  (iv) Minimum bandwidth required.

(c) Show that error probability P_e for BPSK is given by $\frac{1}{2} erfc \sqrt{\frac{E}{N_0}}$ when E is bit energy and $N_0/2$ is PSD of white noise.

5 Attempt any **four** of the following : **5×4=20**

(a) T_1 system uses 24 voice channels based on 8 bit PCM. Voice signals are sampled at 8 kHz. A single bit is added at the end of each frame for synchronization. Determine : (i) Duration of each bit (ii) Transmission rate.

(b) Show that entropy is a measure of uncertainty. Give some examples in support of it.

(c) Derive the channel capacity and mutual information for BSC channel. (Binary symmetric)

(d) Consider an AWGN channel with 4-kHz bandwidth and the noise PSD $N/2=10^{-2}$ w/Hz. The signal power required at the receiver is 0.1 mw. Calculate the capacity of the channel.

(e) Apply Huffman coding for the system

$$[X] = \{x_1 \quad x_2 \quad x_3 \quad x_4 \quad x_5 \quad x_6 \quad x_7\}$$
$$[P] = \{.4 \quad .2 \quad .12 \quad .08 \quad .08 \quad .08 \quad .04\}$$

Find the coding efficiency.

(f) Explain with relevant diagram Shannon Fano coding schemes.