

III B.Tech(CCC) Regular Examinations, December 2007  
**ANALOG AND DIGITAL COMMUNICATIONS**  
 (Electronics & Communication Engineering)

Time: 3 hours

Max Marks:100

Answer any FIVE Questions  
 All Questions carry equal marks

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1. (a) An AM transmitter radiates 8KW with carrier unmodulated and 9KW when the carrier is sinusoidally modulated. Calculate the modulation index. If another sine wave, corresponding to 50% modulation, is transmitted simultaneously, determine the total radiated power.
- (b) What is Frequency Translation and discuss various methods of frequency translation techniques. [10+10]
2. (a) Draw the frequency spectrum of FM wave and write various observations.
- (b) In FM, the modulation index determines how many sideband components have significant amplitude Explain with an example. [10+10]
3. Show the following:
  - (a) If the noise power density is symmetrical about  $\omega = \omega_c$ , then the input noise power in DSB is exactly twice that in SSB.
  - (b) For nonsymmetrical noise power density, this factor may be greater than or less than. [10+10]
4. (a) Establish the principles of flat top sampling with neat schematics. Hence explain the phenomenon of aperture effect and equalization.
- (b) A TV Signal has a bandwidth of 4.5 MHz. Determine the sampling rate and sampling intervals for
  - i. minimum sampling
  - ii. 10% under sampling and
  - iii. 20% over sampling. [12+8]
5. (a) Prove that impulse response of the modified duo-binary filter consists of two sine functions that are time-shifted by  $2 T_p$  seconds, and sketch its response.
- (b) A source emits one of three equiprobable symbols in an independent sequence at a symbol rate of 1000 bps. Design a three level PAM system to transmit the output of this source over an ideal lowpass channel with additive Gaussian noise having a PSD of  $\eta/2 = 10^{-14}$  Watt/Hz. The symbol error probability has to be maintained at or below  $10^{-6}$ . Specify the power, bandwidth requirements and  $H_T(f)$ ,  $H_R(f)$   $P_g(t)$ . [10+10]
6. (a) With a neat block diagram explain the working of a DPCM system.

- (b) The bandwidth of signal input to the PCM is restricted to 4KHz. The input varies from -3.8v to +3.8v and has average power of 30mW. The required SNR is 20dB. The modulator produces binary output. Assume uniform quantization.
- Calculate the number bits required per sample
  - Outputs of 30 such PCM Coders are time Multiplexed. What is the minimum required transmission bandwidth for the multiplexed signal. [10+10]
7. (a) Compare and discuss a binary scheme with M-ary signaling scheme.
- (b) Digital data is desired to be transmitted over a channel with  $N_0=10^{-8}$ Watt/Hz. The channel bandwidth is 2 MHz. Consider the ASK, BPSK and FSK modulation schemes
- What is the maximum data rate that can be supported by the channel?
  - Find the received signal power in order to achieve  $P_e=10^{-6}$  at the same data rate as in (i). [10+10]
8. (a) Generate all the code words for the Hamming code described by the generator matrix

$$G = \begin{bmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 \end{bmatrix}$$

Find the parity check matrix.

- (b) Verify that cyclic shifts of the Hamming code word 1110100 are also Hamming code words. [20]

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