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B. E. (Fourth Semester) EXAMINATION, June, 2009

(Old Scheme)

(Common for CS, EC, EE, EI, IT & BM Engg.)

ANALOG AND DIGITAL COMMUNICATION

Time : Three Hours

Maximum Marks : 100

Minimum Pass Marks : 35

Note : Attempt any *five* questions. All questions carry equal marks.

1. (a) Define convolution. Prove that convolution in time domain of two functions is multiplication of their spectrum in frequency domain and vice versa.

   (b) State and prove Parseval's theorem of energy signal. Define energy and power density spectrum.

2. (a) Find the expression for FM wave and define modulation index. Draw the spectrum and explain how modulation index affects the bandwidth.

   (b) Explain the synchronous detection method of SSB-SC signals. Explain the effect of phase and frequency errors in synchronous detection.

3. (a) Explain the working of envelope detector. Determine the relation for obtaining optimum value of time constant in terms of modulation index and modulating frequency.

(b) A multitone modulating signal $f(t)$ consisting of three frequency components is given by :

$$f(t) = E_1 \cos \omega_1 t + E_2 \cos \omega_2 t + E_3 \cos \omega_3 t$$

where $\omega_3 > \omega_2 > \omega_1$ and $E_1 > E_2 > E_3$. The signal $f(t)$ modulates a carrier $e_c = E_C \cos \omega_c t$.

   (i) Derive an expression for AM wave.

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

4. (a) Explain the working of superheterodyne receiver with the aid of a block diagram.

   (b) Determine the signal to noise ratio of PCM system.

5. (a) State and prove the sampling theorem for a signal band limited to B Hz. How the sampled signal is recovered using LPF ?

   (b) Explain Delta modulation with block diagram. Define slope overload error and explain how it can be reduced.

6. (a) Explain the generation and reception of BPSK scheme.

   (b) Discuss the properties of optimum filter. Explain its applications.

7. (a) Show that the entropy is maximum when all the messages are equiprobable.

   (b) Apply Shannon-Fano coding procedure to find coding efficiency for the following message ensemble :

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

Write short notes on any *two* of the following :

  (i)   Signal distortion in transmission

 (ii) Comparison of AM and FM system

(iii) Pre-emphasis and De-emphasis

(iv) Quantization

 (v) Shannon's theorem