CS/EE/IT/BM–405

B. E. (Fourth Semester) EXAMINATION, June, 2012

(Grading/Non-Grading)

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

ANALOG AND DIGITAL COMMUNICATION

Time : Three Hours

Maximum Marks : $\begin{cases} GS : 70 \\ NGS : 100 \end{cases}$

Note : Attempt *one* question from each Unit. All questions carry equal marks.

Unit—I

1. (a) Find the Fourier transform of a unit step function.

   (b) State and prove the following properties of Fourier transform :

   (i) time shifting property

   (ii) frequency shifting property

Or

2. (a) State and prove Parseval's theorem for energy signals.

   (b) Explain and differentiate between convolution, correlation and autocorrelation.

Unit—II

3. (a) A single tone modulating signal $e_m = E_m \cos \omega_m t$ amplitude modulates a carrier $e_c = E_c \cos \omega_c t$:

   (i) Derive an expression for AM wave $e(t)$.

   (ii) Derive an expression for modulation index.

    (b) Explain synchronous detection technique for the detection of SSB-SC signal. Also discuss the effect and cause of phase and frequency errors.

Or

4. (a) Find an expression for the FM wave and a narrowband FM for a single tone frequency modulation when carrier $A \cos \omega_c t$ is frequency modulated by a single tone modulating signal $f(t) = E_m \cos \omega_m t$.

    (b) Discuss the effect of variation in mf on the spectrum of FM wave. Also explain NBFM and WBFM.

Unit—III

5. (a) Explain natural and flat top sampling. Compare the two. Also describe aperture effect.

    (b) Explain how PPM and PWM signals are generated from :

       (i) PAM signals

      (ii) directly

Or

6. (a) Explain quantization. What is quantization error ? How does it depend upon the step size ? Explain.

    (b) Describe delta modulation. What are its limitations ? How are they overcome ?

Unit—IV

7. (a) Describe generation and detection of BFSK.

    (b) Explain PSK and DPSK and compare the two.

Or

8. (a) Explain generation, detection, bandwidth of Quadrature Amplitude Modulation (QAM).

(b) Compare in detail all digital modulation techniques.

Unit—V

9. (a) Explain Entropy, Mutual Information, Noise Free Channel, Binary Symmetric Channel and Binary Erasure Channel (BEC).

(b) For the BSC shown in figure below find the channel capacity for :

(i) $P = 0.9$

(ii) $P = 0.6$
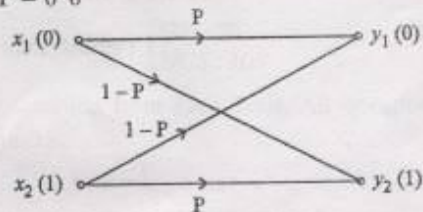
Or

10. (a) Apply the Shannon-Fano coding procedure for the following message ensemble and find the coding efficiency :

$[X] = [x_1 \quad x_2 \quad x_3 \quad x_4 \quad x_5 \quad x_6 \quad x_7]$

$[P] = [0.4 \quad 0.2 \quad 0.12 \quad .08 \quad .08 \quad .08 \quad .04]$

(b) What is coding efficiency ? Show that the coding efficiency is maximum when $P(0) = P(1)$.