Code No: RR311202 **Set No. 1**

III B.Tech I Semester Regular Examinations, November 2006
COMMUNICATION THEORY
(Information Technology)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) A pulse extending from 0 to A volts and having a duration τ is applied to a high-pass RC circuit. Show that the area under the response waveform is zero.
   (b) Find the energy spectral density at the output and the relation between input and output energy densities. [6+10]

2. (a) A random variable X has the Probability function given by:
   x: -2 -1 0 1 2 3
   y: 0.1 k 0.2 2k 0.3 3k
   Evaluate P (X < 2) the mean of X and variance of X
   (b) Show that if a Gaussian Process is Stationary than it is strictly stationary [8+8]

3. (a) Explain the filter method of SSB generation and give its limitations.
   (b) When a broadcast AM transmitter is 50% modulated, its antenna when the modulation depth is increased to 0.9?
   (c) Explain the advantages of suppressed carrier modulation our Normal AM. [8+4+4]

4. (a) What are the advantages and disadvantages of FM over AM.
   (b) Explain the working of Fooster-seely discriminator for FM demodulation.[8+8]

5. (a) Define the terms: time division multiplexing and demultiflexing, synchronization and explain their importance in digital signalling.
   (b) What are the limitation of delta modulation and how they can be rectified in ADM. [8+8]

6. (a) State and prove sampling theorem in case of how pass signals.
   (b) If a signal is naturally sampled with a sample width z and with frequency w_s rad/sec. Obtain the expression for Bandwidth. [8+8]

7. (a) Derive an expression for source entropy. Obtain the condition for maximum entropy.
   (b) A discrete source emits one of 5 symbols once every milli second. The symbol probabilities are 0.4, 0.2, 0.15,0.15, 0.1 respectively. Determine the source entropy and information rate. [12+4]

8. (a) Describe the characteristics features of convolutional codes. List out the different types of convolutional codes and their applications.
   (b) Obtain the code tree for the encoder shown in Figure 8b below. [10+6]

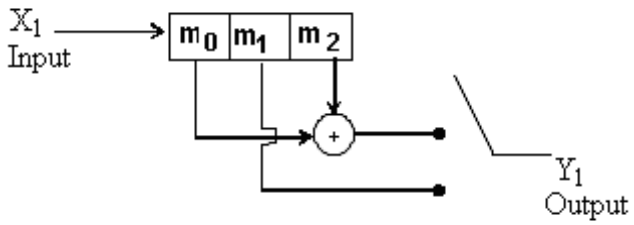

Figure 8b

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Code No: RR311202 **Set No. 2**

III B.Tech I Semester Regular Examinations, November 2006
COMMUNICATION THEORY
(Information Technology)

Time: 3 hours **Max Marks: 80**

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1. Draw the transfer characteristics of an idealized low pass filter and an idealized band pass filter with pass band from f_1 to f_2. Explain why these filters cannot be realized physically. [16]

2. (a) State the Central limit theorem?
   (b) Find the probability density function of Y = $2x^2$-3 if the density function, f (x) of the random variable x is by
   f(x) = 1/6, -3 ≤ x ≤ 3
   0, elsewhere
   (c) For a process having autocorrelation function R (V)= a $e^{-b\ |V\ |}$ find the Spectral density function. [6+5+5]

3. (a) Explain the envelope detector with a circuit diagram and waveforms.
   (b) Explain the principle of VSB transmission. What are its applications? [8+8]

4. (a) Explain the indirect method of FM generation with relevant diagrams.
   (b) A 500Hz modulating voltage fed to a PM generator produces a frequency deviation of 2.25KHz. What is the modulation index, if the amplitude of the modulating voltage is kept constant but its frequency is raised to 6KHz? Determine the modified frequency deviation. [8+8]

5. (a) What is inter symbol interference? What are the reasons for its existence? How it can be minimized in communication system?
   (b) Explain various ways of quantization and bring out the optimum quantization procedure for minimum quantization noise. Derive the expressions. [6+10]

6. (a) What is sampling? Explain the need for sampling and hence discuss various types of sampling.
   (b) Explain clearly the process of sampling for low pass signals and derive conditions for optimum reconstruction of signal. [8+8]

7. (a) Determine the capacity of a band limited Gaussian channel. Using this explain in detail, the trade off between bandwidth and signal to noise ratio.
   (b) Find the capacity of the channel described by the following noise matrix. as shown in Figure 7 [8+8]

	Y_1	Y_2	Y_3	Y_4
X_1	3/8	3/8	1/8	1/8
X_2	1/8	1/8	3/8	3/8

Figure 7

8. (a) Write short notes on Parity and Burst error codes giving the applications of each.

   (b) What are the Convolutional codes? Discuss clearly the principle of generator and detector of Convolutional codes. Bring out the Concept of Average code length. [8+8]

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Code No: RR311202 **Set No. 3**

III B.Tech I Semester Regular Examinations, November 2006
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Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
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1. The waveform v(t) has the Fourier transform V(f).
   (a) Show that the waveform delayed by time t_d, i.e) v(t- t_d) has the transform of V(f)$e^{-j\omega\ td}$
   (b) Show that the time derivative(d/dt)v(t) has the transform (j2πf) V(f)
   (c) Show that the transform of the integral of v(t) is given by [5+5+6]
   $F[\int_{-\infty}^{t} v(\lambda)\ d\lambda] = \frac{v(f)}{j2\pi f}$

2. (a) Write the properties of cumulative distribution function
   (b) Let X be a continuous random variable with probability density function
   f (x) = (x+3)/48, -1 $< x <$ 7
   = 0, elsewhere
   Find the probability density function of the random variable
   Y= (x+3)/2
   (c) Define: [2+8+6]
      i. Auto correlation
      ii. Power spectral density of a stationary random process.

3. (a) Explain the operation of square law modulator.
   (b) The message signal is given by m(t) = 20cos 2Πt -volts and the carrier wave is c(t) = 50 cos 100Π volts. Find the power developed across a load of 100-ohms due to the AM wave with 75% modulation. [6+10]

4. (a) Compare AM and FM and bring out the advantages of FM over AM.
   (b) When the modulating frequency in an FM system is 400 Hz and the modulating voltage is 2.4 V, the modulation index is 60, calculate the maximum deviation. What is the modulation index when the modulation frequency is reduced to 250 Hz and modulation voltage is simultaneously raised to 3.2 volts? [8+8]

5. (a) Define the terms: time division multiplexing and demultiflexing, synchronization and explain their importance in digital signalling.
   (b) What are the limitation of delta modulation and how they can be rectified in ADM. [8+8]

6. (a) Define nyquist rate of sampling and derive the expression for it.

(b) A bandpass signal has a center frequency f_o and extends from (f_o-5) KHz to (f_o+5) KHz. If the sampling rate 25 KHz, find the range of center frequency for which the sampling satisfies nyquist rate. [8+8]

7. (a) Define and explain the significance of the terms :
   i. amount of Information,
   ii. Average information,
   iii. entropy and information rate,
   iv. List out their units.

   (b) For a binary memoryless source, emitting symbols 0 and 1 with probabilities of p_0 and p_1 respectively, evaluate the entropy and sketch the entropy function. Explain the properties of the entropy function. [8+8]

8. (a) With reference to coding techniques, define and explain the following terms:
   i. systematic code
   ii. parity check matrix
   iii. syndrome .

   (b) Classify the different types of error control coding techniques, and distinguish between them. [8+8]

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Code No: RR311202 **Set No. 4**

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1. (a) State and prove the symmetry theorem.
   (b) Prove that F[f(at)]= 1/ $|a$ f(ω/a) ,i.e. The time scaling property where F[f(t)]= f(ω)
   (c) Prove the attenuation property of Fourier Transform
   Φ {f(x)e^{ax}} = f (k-ai)
   where f (k) = Φ {f(x)} [5+5+6]

2. (a) In general the autocorrelation function R(τ) can be expressed as
   R(τ)= $\int_{-t/2}^{t/2}$ s(t) s(t + τ)dt show that R(o) $\geq$ R(τ) [4]
   (b) Obtain the time-average correlation function for a square wave. Does it make any difference whether the square wave has even or odd symmetry. [12]

3. (a) What is the need for modulation? Derive the relation between the ouput power of an AM transmitter and depth of modulation. Give output power in case of critical modulation.
   (b) The ouput RMS current of 60% modulated AM generator is 1.5 A. To what values will this current rise if the generator is modulated additionally, by another audio wave whose modulation index is 0.7? What will be the percentage power saving if the carrier and one of the side bands are now suppressed?[8+8]

4. (a) Explain the principle of pre-emphasis and deemphasis with a circuit.
   (b) Compare and contrast various FM modulation methods. [8+8]

5. (a) Explain the concept of quantization of sampled signal and hence discuss the merits and demerits of it.
   (b) Give the block diagram for PCM generation and reception and discuss the features of each block. [6+10]

6. (a) Define various types of pulse modulations and distinguish between them. (06)
   (b) Explain clearly the differences of sampled signal and PAM and hence discuss the bandwidth criterion for PAM.
   (c) Explain how signal can be recovered from PAM modulated signal. Give necessary conditions. [6+6+4]

7. (a) The voice frequency-modulating signal of a PCM system is quantized in 16 levels with the following probabilities,
$P_1 = P_2 = P_3 = P_4 = 0.1$
$P_5 = P_6 = P_7 = P_8 = 0.05$
$P_9 = P_{10} = P_{11} = P_{12} = 0.075$
$P_{13} = P_{14} = P_{15} = P_{16} = 0.025$
Find the information rate taking the band limiting frequency of the modulating signal at 3 KHz.

   (b) Derive the capacity for binary symmetric channel. [8+8]

8. (a) A random variable has the density function as shown in the figure 8a. Find the corresponding entropy.

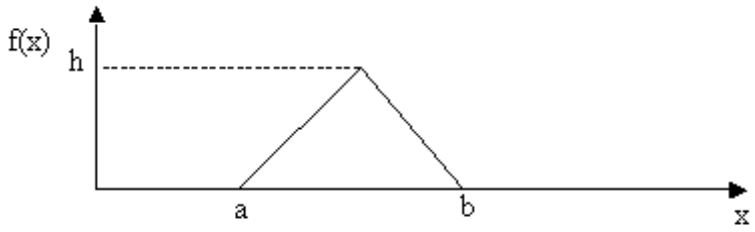

Figure 8a

   (b) Evaluate the capacity of the channel whose matrix is given as [8+8]

$$\begin{vmatrix} 1-\beta & \beta & 0 \\ \beta & 1-\beta & 0 \\ 0 & 0 & 1 \end{vmatrix}$$

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