Code No: OR310551 **OR**

III B.Tech I Semester Supplementary Examinations, April/May 2005
SIGNALS AND MODULATION THEORY
(Computer Science & Engineering)

Time: 3 hours **Max Marks: 70**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Show that the Fourier Transform of a sin c function y(t) = A Sin C 2wt is a gate function. Also sketch both the functions.
   (b) Determine the energy spectral density of a square pulse $x(t) = \Pi(t/T)$ and calculate its energy. If the signal x(t) passed through an ideal LPF of band width $f_c Hz$, find the energy E_o of the output y(t).

2. (a) The auto correlation function of a random process is $R(Z) = e^{-2\alpha|\tau|}$determine the spectral density of the process.
   (b) Define entropy of a
      i. Discrete system and
      ii. Continuous system For a discrete source producing m messages, show that the maximum value of entropy is $H_{max} = \log_2 m$

3. (a) Define:
      i. Sample space and
      ii. Random variable.

      The probability density function can be written as $p(\times \leq x_j) = \sum_{K=-\infty}^{j} p(x_K)$

      What is the interpretation of this expression.
   (b) State Central limit theorem. Discuss two examples where this theorem can be applied in detail.

4. (a) A certain random variable has a dc component of 2V and rms value of 4V. Further measurements indicate that $\vartheta(t)$ and $\vartheta(t-\tau)$ are independent for $|\tau| > 5$ μsec while $R_\vartheta(\tau)$ decreases linearly with $|\tau|$ for $|\tau| \leq 5$ msec
      i. Plot $R_\vartheta(t)$
      ii. Find and plot $G_\vartheta(t)$
   (b) Define:
      i. Cumulative density function F(x)
      ii. Spectral density G(f) of a function.

5. (a) Draw the circuit of a FET balanced modulator and show mathematically that the circuit can act as SSB generator.
   (b) The frequency deviation in FM transmission is 25 kHz. Calculate:
      i. Percent modulation of this signal if it is broadcast in 88.108 MHz band

ii. Percent modulation if this signal were broadcast as audio portion of TV broadcast.

6. (a) With the help of waveforms, describe both the time domain and frequency domain characteristics of
   i. Natural sampling and
   ii. Sample-and-hold technique.

   (b) A rectangular pulse with duration $\tau = 2$ is sampled and reconstructed using an ideal Low pass filter with $B = f_s/2$. Determine the output signal when $T_s = 0.8$

7. (a) For a signal, the band width is 3 kHz and S / N =15
   i. Calculate channel capacity
   ii. If the bandwidth is increased to 4 kHz and signal is transmitted over same channel calculate required S / N and percentage change in signal power.

   (b) Define code efficiency A service is transmitting two symbols A and B with probabilities 7 / 8 and 1 / 8 respectively.
   Calculate the entropy of the service and required channel capacity using simplest code and also compute coding efficiency.

8. Write notes on:
   (a) Convolution code
   (b) T D Multiplexing
   (c) Phase modulation.

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