Code No: RR211901 **Set No. 1**

II B.Tech I Semester Supplementary Examinations, November 2006
SIGNALS & MODULATION THEORY
(Electronics & Computer Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Evaluate the given convolution integral $t^2u(t) * e^{-t}.u(t)$
   (b) Find the F.T of $f(t) = \frac{1}{T}e^{-t/T}.u(t)$ [8+8]

2. (a) Find the cross-correlation of an arbitrary function and impulse function.
   (b) Define auto-correlation and cross-correlation prove any two properties of correlation function. [6+10]

3. (a) A Linear Time Invariant system has the impulse response h(t)=e^{-3t} u(t). Find and plot the output of the system for the input x(t)= e^{-t}[u(t0 – u(t-2)]?
   (b) A signal e^{-3t}u(t) is passed through an ideal Low Pass filter with cutoff frequency of 1 rad/sec . Find the input and output energy. [8+8]

4. (a) Describe the meaning of each term of the following expression.
   V_{am}(t)= 10 Sin (2π 500Kt)- 5 Cos (2π 515 Kt)+ 5 Cos (2π 485Kt)
   (b) Describe AM SSBSC.Compare SSB SC to conventional AM. [8+8]

5. The FM wave
   S(t)=A_cCos[W_ct+2$\pi k_f \int_o^t$dt] is applied to the system is shown in the figure. Assume that the resistance R is small compared with the reactance of the capacitor 'C' for all significant frequency components of s(t) and the envelope detector does not load the filter. Determine the resulting signal at the envelope detector output, assuming that $k_f |m(t)| < f_c$ for all t.(figure5)

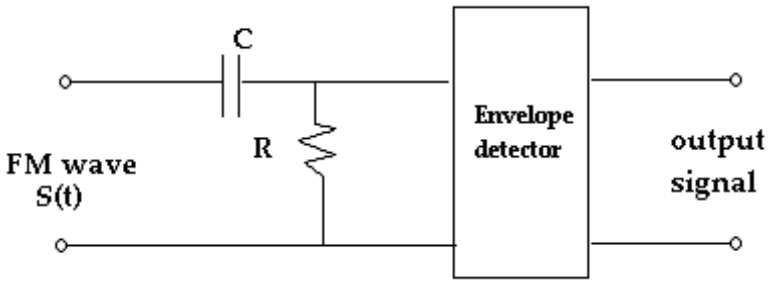

Figure 5

[16]

6. (a) State and prove sampling theorem in time domain.
   (b) Determine the minimum sampling rate and Nyquist interval for the following signals:

i. Sa (100t)
ii. Sa^2 (100t)
iii. Sa (100t) +Sa (50t)
iv. Sa (100t) + sa^2(60t). [8+8]

7. (a) Explain a suitable scheme of getting around the phase synchronization problems associated with coherent PSK detection.
   (b) With appropriate mathematical expressions, show that the BPSK is superior to ASK by 3 dB in the average signal power requirement. [8+8]

8. (a) Briefly explain return to zero and Non return to zero transmissions.
   (b) Contrast the bandwidth considerations of return to zero and Non-return to zero transmissions.
   (c) Contrast the error detection and decoding capabilities of RZ and NRZ transmissions. [4+6+6]

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Code No: RR211901 **Set No. 2**

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

Answer any FIVE Questions
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1. (a) Explain the procedure to recover the signal f(t) from its samples.
   (b) Find the F.T of d.c and step signals. [8+8]
2. (a) Determine and plot the auto-correlation function of $e^{-a|t|}$.
   (b) Prove that auto correlation function of f(t) is maximum at the origin. [8+8]
3. (a) Determine the response of a Linear system driving with a impulse function?
   (b) A signal x(t) =1 for $0 \leq t < 1$ and zero otherwise is passed through a system, which has impulse response h(t) = x(t). Compute the output y(t). [6+10]
4. (a) What is meant by Modulation? Why modulation is necessary?
   (b) A 108 KHz carrier wave is amplitude modulated by a band of frequencies from 300 Hz to 3400 Hz. What frequencies are contained in the upper and lower side bands of the AM wave and what is the bandwidth to transmit this wave? [8+8]
5. (a) Derive the expressions for FM and PM signals.
   (b) Explain how NBFM is generated using Balanced modulator. [8+8]
6. (a) The Signals
   $g_1(t) = 10\text{Cos}(100\pi t)$ and $g_2(t) = 10\text{Cos}(50\pi t)$ are both sampled at a rate of 75 samples per second. Show that the two sequences of samples thus obtained are identical.
   (b) Give the block diagram for PCM generation and reception and discuss the features of each block. [8+8]
7. (a) With a neat block diagram explain the generation and receiption of DPSK signals. What merit does a DPSK signal have over FSK and PSK.
   (b) Show that a QPSK system achieves twice the bit rate per carrier bandwidth that a binary antipodal FSK system with the same bit error probability and power level does. [8+8]
8. (a) What are the different coding techniques?
   (b) Explain the Manchester coding with a neat diagram. [8+8]

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Code No: RR211901 **Set No. 3**

II B.Tech I Semester Supplementary Examinations, November 2006
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(Electronics & Computer Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Explain about the singularity functions.
   (b) Determine the F.T of the given functions and give the value of |f(w)| as $w \rightarrow \infty$ $f(t) = e^{-t}u(t) + \partial(t-2)$ [6+10]

2. (a) Find the cross-correlation of an arbitrary function and impulse function.
   (b) Define auto-correlation and cross-correlation prove any two properties of correlation function. [6+10]

3. (a) What is condition for a system to be physically realizable.
   (b) Prove that the Transmission of a pulse through a Low Pass Filter causes the dispersion of the pulse. [6+10]

4. (a) Show the variation of the sideband power and carrier power with depth of modulation in a single tone AM.
   (b) What is the relation ship between the modulating signal frequency and the bandwidth in a conventional AM system? [10+6]

5. (a) A single-tone modulating signal cos $(15\pi \times 10^3 t)$ frequency modulates a carrier of 10MHz and produce a frequency deviation of 75KHz. Find
      i. Modulation index and
      ii. phase deviation produced in FM wave
      iii. If another modulating signal produces a modulation index of 100 while maintaining the same deviation. [2+2+5+7]

   Find the frequency and amplitude of the modulating signal assuming K_f=15 KHz/volt.
   (b) Why FM is more immune to Noise compared to AM. Explain.

6. (a) Draw the block diagram of Adaptive Delta Modulator system and explain.
   (b) i. Plot μ law compression characteristics for μ=255
      ii. If $m_p = 20V$ and 256 quantizing levels are employed what is the voltage between levels when there is no compression? For μ=255, what is the smallest and largest effective separation between levels. [6+10]

7. (a) Explain the principle of matched filter receiver scheme for binary PSK signaling.
   (b) Describe with suitable figures, coherent detection of FSK signals. [8+8]

8. (a) Compare line-coding techniques in terms of minimum bandwidth, average DC voltage, clock recovery and error detection capabilities of line coding formats.
   (b) Encode the following BP RZ-AMI data stream with B6ZS and B2ZS + - 0000 + - + 0 - 00000 + - 00 +. [8+8]

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Code No: RR211901 **Set No. 4**

II B.Tech I Semester Supplementary Examinations, November 2006
SIGNALS & MODULATION THEORY
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Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
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1. (a) Which of the following signals is Fourier transformable? Why?
   i. $x(t) = e^{-at}.u(t)$, $a > 0$
   ii. x(t)=1
   iii. (t) = | n(t)
   iv. x(t) = [cos(10t)] Sin (2t)
   (b) State and prove convolution and modulation properties of F.T. [8+8]

2. (a) Define auto-correlation and cross-correlation functions. Prove that $\phi_{12}(\iota) = \phi_{21}(\iota)$, where $\phi_{12}(\iota)$ is the correlation between $f_1(t)$ and $f_2(t)$ and $\phi_{21}(\iota)$ is the correlation between $f_2(t)$ and $f_1(t)$.
   (b) Find the auto-correlation of f(t)=Sin wt. [8+8]

3. (a) What is LTI system? Explain its properties
   (b) A signal with a psd shown in (figure3b) is applied to an ideal Low pass filter with a bandwidth of 5 KHz . Find the psd of the filter output and the average normalized power content of the output signal.

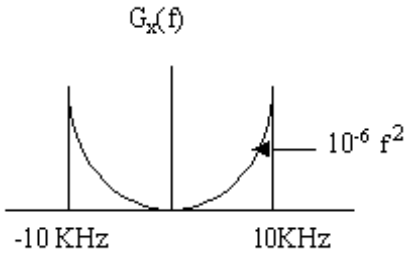

Figure 3b

[6+10]

4. (a) Show that a VSB wave plus carrier wave retains the base-band information in its envelope.
   (b) Explain frequency and phase error in synchronous detection of DSB-SC signals. [8+8]

5. Consider the narrow band wave form S(t) = Cos(W_ct + β Sin $_{Wm}$ t) with β << 1 & f_m <<f_c.
   (a) Show that S(t) can be approximated as S(t) ≈ Cos (W_c t) - β Cos($W_c - W_m$)t) + $\beta/2$ Cos ($W_c + W_m$) t)

(b) Show that this approximate is consistent with the generalised expression for FM signal.

(c) Let the signal S(t) is applied to a square law device. Determine the spectrum of the output signal for the approximated form of S(t) as the input. [5+6+5]

6. (a) Explain in detail the effect of analog to digital conversion. Compare analog and digital systems.

(b) A sinusoidal signal is to be transmitted using pan so that the output signal to quantizing noise ratio is 49.8 dB. Find the minimum number of representation levels L and binary code word n to achieve this performance. [8+8]

7. (a) Explain the principle of matched filter receiver scheme for binary PSK signaling.

(b) Describe with suitable figures, coherent detection of FSK signals. [8+8]

8. (a) State the primary factors that must be considered in selecting a line coding format.

(b) Compare the duty cycle of various line coding formats for the bit sequence 11001010. [8+8]

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