

Code :R7321004

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III B.Tech II Semester(R07) Regular & Supplementary Examinations, April/May 2011
PRINCIPLES OF COMMUNICATION
(Electronics & Instrumentation Engineering)

Time: 3 hours

Max Marks: 80

Answer any FIVE questions
All questions carry equal marks

1. (a) Derive Fourier transform of the signum function .
 (b) Assuming that $X(t)$ is a white noise process with zero mean and power spectral density of $N_0/2$, show that the auto correlation function $R_{xx}(t)=N_0/2 \delta(\tau)$. Comment on the practical significance of the result.
2. (a) State and explain Amplitude modulation scheme. Draw all its possible waveforms.
 (b) Draw the circuit diagram of envelope detector and explain its working principle. What is the condition that should be satisfied to design the demodulator circuit?
 (c) Explain the generation of DSB-SC signals.
3. (a) What are the advantages and disadvantages of FM over AM?
 (b) The sinusoidal modulating wave $m(t) = A_m \cos(\omega_m t)$ is applied to a phase modulator with phase sensitivity 'k'. The un-modulated carrier wave has f_c and amplitude A_c . Determine the spectrum of the resulting phase modulated signal assuming that the maximum phase deviation $\beta_p = kA_m$ does not exceed 0.3 rad.
 (c) Construct a phasor diagram for the above modulated signal and compare it with that of the corresponding narrow band FM signal.
4. Write the following: (i) TDM (ii) FDM (iii) PWM.
5. (a) With a suitable block diagram, explain the operation of ADPCM.
 (b) Show that the output SNR of the uniform quantize is given by $(SNR)_0=6R-7.2$ dB, where 'R' is the number of bits per sample. Assume that the quantizer input extends from -4 to 4.
6. (a) Derive expression for the probability of error in case of binary PSK.
 (b) Discuss about coherent binary FSK system (both modulator and demodulator) in detail. Draw its signal space diagram and infer the conclusions from the diagram.
7. (a) What do you mean by 'Entropy'? discuss about the properties of entropy.
 (b) Explain source coding theorem.
 (c) Consider a discrete memory less source with source alphabet $\{s_1, s_2, s_3\}$ with respective probabilities $1/4, 1/2, 1/2$. Calculate the entropy of the source.
8. (a) Briefly discuss about different types of error detection techniques.
 (b) With the help of suitable example, explain half rate convolutional encoder with constraint length of '3'.

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1. (a) Prove that auto correlation function and energy spectral density, are Fourier transform pair.
 (b) Find the Fourier transform of output $w(t)$ which is produced when signal $v(t)=e^{-at}u(t)$ passes through a filter whose impulse response $h(t)=1/(\pi t)$.
2. (a) Compare the various generation methods of single sideband (SSB) signal.
 (b) A 400 W carrier is modulated to a depth of 0.60. calculate the carrier power, total power in the modulated wave of AM, DSB-SC, SSB-SC signals. Give the inference from the obtained results.
3. (a) Explain the effect of random noise on the output of an FM receiver fitted with amplitude limiter. Develop the concept of noise triangle.
 (b) In an Armstrong modulator the crystal oscillator frequency is 200 kHz. It is desired in order to avoid distortion to limit the maximum angular deviation to 0.2. The system is to accommodate modulation frequencies down to 40 Hz. The output of the modulator carrier frequency is to be 108 MHz and the frequency deviation is 80 kHz. Select multiplier and mixer oscillator frequencies to accomplish this.
4. (a) Draw the block diagram of TDM system and discuss the applications of TDM.
 (b) Draw the circuit diagram for the generation of PWM signal and explain its working principle.
5. (a) What is the main drawback of Delta modulation? Explain how it is eliminated in adaptive delta modulation scheme with suitable sketches.
 (b) Determine $(SNR)_{max}$ for DM system that samples a 400 Hz sinusoid with a sampling rate of (i) 8 kHz, and ii) 16 kHz when no post reconstruction filter is used. Repeat the above if a 1 kHz low-pass post reconstruction filter is used assuming quantization noise is uniform over the frequency band from zero to sampling frequency.
6. (a) Explain the operation of QPSK modem with suitable sketches.
 (b) If digital message input data rate is 8 kbps and average energy per bit is 0.01 unit, find (a) bandwidth required for transmission of the message through BPSK, QPSK. Give the phasor diagrams of the above mentioned modulation schemes.
7. (a) List out the error detection methods. And discuss about one of them.
 (b) For (7,4) cyclic code, the generating polynomial $g(x)=1+x+x^3$. Find the code word if data word is 00011. Show a cyclic is decoded to get the data word.
8. Write the following with suitable examples:
 - (a) Huffman coding
 - (b) Hamming code generation circuits.

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1. (a) Find the Fourier transform of $\sin \omega_0 t$. compare with the transform of $\cos \omega_0 t$. plot and compare the power spectral densities of $\cos \omega_0 t$. and $\sin \omega_0 t$.
 (b) The waveform $v(t)$ has the Fourier transform $V(f)$. show that the waveform delayed by time t_d has the transform $V(f)e^{-j\omega t_d}$
2. (a) An AM transmitter has antenna current of 2 A with the modulation index of 60 percent. What will be the total antenna current if one more identical antenna is connected in parallel with previous one, keeping the transmitter output same? Will it affect the modulation index? Justify your answer.
 (b) An audio single tone single $10 \sin(1000\pi t)$ is used to amplitude modulate a carrier of $50 \sin(2\pi \times 10^5 t)$. Calculate modulation index, side band frequencies, amplitude of each side band, bandwidth required, and the total power delivered to the load of 600 ohms.
3. (a) Distinguish between phase and frequency modulation. Show that the FM signal can be derived using PM signal and vice-versa with the help of differentiator and integrator networks.
 (b) Compute the bandwidth requirement for the transmission of FM signal having a frequency deviation 75 kHz and audio signal bandwidth of 10 kHz.
 (c) In a FM system the frequency deviation constant is 1 kHz/V. A sinusoidal modulating signal having amplitude of 15 V and frequency of 3 MHz is applied: calculate the peak frequency distortion, and modulation depth.
4. (a) Plot the spectrum of PAM signal produced by a modulating signal $m(t)=10 \cos(100\pi t)$, sampling period is 2ms, and pulse duration is 0.5ms.
 (b) Discuss the system for recovering message signal from PAM signal.
5. (a) Draw the block diagram for PCM system and explain how a speech signal is processed through the system. What is the data rate of the PCM output when the speech signal is applied as input?
 (b) Derive the expression for the signal to quantization noise ratio of a uniform quantizer.
6. (a) Discuss about the M-ary modulation schemes.
 (b) Give the expression for FSK transmitted signal and explain the signal is achieved with the help of suitable block diagram.
7. (a) State average information? One of the possible message q_1 to q_5 having probabilities $1/2, 1/4, 1/8, 1/6, 1/16$ respectively is transmitted. Calculate the average information.
 (b) A Gaussian channel has a 1-MHz bandwidth. If the signal power to noise power spectral density is .01 MHz, calculate the channel capacity and the maximum information rate.
8. Write the following:
 - (a) Block codes
 - (b) Convolutional codes

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1. (a) What are the properties of Fourier Transform? Derive any three of them.
 (b) What is relation between convolution and correlation? Explain about convolution with suitable example.
2. (a) Consider a single tone modulating wave and a sinusoidal carrier wave to form an AM wave. Deduce the expression for carrier power, upper and lower side band power from the expression of modulated wave.
 (b) With the help of circuit diagram, and waveforms, explain working principles of ring modulator.
 (c) How much is the power saving in SSB-SC system as compared to the conventional AM system? Justify your answer.
3. (a) Draw the block diagram of a method for generating a narrow band FM signal and deduce the expression for the same.
 (b) A carrier wave of frequency 100MHz is frequency modulated by a sinusoidal wave of amplitude 20 V, and frequency 100 KHz. The frequency sensitivity of the modulator is 25 kHz/volt. Determine the approximate bandwidth of the FM signal using Carson's rule.
 (c) Sketch the waveforms of FM, and PM signals along with information and carrier signals.
4. (a) State and explain sampling theorem.
 (b) Specify the Nyquist rate and Nyquist interval for each of the following signals:
 - i. $g(t) = \text{sinc}(200t)$.
 - ii. $g(t) = \text{sinc}(200t) + \text{sinc}^2(200t)$.
5. (a) Draw the block diagram for generating PCM signal from an analog signal and explain importance of each block.
 (b) A PCM system uses a uniform quantization followed by a 7 bit binary encoder. The bit rate of the system is equal to 50 Mbps. What is the maximum message bandwidth for which the system operates satisfactory?
6. (a) Draw the block diagram of QPSK modulator and demodulator. Explain the importance of each block in detail.
 (b) A binary sequence 1100100010 is applied to the DPSK transmitter. Sketch the resulting waveform at the transmitter output.
7. (a) State and explain the terms 'Information' and 'Entropy'.
 (b) Describe the Huffman coding algorithm with suitable example.
8. Write the following:
 - (a) Hamming codes.
 - (b) Convolution codes
