

BITS PILANI, DUBAI CAMPUS
Dubai International Academic City, Dubai, UAE
BE (Hons.) ECE Third Year, I Semester, 2012-2013
Course No. / Course Title: ECE C383 COMMUNICATION SYSTEMS
Test 2 (Open Book)
Duration: 50 min Max. Marks: 30 Weightage: 15%

Note:- Answer all questions

1. Obtain the limits on entropy of a source containing 16 symbols? When are these limits attained? (5 marks)
2. An analog signal is bandlimited to 4 kHz and sampled at 1.25 times the Nyquist rate. The samples are quantized into four levels. Find the information rate (in bits/sec) of the source if the probabilities of occurrence of the inner two levels are three times that of the extreme two levels. (6 marks)
3. If the SNR of a wireless communication link is 20 dB and the RF bandwidth is 30 kHz, determine the maximum theoretical data rate in kilobits/sec that can be transmitted? (5 marks)
4. For a periodic saw tooth message signal, sketch the corresponding waveforms for the three types of analog pulse modulation. (6 marks)
5. An AM receiver operates with a tone modulation, and the modulation index is 0.3. The message signal is $20\cos 1000\pi t$. (a) Compute the output SNR relative to the baseband performance. (b) Determine the improvement (in decibels) in the output SNR that results if the modulation index is increased from 0.3 to 0.7. (8 marks)

*** Paper ends ***

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Test 1

Duration: 50 min

Max. Marks: 30

Weightage: 15%

Note:- Answer all questions

1. Find the complex exponential Fourier series for the signal $m(t) = \sin^2 \omega_0 t$ and identify the Fourier coefficients clearly. (3 marks)
2. Sketch, with appropriate labeling, the AM signal $s_{AM}(t) = [2 + \cos 50\pi t] \cos 10000\pi t$ in the time domain. Sketch, also, the output of an ideal envelope detector to which this signal is given as input. (4 marks)
3. Sketch, with appropriate labeling, the USB SSB-SC signal in the time domain if the carrier frequency is 100 kHz and the modulating signal is a 2 kHz sine wave. Identify, also, the envelope of the SSB-SC signal in your sketch. (3 marks)
4. Obtain the Hilbert transform of e^{j3t} . Express your answer in terms of e^{j3t} . (3 marks)
5. Sketch, with appropriate labeling, the magnitude spectrum of a single-tone FM signal with carrier frequency 10 MHz and modulating signal frequency 1 kHz. (3 marks)
6. With the aid of a block diagram and appropriate analysis, show how a PM signal can be demodulated using an FM demodulator. (4 marks)
7. Answer the following briefly:
 - a. "Quadrature-null effect" in DSB-SC demodulation. (3 marks)
 - b. Selection of R, C values for an envelope detector. (3 marks)
 - c. Spectral content of an FM signal where the modulating signal is the sum of two sinusoids of frequencies ω_1 and ω_2 . (2 marks)
 - d. Block diagram for demodulation of a PM signal using the PLL. (2 marks)

*** Paper ends ***

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BE (Hons.) ECE Third Year, I Semester, 2012-2013

Course No. / Course Title: ECE C383 COMMUNICATION SYSTEMS

Quiz 2

Duration: 20 min

Max. Marks: 10

Weightage: 5%

Name: _____

ID No.: _____

Answer all questions. Show your rough work in the free space on either page.

1. Define the cumulative distribution function of a random variable X :

_____. (1)

2. The pdf of a random variable X is given by $f_x(x) = ke^{-ax}u(x)$ where a is a positive constant and $u(x)$ is the unit step function. The value of the constant k in terms of a is _____. (1)

3. The expression for the pdf of a Gaussian random variable X having mean value 10 and standard

deviation of 2 is $f_x(x) =$ _____. (1)

4. The conditional probability of an event A given the event B is defined as _____. (0.5)

5. Two events A and B are said to be statistically independent if $P(A \cap B) =$ _____. (0.5)

6. $P(\bar{A}) = 1 -$ _____ and $A \cap \bar{A} =$ _____? (1)

7. A certain device becomes inoperable if two components A and B both fail. The probability that A fails is 0.01, and the probability that B fails is 0.005. However, the probability that B fails increases by a factor of 3 if A has failed. Then, (a) the probability that the device becomes inoperable is _____, and (b) the probability that A will fail if B has failed is _____. (2)

8. For a channel to be distortionless, its magnitude response must be _____ over the entire frequency range and the phase response must be _____ with frequency. (1)

9. AWGN stands for _____. (0.5)

10. A 10 kHz bandwidth signal is transmitted using DSB-SC modulation. Noise with two-sided PSD of 10^{-9} W/Hz is encountered in the channel. For an output SNR of 40 dB, the required signal power at the input of the demodulator is _____. (1.5)
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