VIT

Vellore Institute of Technology

(Deemed to be University under section 3 of UGC Act, 1956)

SCHOOL OF ELECTRONICS ENGINEERING (SENSE)

Fall Semester 2019–20

Continuous Assessment Test – I

ECE4001 – Digital Communication Systems

Duration: 90 minutes | **Max. Marks: 50**

Slot: A1 | **Programme: B.Tech ECE**

Answer ALL Questions

1.	Assume an analog signal x(t), sampled by a train of impulses at a sampling rate of $f_s = 2f_m$. Derive the expression for the sampled signal in the frequency domain. Draw and explain the spectrum of the sampled signal with $f_s = 2f_m$, $f_s > 2f_m$ and $f_s < 2f_m$.	10
2.	The signal $x(t) = 6 \sin(2\pi t)$ is transmitted using 4-bit binary PCM system. The quantizer is of the midtread type, with a step size of 1 volt. Sketch the resulting PCM output waveform (Unipolar NRZ) for one complete cycle of the input. Assume a sampling rate of four samples per second, with samples taken at $t = \pm 1/8, \pm 3/8, \pm 5/8, \ldots\ldots\ldots$, seconds.	10
3	A band-limited signal m(t) of 3 kHz bandwidth is sampled at rate of 33⅓ % higher than the Nyquist rate. The maximum allowable error in the sample amplitude (i.e., the maximum quantization error) is 0.5% of the peak amplitude m_p. Assume PCM binary encoding. Find the minimum bandwidth of the channel to transmit the encoded binary signal.	10
4	In a single integration DM scheme, the voice signal bandwidth of 3.5 kHz is sampled at a rate of 64 kHz. The maximum signal amplitude is 1 Volt and f_o is 3.5 kHz. a. Determine the minimum value of step size to avoid slope overload. b. Determine granular noise power, if the voice signal bandwidth is 3.5 kHz. c. Assuming signal to be sinusoidal, calculate signal power and signal to noise ratio. d. Assuming that noise signal amplitude is uniformly distributed in the range (-1, +1) determine the signal power and signal to noise ratio.	10
5	Draw the following formats for the given binary sequence (11011000) (a). Unipolar NRZ and RZ (b). Bipolar NRZ and RZ (c). Polar Quaternary format (Natural – Encoded) (d). Differential Encoding format.	10

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Final Assessment Test – May 2024

Course: BECE306L - Digital Communication Systems

Class NBR(s): 1166 / 1168 Slot: A2+TA2

Time: Three Hours Max. Marks: 100

- KEEPING MOBILE PHONE/ELECTRONIC DEVICES EVEN IN 'OFF' POSITION IS TREATED AS EXAM MALPRACTICE
- DON'T WRITE ANYTHING ON THE QUESTION PAPER

General Instruction: Error Function table to be permitted

Answer ALL Questions

(10 X 10 = 100 Marks)

1. a) State sampling theorem with appropriate figures and examples. What is aliasing and explain how it will affect a digital communication system? [5]

   b) Evaluate the Nyquist rate and Nyquist interval for the following signals [5]

   (i) $m_1(t) = \frac{1}{2\pi}\cos(4000\pi t)\cos(1000\pi t)$

   (ii) $m_2(t) = sinc(700t) + sinc(500t)$

2. a) A Television signal having a bandwidth of 4.2 MHz is transmitted using PCM system. Given that the number of quantization levels is 512. Determine: [5]

   (i) Code word length

   (ii) Transmission bandwidth

   (iii) Final bit rate

   (iv) Output signal to quantization noise ratio.

   b) For a sinusoidal modulating signal [5]

   $m(t) = A\cos\omega_m t$

   $\omega_m = 2\pi f_m$

   Prove that the maximum output signal-to-quantizing-noise ratio in a delta modulation system under the assumption of no slope overload is given by

   $$SNR_0 = \left(\frac{S}{N_Q}\right)_0 = \frac{3f_s^3}{8\pi f_m^2 f_M}$$

   Where $f_s = 1/T$, is the sampling rate and f_M is the cutoff frequency of a low-pass filter at the output end of the receiver.

3. What are the desirable properties of digital waveform? To transmit a bit sequence 10011011, draw the resulting waveforms using: [10]

   (i) Unipolar RZ

   (ii) Unipolar NRZ

   (iii) Bipolar RZ

   (iv) AMI RZ

   (v) Manchester.

4. a) What is Inter Symbol Interference (ISI) and what is Nyquist criterion for zero ISI? [5]

   b) Explain eye pattern and its properties. [5]

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School of Electronics Engineering
Winter Sem 2023-2024
Continuous assessment test - I
BECE306L – Digital Communication Systems

B.Tech (ECE) SLOT: A1 Marks: 50

Q. No	Answer All Questions	Marks
1.	a) State and prove sampling theorem in time domain.	04
	b) Determine the Nyquist sampling rate and the Nyquist sampling interval for the following signals: i. $x(t) = \sin(100\pi t)\cos(200\pi t)$ ii. $x(t) = \text{sinc}^2(100\pi t)$	06
2.	a) Find the DPCM transmitter and receiver output of the following signal x(k)= {0.3, 1.5, 0.7, 1, 2.3, 3.7, 2.8, 3.4, 2.8, 0} by considering mid-rise type quantizer with step size of 1V.	06
	b) Derive the signal-to-quantization noise ratio for PCM system. Assume that input signal is sinusoidal signal.	04
3.	a) A TV signal x (t) of bandwidth 42 MHz is transmitted using binary PCM. The number of quantization level is 1024. Calculate: (i) Code word length (ii) Transmission Bandwidth (iii) Average output SNR (iv) Bit Rate.	05
	b) With the help of neat diagrams, explain the transmitter and receiver of pulse code modulation.	05
4.	a) Compare between PCM, Delta Modulation, Adaptive Delta Modulation, and Differential Pulse Code Modulation.	05
	b) Consider an analog input signal $x(t) = 0.1\sin(2\pi \times 10^4 t)$. For a Delta Modulation system, the signal is sampled at a rate of 8×10^4 Hz. Find out whether the slope overload distortion occurs for the following step size: (i) $\Delta = 4$ mV (ii) $\Delta = 160$ mV.	05