Hall Ticket No | | | | | | | | | | |

Question Paper Code: AEC009

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

MODEL QUESTION PAPER- 2

B.Tech V Semester End Examinations, November - 2019

Regulation: IARE-R16

DIGITAL COMMUNICATIONS

(Electronics and Communication Engineering)

Time: 3 Hours **Max Marks: 70**

Answer any ONE question from each Unit
All questions carry equal marks
All parts of the question must be answered in one place only

UNIT – I

1	a)	Discuss the drawbacks of Delta modulation and how they overcome using adaptive delta modulation.	[7M]
	b)	Find the maximum amplitude of a 1 KHz sinusoidal signal input to a delta modulator that will prevent slope overload, when the sampling rate is 10,000 samples/sec and the step size is $\Delta = 0.1$.	[7M]
2	a)	Discuss quantization error? How does it depend upon the step size? Suggest some methods to overcome the difficulties encountered depending on the modulating Amplitude swing?	[7M]
	b)	For a Delta Modulation system, signal sampled at 76 KHz and Amax = 4 (a) Assuming that the signal is sinusoidal determine output signal power & SNR. (b) Determine the minimum transmission Band width? Derive the relations.	[7M]

UNIT – II

3	a)	Compare digital modulation systems Amplitude shift keying (ASK),Frequency shift keying (FSK) and Phase shift keying (PSK). Explain the theory of matched filter receiver.	[7M]
	b)	A bandpass QPSK modulation system uses the following orthonormal signals, $\psi 1(t) = 110 \cos(104\pi t)$, $\psi 2(t) = 110 \sin(104\pi t)$. Noise is AWGN with N0 = 1 and the target probability of a bit error is Pb = 10−5. A) Determine the maximum bit rate (bps) of this system. B) Sketch the constellation points used in the bits-to-signal mapper.	[7M]
4	a)	Draw the structure of the receiver for an orthogonal wideband FSK signaling scheme and derive a relation for probability of error.	[7M]
	b)	A voice signal is sampled at the rate of 5000samples/sec and each sample is encoded into 5-bits using PCM system. The binary data is transmitted into free space after modulation. Determine the bandwidth of the modulated signal, if the modulation used is a) ASK b) PSK c) FSK where f1=8MHz and f2=6MHz	[7M]

UNIT – III

5 a) What is BZ8S Scrambling technique? What is HDB3 Scrambling technique? Draw the NRZ and RZ code for the digital data 10110001. Draw the RZ- bipolar line code for the information {10110}. [7M]

b) A scrambling coding scheme uses BZ8S with rectangular pulses. Sketch the signal corresponding to the bit sequence "01100000000100001100". [7M]

6 a) What is meant by Cross talk? Explain in detail about the causes for cross talk in base band transmission. [7M]

b) A communication channel of bandwidth 75 KHz is required to transmit binary data at a rate of 0.1Mb/s using raised cosine pulses. Determine the roll off factor α. [7M]

UNIT – IV

7 a) What are pseudo-noise sequences and why they are used in spread spectrum modulation. [7M]

b) One of five possible message Q1 to Q5 having probabilities 1/4, 1/2, 1/8, 1/16, 1/16 respectively are transmitted. Generate Huffman code and Calculate the coding efficiency [7M]

8 a) Prove that mutual information of the channel is symmetric i.e, I(X;Y) = I(Y;X). [7M]

b) Consider a discrete memory less source with source alphabet S={s0, s1, s2} and source statistics {0.7,0.15,0.15}.Calculate the entropy of source. [7M]

UNIT – V

9 a) For a linear block code, prove with example that: i) The Syndrome depends only on error pattern and not on transmitted code word? ii) All error patterns that differ by a codeword have the same syndrome? [7M]

b) Consider the (8,4) linear block code with [7M]

G= 1 0 0 0 1 1 1 1
0 1 0 0 1 1 1 1
0 0 1 0 0 0 1 1
0 0 0 1 0 1 0 1

(a) Construct all the possible code words
(b) Construct all the single error patterns

10 a) What is the significance of Trellis structure? Explain with neat sketch explain the procedure for Syndrome calculation. [7M]

b) Consider the (3,1,2) nonsystematic convolution encoder with g (0) = (1, 1, 0), g (1) =(1,0,1),g (2)=(1, 1,1). What the generator matrix for this code [7M]

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COURSE OBJECTIVES :

I	Understand the different digital modulation techniques.
II	Discuss the importance of error detection and correction codes and use them in presence of channel noise.
III	Describe and analyze the methods of transmission of digital data using baseband and carrier modulation techniques.
IV	Decompose codes separately into source codes, channel codes, and develop competency in modeling and analyzing communication system elements.

COURSE OUTCOMES (COs):

CO 1	Analyze, interpret and model the components of digital communication systems
CO 2	Analyze, model, evaluate and compare various digital modulation techniques.
CO 3	Analyze, interpret and model baseband pulse transmission systems and digital pass band transmission systems
CO 4	Analyze, evaluate information theory and compare spread spectrum techniques and performance of spread spectrum.
CO 5	Review, analyze and design error-correcting codes used in digital communication.

COURSE LEARNING OUTCOMES

AEC009.01	Understand the basic concepts of pulse amplitude modulation (PAM), pulse position modulation (PPM) and pulse width modulation (PWM). (PPM) and pulse width modulation (PWM).
AEC009.02	Describe the advantages and disadvantages of digital communication systems and remember the concept of pulse code modulation technique.
AEC009.03	Understand the concept of sampling, quantization and coding.
AEC009.04	Understand and remember the concept of amplitude shift keying modulation and demodulation.
AEC009.05	Analyze the frequency shift keying modulator, coherent and non-coherent frequency shift keying detectors.
AEC009.06	Describe the difference between binary phase shift keying ad quadrature phase shift keying techniques.
AEC009.07	Understand the concept of baseband transmission and various line-coding formats used in digital communication systems.
AEC009.08	Describe the significance of pulse shaping to reduce inter-symbol interference in digital communications.
AEC009.09	Understand the operation of raised cosine filter and eye patterns of various ASK PSK and FSK digital modulation techniques.
AEC009.10	Understand and Remember the concept of mutual information and entropy in information theory.
AEC009.11	Design various mathematical modeling schemes for communication channel and determine their channel capacity.
AEC009.12	Analyze various spread spectrum modulation schemes such as direct sequence spread spectrum and frequency hopping spread spectrum.
AEC009.13	Analyze the significance of linear block codes and convolution codes in digital communications.
AEC009.14	Interpret the difference between hamming codes and binary cyclic codes.

AEC009.15	Understand various types and approaches such as time domain approach and transform domain approach for implementation of convolution codes.
AEC009.16	Design different types of error detection and correction techniques for linear block codes and convolution codes.
AEC009.17	Acquire experience in building and troubleshooting simple digital communication system using digital modulation and demodulation techniques.
AEC009.18	Acquire the knowledge and develop capability to succeed in competitive examinations.

MAPPING OF SEMESTER END EXAMINATION TO COURSE LEARNING OUTCOMES:

SEE Question No.		Course Learning Outcomes		Course Outcomes	Blooms Taxonomy Level
1	a	AEC009.02	Describe the advantages and disadvantages of digital communication systems and remember the concept of pulse code modulation technique.	CO 1	Understand
	b	AEC009.02	Describe the advantages and disadvantages of digital communication systems and remember the concept of pulse code modulation technique.	CO 1	Remember
2	a	AEC009.01	Understand the concept of sampling, quantization and coding.	CO 1	Understand
	b	AEC009.03	Understand the basic concepts of pulse amplitude modulation (PAM), pulse position modulation (PPM) and pulse width modulation (PWM)	CO 1	Remember
3	a	AEC009.04	Understand and remember the concept of amplitude shift keying modulation and demodulation.	CO 2	Remember
	b	AEC009.06	Describe the difference between binary phase shift keying ad quadrature phase shift keying techniques.	CO 2	Apply
4	a	AEC009.05	Analyze the frequency shift keying modulator, coherent and non-coherent frequency shift keying detectors.	CO 2	Remember
	b	AEC009.06	Describe the difference between binary phase shift keying ad quadrature phase shift keying techniques.	CO 2	Apply
5	a	AEC009.07	Understand the concept of baseband transmission and various line-coding formats used in digital communication systems.	CO 3	Remember
	b	AEC009.07	Understand the concept of baseband transmission and various line-coding formats used in digital communication systems.	CO 3	Apply
6	a	AEC009.09	Understand the operation of raised cosine filter and eye patterns of various ASK PSK and FSK digital modulation techniques.	CO 3	Understand

	b	AEC009.08	Describe the significance of pulse shaping to reduce inter-symbol interference in digital communications.	CO 3	Apply
7	a	AEC009.11	Design various mathematical modeling schemes for communication channel and determine their channel capacity.	CO 4	Understand
	b	AEC009.11	Design various mathematical modeling schemes for communication channel and determine their channel capacity.	CO 4	Apply
8	a	AEC009.11	Design various mathematical modeling schemes for communication channel and determine their channel capacity.	CO 4	Remember
	b	AEC009.11	Design various mathematical modeling schemes for communication channel and determine their channel capacity.	CO 4	Apply
9	a	AEC009.13	Analyze the significance of linear block codes and convolution codes in digital communications.	CO 5	Understand
	b	AEC009.14	Interpret the difference between hamming codes and binary cyclic codes.	CO 5	Apply
10	a	AEC009.15	Understand various types and approaches such as time domain approach and transform domain approach for implementation of convolution codes.	CO 5	Apply
	b	AEC009.15	Understand various types and approaches such as time domain approach and transform domain approach for implementation of convolution codes.	CO 5	Apply

Signature of Course Coordinator **HOD, ECE**