Hall Ticket No | | | | | | | | | | | Question Paper Code: AEC009

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad - 500 043

MODEL QUESTION PAPER- 1

B.Tech V Semester End Examinations, November - 2019
Regulation: IARE-R16
DIGITAL COMMUNICATION
(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)	Explain the basic principle of DPCM and working of DPCM transmitter and receiver with the help of diagram? Derive an expression for channel noise in delta modulation.	[7M]
	b)	The input to the PCM system is m(t)=10cos2πx104t, the signal is sampled at nyquist rate, each sample is encoded in to 4-bits. Determine, i) Bit rate ii) Bandwidth, iii) Signal to Noise ratio	[7M]
2	a)	Describe the process of Sampling and Quantization in digital Communication. What is aliasing effect in sampled signal? How aliasing can be eliminated? Explain with neat diagram.	[7M]
	b)	Specify the Nyquist rate and the Nyquist interval for each of the following signals: a)g(t)= sinc(200t) b) g(t)= sinc2(200t) c) g(t)= sinc(200t)+ sinc2(200t)	[7M]

UNIT – II

3	a)	Draw the block diagram of QPSK demodulator and explain in detail. Derive a relation for probability of error and band width in Quadtrature Phase Shift Keying.	[7M]
	b)	Binary PSK (BPSK) is used for data transmission over an AWGN channel with power spectral density N0/2 = 10^{-10} W/Hz. The transmitted signal energy is Eb = A2T /2, where T is the bit duration and A is the signal amplitude. Determine the value of A needed to achieve an error probability of 10^{-6}, if the data rate is: (a) 10 Kbit/s (b) 100 Kbit/s (c) 1 Mbit/s	[7M]
4	a)	Derive an expression for probability of bit error of a binary coherent FSK receiver. Derive an expression for probability of bit error of a binary non-coherent ASK.	[7M]
	b)	Assume that 4800 bits/sec random data are sent over band pass channel by using the following schemes: A) BPSK b) FSK Determine the Transmission bandwidth.	[7M]

UNIT – III

5 a) Discuss in detail about Bipolar line encoding format and represent the data 100111010 using the bipolar NRZ digital data format. [7M]

b) A line coding scheme uses Bipolar NRZ and RZ encoding with rectangular pulses. Sketch the signal corresponding to the bit sequence "101110". [7M]

6 a) Discuss the information about performance of a system provided by the eye pattern. Draw the eye diagram for Amplitude Shift Keying, frequency shift keying and phase shift keying. [7M]

b) A certain telephone line bandwidth is 4 KHz. Calculate the data rate in bps that can be transmitted if we use binary signaling with raised cosine pulses and a roll off factor α=0.25. [7M]

UNIT – IV

7 a) Describe the role of code division multiple access technique in present generation? Give a brief history about direct sequence spread spectrum. [7M]

b) A source is transmitting the symbols A and B with probabilities 1/16 and 15/16 respectively. Calculate the Entropy of the source and the required channel capacity using the simplest code and also coding efficiency. [7M]

8 a) What is meant by Synchronization? Why we require synchronization in spread spectrum? Explain in detail. [7M]

b) Apply Shannon fano coding for the 5 messages with probabilities 0.4, 0.15, 0.15, 0.15, 0.15 and find the coding efficiency. [7M]

UNIT – V

9 a) Explain about Error detection and Correction capabilities of Hamming codes. Explain how Parity checking can be used for error detection or error correction. [7M]

b) Consider (7, 4) linear code whose generator matrix is- [7M]

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

(i) Find all code vectors of this code. (ii)Find the parity check matrix for this code. (iii) Find the minimum weight of this code. (iv) Prove equation $CH^T=0$.

10 a) Write short notes on following with examples: [7M]
a) Convolutional codes
b) Viterbi Decoding.

b) Consider a (7,4) cyclic code with generator polynomial g(x)= (x3+x2+1).Determine the code for data bits 1010,1111, and 0001 [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	AEC009.03	Understand the concept of sampling, quantization and coding.	CO 1	Understand
	b	AEC009.03	Understand the concept of sampling, quantization and coding.	CO 1	Remember
3	a	AEC009.06	Describe the difference between binary phase shift keying ad quadrature phase shift keying.	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	AEC009.09	Understand the operation of raised cosine filter and eye patterns of various ASK PSK and FSK digital modulation techniques.	CO 3	Apply
7	a	AEC009.12	Analyze various spread spectrum modulation schemes such as direct sequence spread spectrum and frequency hopping spread spectrum.	CO 4	Understand
	b	AEC009.10	Understand and Remember the concept of mutual information and entropy in information theory.	CO 4	Apply
8	a	AEC009.12	Analyze various spread spectrum modulation schemes such as direct sequence spread spectrum and frequency hopping spread spectrum.	CO 4	Remember
	b	AEC009.13	Analyze the significance of linear block codes and	CO 4	Apply

			convolution codes in digital communications.		
9	a	AEC009.14	Interpret the difference between hamming codes and binary cyclic codes.	CO 5	Understand
	b	AEC009.16	Design different types of error detection and correction techniques for linear block codes and convolution codes.	CO 5	Apply
10	a	AEC009.16	Design different types of error detection and correction techniques for linear block codes and convolution codes.	CO 5	Apply
	b	AEC009.14	Interpret the difference between hamming codes and binary cyclic codes.	CO 5	Apply

Signature of Course Coordinator **HOD, ECE**