Hall Ticket Number:

Code No. : 15460 N/O

VASAVI COLLEGE OF ENGINEERING *(AUTONOMOUS)*, HYDERABAD

Accredited by NAAC with A++ Grade

B.E. (E.C.E.) V-Semester Main & Backlog Examinations, Jan./Feb.-2024

Analog and Digital Communication

Time: **3 hours** Max. Marks: **60**

*Note: Answer all questions from **Part-A** and any **FIVE** from **Part-B***

Part-A (10 × 2 = 20 Marks)

Q. No.	Stem of the question	M	L	CO	PO	PSO
1.	Define DSBSC modulation and its significance in AM communication.	2	1	1	2	1
2.	What are the primary components of a typical amplitude modulation (AM) transmitter and their respective functions in the modulation process?	2	1	1	2	1
3.	What is the difference between NBFM and WBFM in frequency modulation?	2	1	2	1	2
4.	Explain the differences between phase modulation (PM) and frequency modulation (FM) in the context of angle modulation.	2	1	2	2	2
5.	Explain the concept of quantization in Pulse Code Modulation (PCM).	2	1	3	2	2
6.	Describe the process of pulse width modulation (PWM) and how it differs from pulse amplitude modulation (PAM).	2	1	3	2	1
7.	Define M-ary signaling in digital communication.	2	1	4	2	1
8.	Compare and contrast different digital modulation schemes such as ASK, PSK, and FSK. Explain the key advantages and disadvantages of each scheme in the context of digital communication.	2	2	4	2	2
9.	What are the types of transmission errors that error control coding helps address?	2	1	5	1	1
10.	Compare the efficiency of Shannon-Fano algorithm and Huffman coding in terms of compression and decoding complexity.	2	2	5	1	2
	Part-B (5 × 8 = 40 Marks)					
11. a)	Compare Square Law Modulation to other AM modulation techniques and outline the advantages it offers in amplitude modulation.	4	2	1	1	1
b)	In a practical AM communication system, the carrier frequency is 1 MHz, and the modulating signal is a sinusoidal waveform with a frequency of 10 kHz. Calculate the upper and lower sideband frequencies and their respective bandwidths. Also, determine the total bandwidth of the modulated signal.	4	4	1	1	1

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12. a)	Describe the significance of pre-emphasis and de-emphasis in FM systems. Present a numerical example illustrating how pre-emphasis and de-emphasis parameters are chosen for a specific FM transmitter.	4	2	2	2	2
b)	Given a phase modulation (PM) signal with a frequency deviation of 25 kHz and a modulating frequency of 5 kHz, calculate the peak phase deviation. Explain the concept of peak frequency deviation and its relationship with the phase deviation.	4	4	2	2	2
13. a)	Explain the concept of companding in PCM (Pulse Code Modulation) systems. Calculate the quantization noise power for any PCM signal assuming some quantization levels and uniform quantization.	4	2	3	2	2
b)	In a PAM (Pulse Amplitude Modulation) system, the pulse duration is 10 microseconds, and the sampling rate is 100 kHz. Calculate the Nyquist rate and the necessary quantization levels to prevent aliasing.	4	4	3	2	2
14. a)	In the context of an M-ary signaling scheme, elaborate on decision regions and the criteria required for maximum likelihood decoding. Calculate the probability of error for a specific M-ary scheme when given the signal-to-noise ratio.	4	2	4	1	1
b)	In a PSK (Phase Shift Keying) communication system, if the signal-to-noise ratio (SNR) is 20 dB and 16-QAM is used, calculate the symbol error rate. Discuss the trade-off between modulation order and symbol error rate in digital communication.	4	4	4	1	1
15. a)	Discuss the principles of convolutional codes and highlight their advantages over block codes for error correction. Provide an illustrative example of a convolutional encoder and decoder in action to correct a specific error pattern.	4	2	5	2	2
b)	For a systematic linear block code [7,4], the three parity check digits are given by C1=m1 ⊕ m2 ⊕m3 ; C2=m1 ⊕m2⊕m4 ;C3=m1 ⊕m3⊕m4. (i) Construct generator matrix (ii) Construct code generated by this matrix. Decode the received word 1011001.	4	4	5	2	1
16. a)	In an AM broadcasting system, the carrier frequency is 1 MHz, and the modulation index is 0.8. If the maximum amplitude of the modulating signal is 2 V, calculate the peak amplitude of the AM signal and the total power in the transmitted signal.	4	4	1	1	1
b)	In an FM radio broadcast system, the carrier frequency is 100 MHz, and the maximum frequency deviation is 75 kHz. Calculate the peak frequency deviation in radians per second (rad/s) and the modulation index for this FM signal.	4	4	2	2	2

17.	Answer any ***two*** of the following:					
a)	In a Pulse Code Modulation (PCM) system, the analog signal has a bandwidth of 4 kHz. Calculate the Nyquist rate and the minimum number of quantization levels required to represent the signal without aliasing.	4	4	3	2	1
b)	In a QAM (Quadrature Amplitude Modulation) system, the constellation diagram shows eight equally spaced symbols on the I-Q plane. If the signal-to-noise ratio (SNR) is 20 dB, calculate the bit error rate (BER) for this system.	4	4	4	2	2
c)	You are designing an error control code with a Hamming distance of 5. Calculate the minimum number of error-correcting bits required for a code to correct two-bit errors. Provide the code rate and describe its error-correcting capabilities.	4	4	5	2	2

M : Marks; L: Bloom's Taxonomy Level; CO; Course Outcome; PO: Programme Outcome

i)	Blooms Taxonomy Level – 1	20%
ii)	Blooms Taxonomy Level – 2	30%
iii)	Blooms Taxonomy Level – 3 & 4	50%

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