ANDHRA LOYOLA INSTITUTE OF ENGINEERING AND TECHNOLOGY

VIJAYAWADA-8

ACADEMIC YEAR: 2019-2020

YEAR: **III ECE**

SEMESTER: **I**

SUBJECT NAME: **DIGITAL COMMUNICATIONS**

Cognitive levels
L1– Remember, L2-Understanding, L3- Applying /Analyzing

Question – Bank for unit-1 to unit-3

Unit-1

Q.No	Question	Marks	Cognitive level
1	Given a sine wave of frequency fm and amplitude Am applied to a delta modulator having a step size Δ.Find the condition on Am for which slope overload distortion will occur.	5M	L1
2	What is Slope overload distortion and granular noise in delta modulation? How is it removed in ADM?	5M	L1
3	What is the necessity of Non -uniform quantization and explain companding.	7M	L1
4	If mp = 20V and 256 quantizing levels are employed, what is the voltage between levels when there is no compression?	3M	L1
5	List the advantages of digital communication system.	3M	L1
6	Discuss the elements of digital communication system.	5M	L1
7	Explain quantization error and derive an expression for maximum SNR in PCM system that uses linear quantization.	10M	L2
8	Explain the delta modulation in detail. Evaluate SNR of delta modulation.	10M	L2
9	In a binary PCM system, the output signal to quantizing noise ratio is to be held to a minimum value of 40dB.Determine the number of levels and find the corresponding signal to quantizing noise ratio.	5M	L2
10	A speech signal of maximum frequency 3.4 KHz is applied to a delta modulator whose bit rate is 20 kbps. Determine the minimum step size for the delta modulation so that there is no slope overload?	5M	L2
11	A television (TV) signal with a bandwidth of 4.2 MHz is transmitted using binary PCM. The number of representation levels is 512. Calculate the following parameters. (i) The code word length (ii) The final bit rate (ii) The transmission bandwidth	7M	L2

12	Consider an audio signal with spectral components limited to the frequency band of 300Hz to 3300Hz. A PCM signal is generated with a sampling rate of 8000 samples/sec. The required output-signal-to-quantizing-noise ratio is 30dB. i) What is the minimum number of uniform quantization levels needed and what is the minimum number of bits per sample needed? ii) Calculate the minimum system bandwidth required.	5M	L3
13	A DM system is designed to operate at three times the Nyquist rate for a signal with 3KHz bandwidth. The quantizing step size is 250 mV i) Determine the maximum amplitude of a 1 KHz input sinusoid for which the delta modulator does not show slope overload ii) Determine the post filtered output SNR for the signal of part (i)	10M	L3

Unit-2

Q.No	Question	Marks	Cognitive level
1	What are power spectra? Explain power spectra of BPSK signal along with graphs.	5M	L1
2	Write the power spectral density of QPSK signals and draw the power spectrum.	5M	L1
3	Determine the bandwidth required for M-ary FSK system. Draw the geometrical representation of M-ary FSK signals and find out the distance between the signals.	5M	L1
4	Explain the demodulation of FSK using coherent detection.	5M	L2
5	Explain non-coherent detection methods of binary frequency shift keying scheme.	5M	L2
6	Explain with neat block diagram the generation and recovery of BPSK	5M	L2
7	Draw the block diagram of DPSK modulator and explain how synchronization problem is avoided for its detection.	5M	L2
8	Explain the principle of QPSK system.	5M	L2
9	Explain the generation of M-ary ASK with a neat block diagram.	5M	L2
10	Explain in detail about DEPSK with necessary Block diagram and compare DPSK and DEPSK.	5M	L2

11	Sketch the QPSK waveform for the sequence 1101010010, assuming the carrier frequency equal to bit rate.	5M	L3
12	Sketch the DPSK waveform for the binary data stream 0010010011.	5M	L3

Unit-3

Q.No	Question	Marks	Cognitive level
1	What is matched filter? How it differs from optimum filter? Derive an expression for impulse response, Signal to noise ratio and probability of error for matched filter.	10M	L1
2	Explain how integrator is used to detect the baseband signal. Obtain an expression for S/N of integrator and dump receiver.	10M	L2
3	Explain the significance of Baseband receiver? Derive the expression for probability of error in case of Baseband receiver.	10M	L2
4	Derive the expression for maximum signal to noise ratio in case of optimum filter.	10M	L2
5	Derive the expression for probability of error in Optimum filter? Calculate the transfer function of the Optimum filter.	10M	L2
6	Obtain an expression for the probability of error for BPSK and ASK.	10M	L2
7	A binary receiver system receives a bit rate of 1Mbps. The waveform amplitude is 5mV and the noise power spectral density is 0.5x10-11 W/Hz. Calculate the average bit error probability if the modulation schemes are ASK, FSK and PSK.	10M	L3

Unit-4

Q.No	Question	Marks	Cognitive level
1	Explain the concept of amount of information and its properties	5M	L1
2	Explain the concept of entropy and its properties	5M	L1
3	An analog signal is band limited to B Hz, sampled at the nyquist rate, and the samples are quantized into 4 levels. The quantization levels q1, q2, q3 and q4 are assumed	5M	L1

	independent and occur with probabilities p1=p4=1/8 and p2=p3=3/8.Find the information rate of the source.		
4	One of the five possible messages q1 to q5 having probabilities 1/2, 1/4, 1/8, 1/16, 1/16 respectively, is transmitted. Calculate the average information	4M	L1
5	Consider a discrete memoryless source with source alphabet of three symbols and their probabilities 0.7, 0.15, 0.15 respectively. i) Calculate the entropy of the source ii) Calculate the amount of information	5M	L1
6	Explain the joint and conditional entropies of a discrete memory less channel with necessary expressions.	5M	L2
7	A discrete source emits one of the five symbols once every millisecond. The symbol probabilities are 1/2,1/4,1/8,1/16, and 1/16 respectively. Find the source entropy and information rate.	5M	L2
8	What is the entropy of X? Explain the mutual information and its properties	6M	L2
9	If X represents the outcome of a single roll of a fair die. Find Entropy	4M	L2
10	An analog signal band limited to 10khz is quantised in 8 levels of a PCM system with probabilities of 1/4,1/5,1/5,1/10,1/10,1/20,1/20 and 1/20 respectively. Calculate the entropy and the rate of information.	5M	L2
11	An analog signal band limited to 10HKz quantize 8-levels of PCM System with probability of 1/4,1/5,1/4,1/10,1/20,1/10,1/20 and 1/10 respectively. Find the entropy and rate of information.	6M	L2
12	A code is composed of dots and dashes. Assume that the dash is three times as long as the dot and has one-third the probability of occurrence. i)Calculate the information in a dot and that in a dash ii) Calculate the average information in a dot-dash code iii) Assume that a dot lasts for 10 ms and that this same time interval is allowed between symbols. Calculate the average rate of information transmission.	7M	L3
13	Show that entropy for a discrete memory less source is maximum when the output symbols are equally probable	3M	L3

Unit-5

Q.No	Question	Marks	Cognitive level
1	State the Shannons source coding theorem and derive the expression for coding efficiency.	5M	L1

2	What is binary symmetric channel and derive the expression for its capacity	5M	L1
3	Write a short notes bandwidth-S/N trade off	5M	L1
4	Consider five messages given by the probabilities 1/2,1/4,1/8,1/16,1/16. i) Calculate H ii) Use Shannon-Fano algorithm to develop an efficient code and for that code, calculate the average number of bits/message. Compare with H.	10M	L2
5	A discrete memory less source has the letters A,B,C,D,E,F and G with corresponding probabilities{0.08,0.2,0.12,0.15,0.03,0.02,0.4},design Huffman code for the above source and determine the average length of the codeword and coding efficiency.	10M	L2
6	A discrete memory less source produces symbols x_i where i=0 to 5 with the following probabilities $p(x_0)=0.1$, $p(x_1)=0.2$, $p(x_2)=0.15$, $p(x_3)=0.09$, $p(x_4)=0.20$, $p(x_5)=0.26$.Design the Huffman code for the above source and find the coding efficiency.	10M	L2
7	A discrete memory less source with alphabet s_0,s_1,s_2 produces them with probabilities of 0.7,0.2,0.1 respectively. Use shannon-fano algorithm and determine its coding efficiency.	5M	L2
8	A DMS X has five symbols x1,x2, x3,x4 and x5 with respective probabilities 0.2,0.15,0.05,0.1 and 0.5.Construct huffman code and calculate its code efficiency	10M	L2
9	A DMS X has 5 equally likely symbols (i)Construct Shannon-Fano code for X , calculate the efficiency of the code (ii) Repeat the Huffman code and compare the results	10M	L3
10	A Gaussian channel has a 1-MHz bandwidth .If the signal-power-to -noise power spectral density $S/\eta=10^5$ Hz. Calculate the channel capacity C and the maximum information transfer rate R	5M	L3
11	Explain and derive the expression for the channel capacity of a Gaussian channel	10M	L3

Unit-6

Q.No	Question	Marks	Cognitive level
1	For a systematic Linear block code, the three parity check digits c_4,c_5 and c_6 are given by $c_4=m_1+m_2+m_3$ $c_5= m_1+m_2$ $c_6= m_1+m_3$ (i) Construct generator matrix (ii) Construct code generated by this matrix	10M	L2

	(iii) Determine error correcting capability (iv) Prepare suitable decoding table (v) Decode the received code words 101100 and 000110		
2	The parity check matrix of a particular (7,4) linear block code is given by $[H]=\begin{bmatrix}1&1&1&0&1&0&0\\1&1&0&1&0&1&0\\1&0&1&1&0&0&1\end{bmatrix}$ (i) Find the generator matrix G (ii) List all the Code Vectors (iii) What is the minimum distance between code words (iv) How many errors can be detected and corrected	10M	L2
3	The parity check bits of a (8,4) block code are generated by c5= d1+d2+d4 c6=d1+d2+d3 c7=d1+d3+d4 c8=d2+d3+d4 where d1, d2, d3 and d4 are the message digits. (i) Find the generator matrix and parity check matrix for this code (ii)Find the minimum weight of this code (iii)Find the error detecting capabilities of this code.	10M	L2
4	Using Transform domain approach of convolutional codes, find coded sequence for the given rate ½ encoder with generator sequences g1= (1, 0, 1), g2 = (0, 1, 1) and message m = (10111).	10M	L2
5	Briefly describe about the Code tree, Trellis and State Diagram for a Convolution Encoder.	10M	L2
6	Draw the state diagram, tree diagram, and trellis diagram for K=3, rate 1/3 code generated by $g1(x) = 1+x^2$, $g2(x) = 1+x$ and $g3(x) = 1+x+x^2$.	10M	L3
7	Draw Code Tree and State diagram for rate ½ convolutional encoder with Constraint length 3 and generator sequences g1=(1, 1, 1) and g2= (1, 0, 1)	10M	L3
8	Using Transform domain approach of convolutional codes, find coded sequence for the given rate 1/3 encoder with generator sequences g1= (1, 0, 1), g2 = (1, 1, 0) and g3 = (1, 1, 1) and message m = (111011).	10M	L3

Faculty : G.VIJAYA KUMAR