BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: B.TECH **SEMESTER : V**
BRANCH: ECE **SESSION : MO/2023**

SUBJECT: EC301 DIGITAL COMMUNICATION

TIME: 3 HOURS **FULL MARKS: 50**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

			CO	BL
Q.1(a)	Discuss various types of sampling techniques with suitable diagram. Also, determine the minimum sampling freq. to digitize the signal $s(t) = (\text{Cos } 6\pi\ 10^3\ t\ )^2$.	[5]	01	02
Q.1(b)	Derive an expression for peak signal power to average quantization noise power ratio for a **M**-level linear quantizer for an analog signal with a peak-to-peak voltage range of Vpp volts and the quantile interval equal to **p** volts. Also, highlight the granular noise as well as slope overload distortion in delta modulation with diagram only and discuss its mitigation technique.	[5]	01	02
Q.2(a)	Let g(t) = p(t) * p(t), where * denotes convolution and p(t)=u(t) - u(t-1) with u(t) being the unit step function. Determine the impulse response of filter matched to the signal s(t) = g(t) – δ(t-2) * g(t).	[5]	02	04
Q.2(b)	Illustrate the Gram-Schmidt orthogonalization procedure for a set of three vectors with a suitable example.	[5]	02	02
Q.3(a)	Compare the probability of error of ASK with the probability of error of BPSK for gaussian noise and discuss with diagram. Also explain the probability of error in the context of QPSK.	[5]	03	02
Q.3(b)	What is the need of an equalizer in a communication system? Highlight the advantage of a non-linear equalizer over linear equalizer.	[5]	03	01
Q.4(a)	Explain the properties of entropy for a discrete memoryless source. Show that entropy is bounded as $0 \leq H(X) \leq \log_2 K$, when K is the no. of symbols.	[5]	04	01
Q.4(b)	Describe Huffman coding algorithm. Consider a DMS with probabilities 0.37, 0.33, 0.16, 0.07, 0.04, 0.02 and 0.01, respectively. Construct Huffman code for the DMS and find out code efficiency.	[5]	04	02
Q.5(a)	Discuss various types of spread spectrum techniques. Also illustrate characteristics as well as various applications of spread spectrum technique.	[5]	05	02
Q.5(b)	Illustrate the direct sequence spread spectrum with a suitable example (assume data bits along with a spreading sequence) and also determine the spreading gain.	[5]	05	04

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