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

CLASS: B.TECH. **SEMESTER: VI**
BRANCH: ECE **SESSION: SP/2024**

SUBJECT: EC359 INFORMATION THEORY AND CODING

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

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

				CO	BL
Q1	(a)	Show that the maximum entropy of 8-symbol source is 4 bits.	[5]	1	2
Q1	(b)	Consider a 5-alphabet source giving symbols a, b,, c, d, e with probabilities 0.5, 0.3, 0.15, 0.05, 0.05 respectively. Compare the code lengths for arithmetic coding and Lempel Ziv coding when the input sequence is BAD.	[5]	1	2
Q2	(a)	What do you mean by a binary symmetric channel? What is the average mutual information of binary symmetric channel when probability of one of the input symbols is 0.1 and error probability is 0.5.	[5]	2	2
Q2	(b)	What do you mean by channel capacity? Find the capacity of the channel given in 2(a) above? What is the value of channel capacity when channel bandwidth become very large?	[5]	2	3
Q3	(a)	Find the error sequence when the syndrome sequence is 010 for (6,3) block code given by $c_i = a_i$, for $1 \leq i \leq 3$, $c_4 = a_1 + a_3$, $c_5 = a_2 + a_3$, $c_6 = a_1 + a_2 + a_3$.	[5]	3	3
Q3	(b)	Write all the elements of GF(2^3) modulo primitive polynomial $x^3 + x^2 + 1$. Show that primitive polynomial $x^3 + x^2 + 1$ is also the minimal polynomial of the element α^2 in this field where α is the primitive element of the field.	[5]	3	3
Q4	(a)	How do you select generator polynomial of (7,4) cyclic code? Show that BCH code is also of cyclic property.	[5]	4	3
Q4	(b)	Draw the block diagram of generating systematic cyclic code using polynomial $g(x) = x^3 + x + 1$,	[5]	4	3
Q5	(a)	Give a block diagram for generation of rate 1/3 nonsystematic convolutional code using 2-bit memory units.	[5]	5	2
Q5	(b)	Describe the recursive updating of path metric using Viterbi Decoding algorithm applied to binary trellis.	[5]	5	3

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