

JK Lakshmipat University, Jaipur
INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Regular), December 2021
B. Tech. in Electrical & Electronics Engineering, Semester VII

Roll No.....

EE1218: Information Theory and Coding

Time: 2 hrs

Max. Marks: 30

Instructions to students:

1. Do not write anything other than your roll number on question paper
2. Writing appropriate units, nomenclature, and drawing neat sketches/schematics/ flow chart wherever required are an integral part of the answer
3. Use of programmable calculator, class lecture notes/handouts, etc., are not allowed
4. Assume suitable data wherever required and mention it clearly

- Q.1 For a bandlimited continuous channel, derive how the mutual information $I(X;Y)$ can be expressed in terms of entropies of channel input or output and their conditional entropies. 8
(CO 3)

0.1 0.05 0.05

If $P(xy) =$ 0.2 0.15 0.1

0.1 0.2 0.05

Calculate the mutual information

- Q.2 Establish that the error probability P_e of a digital 2-hop cascaded (2 BSCs) Tx-Rx system is $2p'$ if the transition probability of each binary symmetric channel (BSC) is p' . Justify when repeaters must be installed between Tx-Rx stations. 4
(CO 2)
- Q.3 Design the structure of one single round of advanced encryption standard (AES) algorithm where 128-bit data path is split into 16 bytes and give suitable examples for each of the 4 sublayers in that single round, justifying the use of GF(2) arithmetic. 8
(CO 4 & 5)

- Q.4 For the 2 code systems given below, calculate the redundancy and coding efficiency. Determine which among them satisfies the Kraft-McMillan inequality for optimal codes. 4
(CO 1 & 6)

Source Symbol	Probability	Code 1	Code 2
A	9/16	0	00
B	3/16	10	01
C	3/16	110	10
D	1/16	111	11

- Q.5 Encode and obtain optimal compact codes for the given messages with their respective probabilities of occurrence using the Huffman regressive coding algorithm and calculate entropy, Kraft-McMillan criterion, redundancy and coding efficiency. 6
(CO 1 & 4)

Source Message	Probability *
M1	0.12
M2	0.25
M3	0.15
M4	0.3
M5	0.10
M6	0.08