

K. J. Somaiya Institute of Engineering and Information Technology, Sion, Mumbai-22

(Autonomous College Affiliated to University of Mumbai)

End Semester Exam

Nov – Dec 2021

(B.Tech) Program: Electronics and Telecommunication

Examination: TY Semester: V

Course Code: IUEXC501 and Course Name: Digital Communication

Duration: 03 Hours

Max. Marks: 60

Instructions:

- (1) All questions are compulsory.
- (2) Draw neat diagrams wherever applicable.
- (3) Assume suitable data, if necessary.

		Max. Marks
Q 1	Solve any six questions out of eight:	12
i)	Calculate the minimum SNR for transmitting 1 Mbps through a Gaussian channel with a bandwidth of 10 kHz	2
ii)	Calculate the code efficiency of Huffman code for the symbols S1, S2 and S3 with probabilities 0.22, 0.48 and 0.30 respectively	2
iii)	Calculate 3-bit HRC for the following message bits: 111101011110	2
iv)	Calculate 3-bit checksum for the following message bits:	2

	111101011110	
v)	Determine a correct generator polynomial for (3, 2) cyclic code	2
vi)	Calculate the average bit energy of the data 1010 with NRZ Manchester format transmission	2
vii)	How much more bit energy is needed for orthogonal signals compared to antipodal signals to achieve the same error probability when the receiver is matched filter	2
viii)	Calculate the baud rate if the modulation is 16-ary QASK and bit rate is 100kbps	2
Q.2	Solve any four questions out of six.	16
i)	Calculate CRC code using CRC-8 polynomial for the data 1 followed by 15 zeros.	4
ii)	Design a generator matrix for (5,2) systematic linear block code and determine all the code words for 1 bit error correction.	4
iii)	Find the generator polynomial for (4, 3) cyclic code and determine all the code words.	4
iv)	Generator sequences of a convolutional encoder are $g^{(1)} = 1000$, $g^{(2)} = 1001$, $g^{(3)} = 1111$. a) Sketch the encoder b) Find the code rate and constraint length c) Find the code word for the message 100	4
v)	Sketch QPSK and OQPSK waveforms for the data sequence 00011011	4
vi)	Sketch 4-ary orthogonal FSK and MSK waveforms for the data sequence	4

	00011011	
Q.3	Solve any two questions out of three.	16
i)	Find fixed length code, minimum variance Huffman code, and minimum variance Shannon-Fano code for the following 8 symbols and calculate the efficiency of each code. Symbols are S1, S2, S3, S4, S5, S6, S7, and S8 with probabilities 0.1, 0.05, 0.07, 0.35, 0.13, 0.15, 0.09 and 0.06 respectively.	8
ii)	Generator sequences of a (3, 1, 2) convolutional encoder are given below: $g^{(1)} = 100, g^{(2)} = 101, g^{(3)} = 111$ Decode the message bits from the received code 101110101000011 using Viterbi's decoding	8
iii)	Compare QPSK and MSK in terms of bandwidth, error probability, ICI and ISI(include all the supportive proof)	8
Q.4	Solve any two questions out of three.	16
i)	Compare NRZ polar, AMI and Manchester line codes in terms of bandwidth, power requirement, dc component, sync capability and polarity inversion error. Sketch all 3 waveforms for the data 0011	8
ii)	Calculate the error probability of integrate and dump receiver with gain 10 for the following cases: a) Baseband signal is NRZ polar with amplitudes ± 2 volts, bit rate 1 kbps and PSD of one-sided Gaussian noise of 10^{-3} w/Hz. b) Baseband signals for 1 and 0 are orthogonal and other values are same as the previous case.	8
iii)	Compare 16-ary QASK and 16-ary FSK in terms of bandwidth, error probability, ICI and ISI	8