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Code No. : 22557

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS), HYDERABAD

Accredited by NAAC with A++ Grade

M.E. (E.C.E.) II-Semester Main Examinations, September-2022**Coding Theory and Techniques**

(Communication Engineering & Signal Processing)

Time: 3 hours

Max. Marks: 60

Note: Answer all questions from Part-A and any FIVE from Part-B

Part-A (10 × 2 = 20 Marks)

Q. No.	Stem of the question	M	L	CO	PO
1.	Mention the importance of Error Control Codes in digital communication system.	2	1	1	3
2.	Compare BER performance of BPSK in AWGN and Rayleigh fading channels.	2	2	1	3
3.	Differentiate between regular and irregular LDPC codes with an example.	2	2	2	3
4.	Give the relationship between generator matrix and parity check matrix for linear block codes.	2	1	2	3
5.	Differentiate between Block codes and Convolutional codes.	2	2	3	3
6.	What are structural properties of convolutional codes?	2	1	3	3
7.	Bring out the necessity of interleaver in Turbo decoders.	2	1	4	3
8.	List the components used for generation of Turbo codes.	2	1	4	3
9.	Distinguish between STBCs and STTCs	2	2	5	3
10.	Explain rate gain for a MIMO system.	2	1	5	3
Part-B (5 × 8 = 40 Marks)					
11. a)	Briefly explain the diversity techniques for fading channels.	4	2	1	3
b)	Determine the coding gain required to maintain BER of 10^{-3} when the received E_b/N_0 remains fixed and the modulation format is changed from BPSK to 8-PSK in AWGN channel.	4	3	1	3,4
12. a)	Construct Parity check and generator matrices for (7,4) Hamming code.	4	3	2	4
b)	Explain the procedure of constructing LDPC codes using Gallager's method.	4	2	2	4
13. a)	Differentiate between recursive and non-recursive convolutional encoders with example.	2	2	3	3
b)	The impulse responses of a convolutional encoder are given by $g_1=[101]$, $g_2=[111]$, $g_3=[110]$. (i) Construct the corresponding encoder (ii) Construct the state diagram	6	4	3	1,3

Contd... 2

14. a)	Find the output codeword for the above encoder for the input sequence $X = [1 \ 1 \ 0 \ 0 \ 0 \ 1]$. Let the interleaver be $[3 \ 0 \ 2 \ 4 \ 1 \ 5]$.	6	4	4	1,3
b)	Discuss the Viterbi decoding algorithm of convolutional codes.	2	2	4	3
15. a)	Develop Alamouti space time coding with 2-transmit 2-receive antennas and analyze.	4	4	5	1
b)	Derive an expression for channel capacity of a MIMO fading channel.	4	3	5	1,3
16. a)	Construct $GF(2^4)$ from the primitive polynomial $P(X)=X^4 +X+1$ over $GF(2)$. Assume 'α' to be the root of the primitive polynomial. Show the power polynomial and 4-tuple representations.	4	4	1	1,3
b)	Design a double error correcting binary BCH code of length 15.	4	4	2	1,3
17	Answer any <i>two</i> of the following:				
a)	Discuss the advantages of Trellis Coded Modulation.	4	2	3	3
b)	Discuss the working principle of Turbo codes and compare them with LDPC codes.	4	2	4	3
c)	What are OSTBC codes? Explain. Discuss their advantages and disadvantages.	4	1	5	3

M : Marks; L: Bloom's Taxonomy Level; CO; Course Outcome; PO: Programme Outcome

i)	Blooms Taxonomy Level – 1	20%
ii)	Blooms Taxonomy Level – 2	35%
iii)	Blooms Taxonomy Level – 3 & 4	45%
