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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
07 THRISSUR CLUSTER

SECOND SEMESTER M.TECH. DEGREE EXAMINATION APRIL 2018

Electronics & Communication Engineering
Communication Engineering and Signal Processing
07EC6232 CODING THEORY

Time : 3 hours

Max. Marks: 60

Answer all six questions. Part 'a' of each question is compulsory.

Answer either part 'b' or part 'c' of each question

Q.no.	Module 1	Marks
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1a	Define field and give a typical example.	4
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Answer b or c

b	Solve the following equations over $GF(2^4)$	5
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$$X + \alpha^7 Y = \alpha^2$$

$$\alpha^{12} X + \alpha^8 Y = \alpha^4$$

c	(i) Find out the linear combination of the vectors (10101), (01110) and (11011) .	5
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	(ii) Are these vectors linearly independent? Give reason for your answer.	
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Q.no.	Module 2	Marks
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2a	Give an example for a Hamming code and bring out its peculiarities.	4
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Answer b or c

b	The generator matrix of (6, 3) linear block code is given below. Construct its standard array.	5
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$$G = \begin{bmatrix} 0 & 1 & 1 & 1 & 0 & 0 \\ 1 & 0 & 1 & 0 & 1 & 0 \\ 1 & 1 & 0 & 0 & 0 & 1 \end{bmatrix}$$

c	Draw the decoder diagram of a (n, k) linear systematic block code explain.	5
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Q.no.	Module 3	Marks
3a	Prove that the nonzero code polynomial of minimum degree in a cyclic code is unique.	4

Answer b or c

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| b | The generator polynomial of (7, 3) cyclic code is $1 + X^2 + X^3 + X^4$. Draw the encoder diagram of this code and explain the operation. | 5 |
| c | Using the syndrome computation circuit of (7,4) cyclic code, find out the syndrome for the received vector $r = (0111101)$. Also find out the syndrome for the received vector shifted to the right by 3 positions. Verify the computations mathematically. | 5 |

Q.no.	Module 4	Marks
a	How do you get the generator polynomial of a BCH code.	4

Answer b or c

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| b | Find out the parity check matrix of double error correcting BCH code with length 15. | 5 |
| c | The received polynomial corresponding to a code word from a double error correcting (7, 3) RS code is $r(X) = X^4 + X^2 + \alpha^3$. Decode it. | 5 |

Q.no.	Module 5	Marks
5a	<p>(i) Draw the encoder diagram of a convolutional encoder with two outputs and one input with the following generator sequences.</p> <p style="text-align: center;">$g^1 = (111) \qquad g^2 = (101)$</p> <p>(ii) Give the rate and constraint length of the above encoder.</p> <p>(iii) Find out the generator matrix in transform domain and using it find out the code polynomial corresponding to the message 011.</p>	5

Answer b or c

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| b | For a simple convolutional encoder, draw its state diagram and hence describe the method to find out the free distance of it. | 7 |
| c | With a flow chart explain Fano algorithm used for sequential decoding. | 7 |

Q.no.	Module 6	Marks
6a	Explain Trellis coded modulation.	5
Answer b or c		
b	Explain block and convolutional interleaving.	7
c	Explain Turbo codes in detail.	7