

**GUJARAT TECHNOLOGICAL UNIVERSITY****ME - SEMESTER-I(New course)• EXAMINATION – WINTER- 2015****Subject Code: 2714106****Date: 01/01/2016****Subject Name: Digital Modulation and Coding****Time: 2:30 pm to 5:00 pm****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1** (a) Discuss M-ary QAM in detail with derivation of minimum euclidean distance. **07**  
Also draw the signal space diagrams for M= 4,8,16,32.
- (b) For a (6,3) systematic linear block code, three parity check digits are **07**  
 $C_4 = d_1 + d_2 + d_3$ ,  
 $C_5 = d_1 + d_2$ ,  
 $C_6 = d_1 + d_3$ ,  
 where  $d_1, d_2$  and  $d_3$  are message digits. Construct the appropriate generator matrix and codeword table. Decode the data word if received words are: 101100, 000110 & 101010.
- Q.2** (a) Discuss M-ary FSK modulation and derive the condition of minimum **07**  
frequency separation for the MFSK signals to be orthogonal.
- (b) For a systematic (7,4) cyclic code with generator polynomial **07**  
 $g(x) = x^3 + x^2 + 1$ , construct the generator matrix and parity check matrix. Decode the data word if received codeword is  $r = 1101101$ .
- OR**
- (b) Discuss standard array decoding of linear block codes with suitable example. **07**
- Q.3** (a) Describe burst error correcting code in detail. **07**
- (b) Explain interleaved codes in detail. **07**
- OR**
- Q.3** (a) Describe Reed Solomon codes. **07**
- (b) Explain C.P.F.S.K as a particular class of C.P.M with necessary derivation **07**  
and show that it is a modulation scheme with memory.
- Q.4** (a) Draw convolution encoder (2,1,2) for generator matrix **07**  
 $G(D) = [1+D \quad 1+D+D^2]$ . Obtain state diagram, code tree and trellis diagram for it.
- (b) What do you mean by feedback convolution encoder? Explain rate  $R = 1/3$  **07**  
systematic feedback encoder.
- OR**
- Q.4** (a) Explain encoding of rate  $R = 1/2$  non systematic feed forward convolution **07**  
encoder. Also show the transform domain representation of the encoder.
- (b) Draw convolution encoder (2,1,3) for generator matrix **07**  
 $G(D) = [1+D+D^2+D^3 \quad 1+D+D^3]$  and hence obtain state table, code tree and trellis diagram for the same.
- Q.5** (a) Write a short note on: LDPC codes. **07**
- (b) Discuss basics of iterative decoding of turbo codes and hence explain it with **07**  
2-state (2,1,1) encoder with generator matrix  $G(D) = [1 \quad 1/(1+D)]$  using log-MAP algorithm.
- OR**
- Q.5** (a) Write a short note on BCH codes. **07**
- (b) Discuss the fundamental ideas behind construction of turbo codes and explain **07**  
basic turbo encoding structure.

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