

**GUJARAT TECHNOLOGICAL UNIVERSITY**  
**M. E. - SEMESTER – I • EXAMINATION – WINTER 2012**

**Subject code: 714403N****Date: 16-01-2013****Subject Name: Modern Digital Communication Techniques****Time: 02.30 pm – 05.00 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 the relationship between power and bandwidth. Explain various ways to describe bandwidth as performance parameter of communication system **07**

(b) Describe the duobinary pulse suitably in time as well as in frequency domain. What is its significance with reference to ISI? The binary sequence 111010010001101 is the input to a pre-coder whose output is used to modulate a duobinary transmitting filter. Construct a table showing the transmitting amplitude levels, the received signal levels and the decoded sequence **07**

**Q.2** (a) What is ISI? Discuss the Nyquist criterion for the design of band-limited signals with no ISI. **07**

(b) Explain the Viterbi algorithm for the discrete-time white noise filter model. **07**

**OR**

(b) Why equalization is required? Discuss the mean square error criterion for the linear equalization. **07**

**Q.3** (a) Write a short note on Decision feedback equalization. **07**

(b) Discuss any one application of DS spread spectrum signal. **07**

**OR**

**Q.3** (a) Derive the expression for the PSD of synchronous data pulse stream generated by a binary zero-mean, WSS sequence. Investigate the expression. **07**

(b) Consider the sequence formed by interleaving N independent first order Markov sources with respective transition probabilities  $P_{t_n}$ ;  $n=1,2,\dots,N$ . Then the resulting sequence is cyclo-stationary with correlation function

$$R_a(n; l) = (1 - 2P_{t_n})^{|l|/N} ; l=0, \pm N, \pm 2N, \dots$$

$$= 0 ; \text{ all other integer } l$$

**Q.4** (a) What are the advantages of multicarrier communication system? Describe an FFT-based multicarrier system. **07**

(b) Show that the channel capacity C in bits/sec increases monotonically toward its maximum value  $C_\infty$  as Bandwidth B increases. **07**

**OR**

**Q.4** (a) Discuss convolution coded digital communication using suitable example. **07**

(b) Explain the un-coded and coded digital communication system architectures using block diagram. Compare them. **07**

- Q.5** (a) Compare following **07**
- (i) block coded and convolution coded system
  - (ii) scalar communication and vector communication over memory-less channel
- (b) Consider the mathematical model of discrete communication channel **07**
- having 3 possible input messages {a, b, c} and 3 possible output symbols {1, 2, 3} as shown in Figure 1. The channel model is completely described by the set of nine conditional probabilities
- $P(1/a) = 0.6$      $P(2/a) = 0.3$      $P(3/a) = 0.1$   
 $P(1/b) = 0.1$      $P(2/b) = 0.5$      $P(3/b) = 0.4$   
 $P(1/c) = 0.1$      $P(2/c) = 0.1$      $P(3/c) = 0.8$
- (i) Given that the received symbol is 1, what is the decision of the optimum receiver regarding which message is transmitted?
  - (ii) Repeat (i) for the received symbol 3.

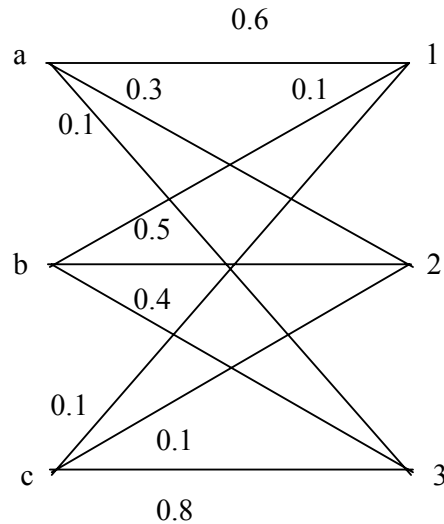


Figure 1

**OR**

- Q.5** (a) What is PN sequence? Explain the generation of PN sequence. **07**
- (b) Explain following **07**
- (i) Spread spectrum signals
  - (ii) Direct sequence spread spectrum signals
  - (iii) Frequency-hopped spread spectrum signals

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