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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
FIRST SEMESTER M.TECH DEGREE EXAMINATION, DECEMBER 2017
Electronics & Communication Engineering

Stream(s):

1. Microwave & Television Engineering
2. Signal Processing
3. Telecommunication Engineering

01EC6205: Advanced Digital Communication

Answer any two full questions from each part
Limit answers to the required points.

Max. Marks: 60

Duration: 3 hours

PART A

1. Consider the signal set given below:

$$S_1(t) = 2, \quad 0 \leq t \leq 3$$

$$S_2(t) = 2, \quad 0 \leq t \leq 1$$

$$S_3(t) = -2, \quad 1 \leq t \leq 3$$

$$S_4(t) = 2, \quad 0 \leq t \leq 2$$

- a. Find the basis functions and Draw the constellation diagram. 4
- b. Represent each signal using the set of basis functions and find Euclidean distance. 5

2. A BPSK system employs the signals:

$$S_1(t) = \sqrt{\frac{2E_b}{T_b}} \cos 2\pi f_c t, \quad 0 \leq t \leq T_b$$

$$S_2(t) = 0$$

Where E_b is the bit energy and T_b is the bit duration.

Find the probability of error as a function of SNR as well as Euclidean distance. 9

3. Consider the signal:

$$S(t) = \begin{cases} \left(\frac{A}{T}\right)t \cos 2\pi f_c t, & 0 \leq t \leq T \\ 0, & \text{otherwise} \end{cases}$$

- a. Determine the impulse response of the matched filter for the signal. 3
- b. Find the output of the matched filter at $t=T$ 6

PART B

- 4. a. Prove the Nyquist theorem for zero ISI. 4
- b. The binary sequence 10010110010 is the input to a precoder whose output is used to modulate a duobinary transmitting filter. Find the precoded sequence, the transmitted amplitude levels, the received signal levels and the decoded sequence. 5
- 5. Obtain an optimum ML receiver for channels with ISI and AWGN. 9
- 6. Derive the expression for the capacity of a nonideal linear filter channel and explain water filling method for power distribution. 9

PART C

- 7. a. Derive the equations for processing gain and jamming margin for DS spread spectrum. 6
- b. A DS binary PSK spread spectrum signal has a processing gain of 500. What is the jamming margin against a continuous tone jammer if the desired error probability is 10^{-5} . 6
- 8. a. Explain how a PN sequence is generated for spread spectrum applications. 6
- b. Describe the performance of a RAKE demodulator 6
- 9. Derive the probability of error for a binary digital communication system with diversity. 12