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**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**  
**FIRST SEMESTER M.TECH DEGREE EXAMINATION, DECEMBER 2017**

*Branch:*

**Electronics & Communication Engineering**

*Stream(s):*

1. **Microwave & Television Engineering**
2. **Signal Processing**

*Course Code & Name:*

**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. A digital communication system uses the following signal set:

$$S_1(t) = 1, \quad 0 \leq t \leq 1$$

$$S_2(t) = 1, \quad 1 \leq t \leq 2 \text{ \& } -1, \quad 2 \leq t \leq 3$$

$$S_3(t) = -1, \quad 0 \leq t \leq 3$$

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

2. A BFSK system employs the signals:

$$S_1(t) = \sqrt{\frac{2E_b}{T_b}} \cos 2\pi f_1 t, \quad 0 \leq t \leq T_b$$

$$S_2(t) = \sqrt{\frac{2E_b}{T_b}} \cos 2\pi f_2 t, \quad 0 \leq t \leq T_b$$

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

Design an optimum correlation based receiver for the system. 9

3. a. Obtain the maximum output of a matched filter 5
- b. Prove that the output obtained from a matched filter is same as that of a correlator based demodulator output for the same signal. 4

**PART B**

4. a. Explain how a Raised Cosine Spectrum is used to remove the Inter Symbol Interference. 4
- b. Determine the transmitting and receiving filter for a binary communication system that transmits data at a rate of 4800bits/s over a channel with frequency response 5

$$|C(f)| = \frac{1}{\sqrt{1 + (f/W)^2}}; |f| \leq W$$

Where  $W = 4800\text{Hz}$ , The AWGN is zero mean with spectral density  $N_0/2 = 10^{-15} \text{ W/Hz}$ .

5. a. Explain the LMS algorithm for equalization. 4
- b. The sampled output from a demodulator is -0.5, 0.1, 1, -0.2, 0.05 determine the tap coefficients of a three-tap zero-forcing equalizer 5
6. a. Describe the modulation and demodulation in an OFDM system. 4
- b. Obtain the expression for the demodulated sequence in an FFT based OFDM system. 5

**PART C**

7. a. Obtain a tapped-delay-line channel model for a frequency selective slowly fading channel 6
- b. What are the various diversity techniques? Briefly explain. 6
8. Explain the various phases for synchronization of the spread spectrum systems. 12
9. An FH binary orthogonal FSK system employs an  $m=15$  stage linear feedback shift register that generates an ML sequence. Each state of the shift register selects one of  $L$  non-overlapping frequency bands in the hopping pattern. The bit rate is 100bits/s and the hop rate is one per bit. The demodulator employs noncoherent detection.
- a. Determine the hopping bandwidth for the channel 4
- b. What is the processing gain? 4
- c. Find the error probability in the presence of AWGN 4