Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SIXTH SEMESTER B.TECH DEGREE EXAMINATION, APRIL 2018

Course Code: EC302

Course Name: DIGITAL COMMUNICATION (EC)

Max. Marks: 100 Duration: 3 Hours

PART A

Answer any two full questions, each carries 15 marks. Marks

1 a) Define autocorrelation function of random process and explain its properties. (5)

b) Find power spectral density of the WSS process if its autocorrelation function is given by (7)

$R_X(\tau) = e^{-\alpha|\tau|}$ for $-\infty < \tau < \infty$.

c) Explain the need for anti-aliasing filter in a digital communication system. (3)

2 a) What is a matched filter? Derive an expression for the impulse response of a matched filter. (8)

b) Derive impulse response for Duobinary encoder. (7)

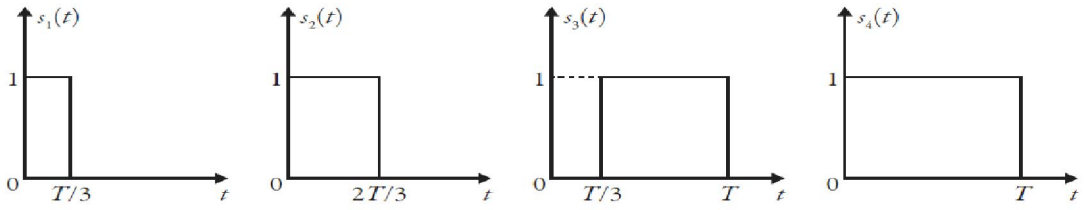
3 a) Consider a random process $X(t) = A\cos(2\pi f_c t+\phi)$ where A and fc are constants and ϕ is uniformly distributed over the interval $(-\pi, \pi)$. Check whether the given random process is WSS. (7)

b) A baseband digital system uses 4-level PAM along with the raised cosine pulse. The system has a frequency response of 3.2 kHz. If the binary data is transmitted at 9600 bps data rate, then what would be the symbol rate and roll-off factor of the transmitted pulse shape for zero ISI? (8)

PART B

Answer any two full questions, each carries 15 marks.

4 a) Given the signals $s_1(t), s_2(t), s_3(t)$ and $s_4(t)$ shown in Figure. Use the Gram-Schmidt orthogonalization procedure to find an orthonormal basis for the set of following signals: (8)



b) Find mean and variance of received signal x(t), if signal $s_{i(t)}$ was transmitted which is corrupted by AWGN with zero mean such that $x(t)= s_{i(t)} +w(t)$,where w(t) is AWGN. (7)

5 a) Derive an expression for probability of error for BPSK. (8)

b) Draw the block diagram for QPSK generation and detection with relevant equations. (7)

6 a) Explain how a continuous AWGN channel can be converted into a vector channel. (8)

b) With the help of a neat diagram explain the detection of non-coherent orthogonal modulation schemes. (7)

PART C

Answer any two full questions, each carries 20 marks.

7 a) Define process gain and jamming margin as applied to a spread spectrum system. (5)

b) Derive probability of error in direct sequence spread spectrum with coherent binary phase shift keying (DS/BPSK). (8)

c) In a DSSS modulation scheme, a 14-stage linear feedback shift register is used to generate the PN code sequence. Find (7)

(a) the period of code sequence

(b) Process gain.

8 a) Explain the principle of CDMA. Discuss the near field problem associated with CDMA. (7)

b) Discuss the need for diversity techniques for wireless communication. Give a brief outline of various diversity techniques. (8)

c) Explain how a rake receiver counters the effects of multipath fading? (5)

9 a) In DSSS-CDMA, the data rate Rb = 6 kbps and the chip rate Rc = 12 Mbps. What is the JM if an output SNR of 10 dB is required for a $Pc = 10^{-5}$. Also, find the JM if we include a system loss of 1.5 dB owing to imperfections in tracking and detection. (8)

b) Derive the bit error rate for a coherent BPSK over a flat-flat Rayleigh fading channel (7)

c) What are the advantages of FDMA over TDMA? (5)

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