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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.

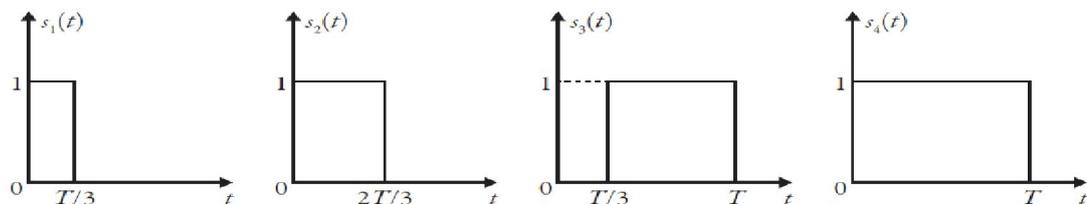
Marks

- 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
 $R_X(\tau) = e^{-\alpha|\tau|}$ for $-\infty < \tau < \infty$. (7)
- 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 $X(t) = A\cos(2\pi f_c t + \theta)$ where A and f_c are constants and θ 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 $R_b = 6$ kbps and the chip rate $R_c = 12$ Mbps. What is the JM if an output SNR of 10 dB is required for a $P_c = 10^{-5}$. 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)
