Name : ....

Roll No. : ....

Invigilator's Signature : ....

CS/M.Tech(ECE)/SEM-1/MVLSI-105D/2012-13

2012

ADVANCED DIGITAL COMMUNICATION

Time Allotted : 3 Hours   *Full Marks* : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words

as far as practicable.

GROUP – A
(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following :

$$10 \times 1 = 10$$

     i)   Quantization noise power is directly proportional to the square of the

         a)   sampling rate

         b)   bandwidth of the baseband signal

         c)   step size

         d)   none of these.

     ii)   Slope overload distortion occurs in

         a)   BPSK

         b)   PAM

         c)   Delta modulation

         d)   none of these.

     iii)   Autocorrelation function of strictly stationary process depends only on the

         a)   time difference   b)   ensemble average

         c)   time average   d)   none of these.

iv) In pure Aloha, the sender sends the frame
    a)   at fixed time
    b)   whenever it has frame to send
    c)   after sensing the carrier
    d)   at request only.

v) Fading in narrow band system can be reduced with

    a)   decreasing modulation index

    b)   filtering

    c)   overmodulation

    d)   spread spectrum.

vi) Balance property states that, number of zero with respect to number of one is always

    a)   more than one   b)   less than one

    c)   equal   d)   half.

vii) If the message signal bandwidth is B Hz and corresponding spread spectrum signal bandwidth Bss Hz, then processing gain is

    a) $2\,B/Bss$ b) $B/2\,Bss$

    c) $B\,/\,Bss$ d) $Bss\,/\,B$.

viii) The dc value of bipolar line code is

    a)   one unit   b)   max value

    c)   zero   d)   min value.

ix) The impulse response of a matched filter of pulse signal $g(t)$ of duration T is

    a) $kg(t)/T$ b) $kg(T-t)$

    c) $kg(T+t)$ d) $kg(t-T)$.

x) The name of the probability distribution known as normal distribution is

    a)   Binomial distribution   b)   Poisson distribution

    c)   Gaussian distribution   d)   Rayleigh distribution.

xi) OFDM stands for

    a) Orthogonal Frequency Domain Multiplexing

    b) Orthogonal Frequency Diversion Multiplexing

    c) Orthogonal Frequency Division Multiplexing

    d) Orthogonal Frequency Division Multiplier.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following   3 × 5 = 15

2. Describe briefly FDMA and TDMA.

3. Represent noise in orthogonal components.

4. Describe the operation of matched filter.

5. Describe delta modulation process.

6. Write short notes on any *two* of the following :

    i) ALOHA

    ii) BPSK

    iii) GAUSSIAN NOISE.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following.   3 × 15 = 45

7. How are the orthonormality and orthogonality of signals are explained ? Represent a set of M energy signals as a linear combination of M orthonormal basis functions where $N \le M$. Explain the Gram Schmidt procedure to represent a set of arbitrary signals by a set of orthonormal components.

                                            3 + 3 + 3 + 3 + 3

8. What do you mean by stationary random process ? What is autocorrelation function of a stationary random process ? Write down the properties of autocorrelation function of a stationary random process. Find out the autocorrelation function of a sinusoidal wave with random phase. When a random process can be called as Ergodic process ?   5 + 5 + 5
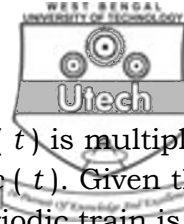
9.   a)   In natural sampling, an analog signal $g(t)$ is multiplied by a periodic train of rectangular pulse $c(t)$. Given that the pulse repetition frequency of this periodic train is f_s and the duration of each rectangular pulse is T (with $f_s T \ll 1$), do the following :

   i)   Find the spectrum of the signal $s(t)$ that results from the use of natural sampling; you may assume that time $t = 0$ corresponds to the midpoint of a rectangular pulse in $c(t)$.

   ii) Show that the original signal $m(t)$ may be recovered from its naturally sampled version, provided that the conditions embodied in the sampling theorem are satisfied.

   b)   Given the data stream 11110001010, sketch the transmitted sequence of pulse for each of the following line codes :

   i)   Unipolar non-return-to-zero

   ii) Polar non-return-to-zero

   iii) Unipolar return-to-zero

   iv) Bipolar return-to-zero

   v)   Manchester code.   5 + 5 + 5

10. What is ISI in baseband pulse transmission ? What is Nyquist theorem for signal design for no ISI for band limited channel ? How ISI can be overcome with Duobinary Signalling ?   5 + 2½ + 2½ + 5

11. a)   What do you mean by spread spectrum ? Write down the principle of DSSS. Define the terms :

   i)   Processing gain

   ii) Jamming margin.

   b)   Explain how OFDM combats multipath fading.

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