Reg. No. : .....

Name : .....

First Semester M.Tech. Degree Examination, March 2014
(2013 Scheme)
Electronics and Communication
Stream:Telecommunication Engineering, Communication Systems Microwave & TV Engineering, Signal Processing
TMC 1002 : ADVANCED DIGITAL COMMUNICATION

Time : 3 Hours Max. Marks : 60

Answer **any 2** questions from **each** Module (**Each** carries **10** marks).

Module – 1

1. Three equiprobable messages m_1, m_2, m_3 are to be transmitted over an AWGN channel with noise power spectral density $\frac{N_0}{2}$ The messages are

$s_1(t) = 1 \quad 0 \le t \le T$
$= 0 \quad \text{otherwise}$

$s_2(t) = -s_3(t) = 1 \quad 0 \le t \le \frac{1}{2}T$
$= -1 \quad \frac{T}{2} \le t \le T$
$= 0 \quad \text{otherwise}$

i) What is the dimensionality of the signal space ?

ii) Find the appropriate basis for the signal space.

iii) Draw the signal constellation and the optimal decision regions.

iv) Which of the three is most vulnerable to noise and why ?

2. a) Consider the optimum detection of the sinusoidal signal $s(t) = \sin\left(\frac{8\pi t}{T}\right) 0 \le t \le T$ in AWGN.

i) Determine the correlator output assuming a noiseless input.

ii) Determine the corresponding matched filter output, assuming that the filter includes a delay T to make at causal.

iii) Hence show that these outputs are the same only at time in start $t = T$ 6

b) Discuss the properties of matched filter. 4

3. a) Explain an optimum receiver for an AWGN channel.

   b) For a binary PAM system the two possible signal points are $s_1 = -s_2 = \sqrt{E_b}$ where E_b is the energy/bit. The prior probability of $P(s_1) = P_1$. Determine a metric for the optimum MAP detector when the transmitted signal is corrupted with AWGN.

Module – 2

4. i) Describe a zero forcing equalizer.

   ii) The transmission of a signal with a raised cosine spectrum through a channel results in the following output from the demodulator.

   $x(-2) = -0.5$, $x(-1) = 0.1$, $x(0) = 0$, $x(1) = -0.2$, $x(2) = -0.05$, it is zero otherwise.

   Determine the tap coefficients of 3 tap linear equaliser based on zero forcing criterion.

5. i) Discuss the synchronization of spread spectrum. 4

   ii) A rate $\frac{1}{2}$ convolutional code with $d_{free} = 10$ is used to encode a data sequence occurring at a rate of 1 kbps. The modulation in BPSK. The DS spread spectrum has a chip rate of 10 MHz.

   a) Determine the coding gain, processing gain and jamming margin. 6

6. i) Explain FH spread spectrum with a block diagram.

   ii) An FH orthogonal FSK system employs an 15 stage linear feedback shift register so that is generates GPN sequence. Each stage of the shift register one of the L non over lapping frequency bands in the hopping pattern. The bit rat is 100 bps and the hop rate is one per bit. The demodulator employs non-coherent detection.

   a) Determine the hopping bandwidth for this channel.

   b) Determine the processing gain and probability of error.

Module – 3

7. Explain clearly the phenomenon of signal fading of multipath channels. Develop statistical models for fading channels and discuss about the statistical characterisation of multipath channels.

8. a) Discuss the random access method of packet transmission. 6

   b) Consider a pure ALOHA system that is operating with a throughput s = 0.1 and packets are generated with a Poisson arrival rate λ. Determine the value of G and average number of attempted transmission to send a packet.

9. i) Compare the performance of FDMA, TDMA and CDMA. 3

   ii) Derive the channel capacity for FDMA. 3

   iii) Discuss the functioning of multiuser receiver for synchronous transmission. 4