



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

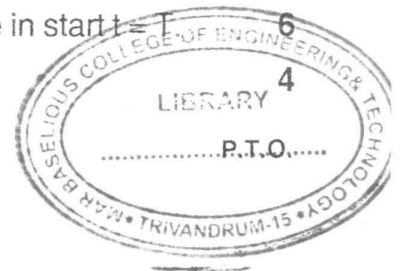
1. Three equiprobable messages m_1, m_2, m_3 are to be transmitted over an AWGN channel with noise power spectral density $\frac{N_0}{2}$. The messages are

$$\begin{aligned}
 s_1(t) &= 1 & 0 \leq t \leq T \\
 &= 0 & \text{otherwise} \\
 s_2(t) &= -s_3(t) = 1 & 0 \leq t \leq \frac{1}{2}T \\
 &= -1 & \frac{T}{2} \leq t \leq T \\
 &= 0 & \text{otherwise}
 \end{aligned}$$

- 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 $s(t) = \sin\left(\frac{8\pi t}{T}\right) 0 \leq t \leq T$ 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 it causal.
 - iii) Hence show that these outputs are the same only at time in start $t = T$.
- b) Discuss the properties of matched filter.





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 is 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 a 15 stage linear feedback shift register so that it generates a PN sequence. Each stage of the shift register outputs one of the L non overlapping frequency bands in the hopping pattern. The bit rate 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
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