

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. IInd Semester–Remedial Examination – June/July- 2011

Subject code: 722202

Subject Name: Advance Digital Communication

Date: 24/06/2011

Time: 10:30 am – 01:00 pm

Total Marks: 60

Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

Q.1 (a) Explain Matched-filter demodulator in brief. Consider the signal: 06

$$s(t) = (A/T)t \cos 2\pi f_c t \quad (0 \leq t \leq T) \\ = 0 \quad (\text{Otherwise})$$

i) Determine the impulse response of the matched filter for the signal and find the output of the matched filter at $t=T$.

ii) Suppose the signal $s(t)$ is passed through a correlator that correlates the input $s(t)$ with $s(t)$. Determine the value of correlator output at $t=T$.

(b) For M-ary phase modulated signal, prove that minimum Euclidian distance for 06

$$\text{adjacent signal phases is } d_{\min}^{(e)} = \sqrt{\varepsilon_g \left(1 - \cos \frac{2\pi}{M} \right)}$$

Where ε_g = energy of gate pulse.

Q.2 (a) The basis signals of a three dimensional signal space are given by 06

$\psi_1 = p(t)$, $\psi_2 = p(t-T_0)$ and $\psi_3 = p(t-2T_0)$ where $p(t)$ is given as,

$p(t) = (T_0)^{-0.5} [U(t) - U(t-T_0)]$ and $U(\cdot)$ is unit step function.

Sketch the signal waveforms in time domain which are represented by (2,-1,1), (3,2,-0.5) and (-0.5,-1,1) coordinates.

(b) Explain in detail with diagram Early -late Gate Synchronizer. 06

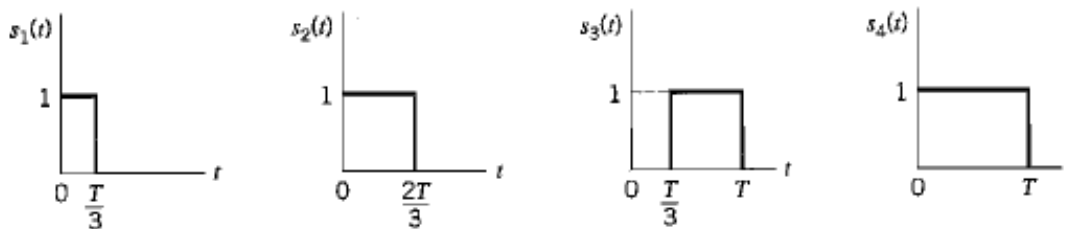
OR

(b) Explain in detail with diagram decision directed Maximum Likelyhood estimation of timing for base band PAM. 06

Q.3 (a) Following figure displays the waveforms of four signals $s_1(t)$, $s_2(t)$, $s_3(t)$ and $s_4(t)$. 06

(a) Using the Gram- Schmidt orthogonalization procedure, find an orthonormal basis for this set of signals

(b) Construct the corresponding signal- space diagram

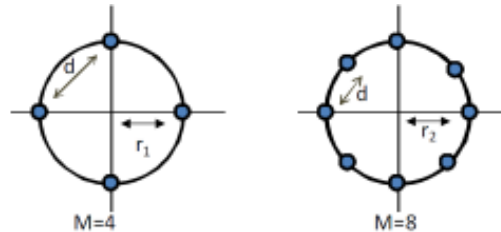


(b) Compare various digital modulation methods at 10^{-5} symbol error probability. 06

OR

- Q.3 (a)** Evaluate the probability of error for M-ary Orthogonal signals. Investigate the effect of increasing M on the probability of error for orthogonal signals and justify the statement “The minimum required E_b/N_0 is 1.42 dB to achieve an arbitrarily small probability of error as $M \rightarrow \infty$ at sufficiently high SNR.” **06**
- (b)** Explain the effect of intersymbol interference on eye opening and prove Nyquist condition for zero ISI. **06**

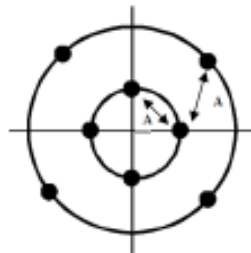
- Q.4 (a)** Consider the four phase and eight phase signal constellation shown in figure below. Determine the radii r_1 and r_2 of circles such that the distance between two adjacent points in the two constellations is d . Also find additional energy required in 8 PSK to achieve same BER as four phase PSK. **06**



- (b)** Explain the Costas loop for generating a properly phased carrier for double sideband suppressed carrier signal. Compare it with Squaring loop method and decision-feedback PLL used to establish the carrier phase estimate of carrier signals. **06**

OR

- Q.4 (a)** In one digital transmission method the 8 signals are represented using constellation diagram as shown in figure below. A nearer neighbor signal points are separated by distance of A units. Find the total average power transmitted by transmitter under this scheme. **06**



- (b)** Define equalizer and list various types of equalization methods. Discuss the error rate performance of linear MSE equalizer. **06**

- Q.5 (a)** Give answer of following questions **06**
- (i) A friend of yours says that she can design printer which can print 100 lines per minute and the printer data is transmitted over voice grade telephone line with bandwidth of 10 KHz and SNR of 15 dB. The printer prints maximum 60 characters per line. Would you believe on your friend? Why?
- (ii) Explain the significance of Parallel transmission under fading channel. Give block diagram to generate Orthogonal Frequency Division Multiplexing (OFDM) signal.
- (b)** What is simplex signal and bi-orthogonal signal? List out all properties of simplex and bi-orthogonal signals. **06**

OR

- Q.5 (a)** Explain an FFT-based multi-carrier communication system in brief. What is the major problem with multi carrier modulation? Describe the various methods investigated to solve it. **06**
- (b)** (i) Describe a discrete-time model for a channel with ISI with an example. **06**
- (ii) List the key features of OFDM system.
