Seat No.: _

Enrolment No.

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E. SEMESTER III-EXAMINATION - WINTER 2015

Subject code: 2730502

Date: 04/12/2015

Subject Name: Advanced Digital Communication

Total Marks: 70

07

Time: 2:30 PM to 5:00 PM

Instructions:

- 1. Attempt all questions.
- 2. Make suitable assumptions wherever necessary.
- 3. Figures to the right indicate full marks.
- Q.1 (a) Explain the representation of Band-pass signal and system in equivalent lowpass 07 signal and system. Prove that $S_l(t)$ is generally a complex valued signal and give the condition under which it is real.
 - (i) Mention the different types of linear modulation with memory. Explain any 04 **(b)** one type in detail.
 - (ii) Explain: Antipodal signals, Biorthogonal signals and Simplex signals. 03
- Q.2 **(a)** Describe the Matched-filter demodulator with its properties.
 - Determine a set of orthonormal functions for the signals shown below using 07 **(b)** Gram-Schmidt procedure.



OR

- Consider the case of binary PAM signals in which the two possible signal points 07 **(b)** are $s_1 = -s_2 = \sqrt{\varepsilon_b}$, where ε_b is the energy per bit. The prior probabilities are $P(s_1) = p$ and $P(s_2) = 1-p$. Let us determine the metrics for the optimum MAP detector when the transmitted signal is corrupted with AWGN.
- Q.3 Derive the expression for probability of error of *M*-ary PSK. Digital information 07 (a) is to be transmitted by carrier modulation through an additive gaussian noise channel with a bandwidth of 100 kHz and $N_0=10^{-10}$ W/Hz. Determine the maximum rate that can be transmitted through the channel for four phase PSK. 07
 - Explain Early-Late gate synchronizers for symbol timing estimation. **(b)**

OR

- Derive the expression for probability of error of *M*-ary PAM. A speech signal is 07 Q.3 (a) sampled at a rate 8 kHz, logarithmically compressed and encoded into a PCM format using 8 bits/sample. The PCM data is transmitted through an AWGN baseband channel via M-level PAM. Determine the band-width required for transmission when M=8.
 - Explain Maximum-Likelihood criterion for carrier phase estimation. Based on a 07 **(b)** ML criterion, determine a carrier phase estimation method for binary on-off keying modulation.
- **Q.4** Compare Decision-Directed loop with Non-Decision Directed loop for carrier 07 (a) recovery. Explain any one Non-Decision Directed loop for carrier recovery.
 - For the design of band-limited signals, State and prove Nyquist condition for 07 **(b)** zero ISI.

Q.4	(a)	Describe Decision Directed and Non-Decision Directed timing estimation methods for baseband PAM signal.	07
	(b)	Explain symbol-by-symbol suboptimum detection of information symbols for controlled ISI.	07
Q.5	(a) (b)	Explain Decision-Feedback equalization method to compensate the ISI Draw and explain an FFT-based multicarrier communication system.	07 07
		OR	
Q.5	(a)	Briefly explain zero-forcing algorithm and LMS algorithm for adaptive optimization in adaptive linear equalizer.	07

(b) Explain characterization of fading multipath channels with necessary 07 expressions.
