Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

Manipal University

SIXTH SEMESTER B.TECH (E & C) DEGREE END SEMESTER EXAMINATION - APRIL/MAY 2017

SUBJECT: DIGITAL COMMUNICATION (ECE - 3201)

TIME: 3 HOURS **MAX. MARKS: 50**

Instructions to candidates

- Answer **ANY FIVE FULL** questions.
- Missing data may be suitably assumed.

1A.	Consider the set of signals $$s_i(t) = \begin{cases} \sqrt{\frac{2E}{T}}\cos(2\pi f_c t - i\frac{\pi}{4}), & 0 \le t \le T \\ 0, & elsewhere \end{cases}$$ where i = 0, 1, 2, 3 and f_c is an integer multiple of 1/T (a) Determine the dimensionality, N of the signal set. (b) Determine set of orthonormal basis functions to represent this set of signals. Determine the coefficients s_{ij} of the signals $s_i(t)$. Also give the signal constellation diagram.
1B.	Consider a signal s(t) = Asinc(t/T) defined over the interval $-\infty < t < \infty$. Determine and make a neat plot of the output of a filter having impulse response h(t) = sinc(t/T) from $-\infty < t < \infty$ if the signal s(t) is given as input. Can we say that h(t) is a matched filter for s(t)? Give reasons for your answer.
1C.	With block diagrams, explain differential phase-shift keying.
	(5+3+2)
2A.	Show that when a stationary message process (strictly band limited) is reconstructed from the sequence of its samples taken at a rate equal to 2w, where 'w' is the highest frequency component, the reconstructed process equals the original process in the mean-square sense for all time
2B.	Obtain the expression for bound on aliasing error.
2C.	Discuss the digital T1 system with the signalling details.
	(5+3+2)
3A.	Starting from fundamentals, obtain the expression for the quantizer characteristic c(x).
3B.	Assuming that video signals have a bandwidth of 4 MHz, and assuming that the sampling is done at twice the Nyquist rate, determine the memory size required in bits to store a two hour video program if the quantizer used has 256 levels of representation.
3C.	A speech signal is sampled at 8 kHz and coded with differential PCM the outputs of which belong to a set of eight symbols. The symbols have the following probabilities, $P(x_1) = 0.4$, $P(x_2) = 0.25$ $P(x_3) = 0.15$, $P(x_4) = 0.1$, $P(x_5) = 0.05$, $P(x_6) = 0.03$, $P(x_7) = 0.01$, $P(x_8) = 0.01$. Find the entropy of the source in bits/symbol and bits/second.
	(5+3+2)
4A.	The binary data 011100101 are applied to the input of a modified duobinary system.

	(i) Construct the modified duobinary coder output and corresponding receiver output with and without a precoder at the transmitter. (ii) Suppose that due to the error during transmission, the level produced by the third digit is reduced to zero, construct the new receiver output without a precoder.
4B.	Determine the power spectral density of the polar quaternary format of NRZ type, based on the natural code. Assume statistically independent and equally likely message bits.
4C.	What are Linear Block codes? Explain with an example in detail.
	(5+3+2)
5A.	Explain the principles of direct sequence spread spectrum and frequency hopping (both slow and fast frequency hopping) spread spectrum communication systems. Include suitable diagrams and waveforms as required.
5B.	For a (6,3) systematic linear block code, the three parity check bits C_4, C_5 and C_6 are formed from the following equations: $C_4 = d1 \oplus d_3$ $C_5 = d_1 \oplus d2 \oplus d_3$ $C_6 = d1 \oplus d_2$ i. Write down the generator matrix G. ii. Construct all possible code words. Suppose that the received word is 010111. Decode this received word by finding the location of the error and the transmitted data bits.
5C.	What is a pseudo – noise sequence? How is it generated? Explain with an example.
	(5+3+2)