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 - 302)

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

Instructions to candidates

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

1A. Prove that a stationary message process can be faithfully reconstructed from its samples at a sequence of points spaced 1/2W seconds apart.

1B. Obtain the expression for the maximum output signal to noise ratio for sinusoidal modulation.

1C. For the Hamming code with generator matrix G and parity-check matrix H of the code, show that these two matrices satisfies the condition $GH^T = 0$.

(5+3+2)

2A. Show that the impulse response of the optimum filter is a time reversed and delayed version of the input signal $\phi(t)$.

2B. Let *E* denote the energy of a strictly band-limited signal *g(t)*. Show that *E* may be expressed in terms of the sample values of *g(t)*, taken at the Nyquist rate, as follows.

$E = \frac{1}{2W}\sum_{n=-\infty}^{\infty}\left|g\left(\frac{n}{2W}\right)\right|^2$, where *W* is the highest frequency component of *g(t)*.

2C. A PCM system uses a uniform quantizer followed by a 7 bit binary encoder. The bit rate of the system is equal to $50*10^6$ bits per second. What is the maximum message bandwidth for which the system operates satisfactorily?

(5+3+2)

3A. Starting from fundamentals, obtain the expression for the quantizer characteristic *c(x)*.

3B. Determine the power spectral density of the bi-polar quaternary format of NRZ type, based on the natural code. Assume statistically independent and equally likely message bits.

3C. Discuss the digital T1 system with the signalling details.

(5+3+2)

4A. Consider a four-stage linear feedback shift register shown in Figure 4A. The initial state of the register is 1101. Find the output sequence of the shift register and demonstrate the balance and run property of the generated PN-sequence. Also calculate and plot the autocorrelation function of the PN-sequence produced by this shift register.

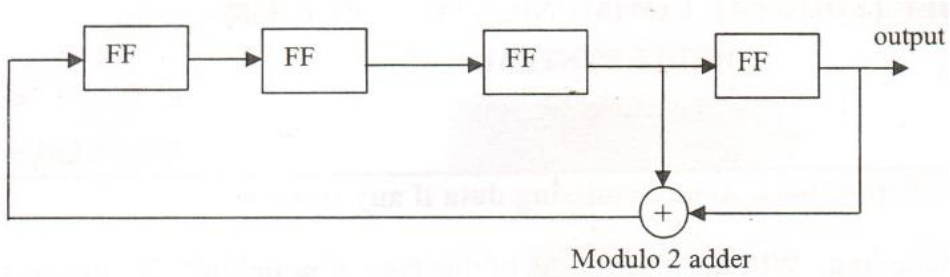

Figure 4A

4B. Assuming an ideal AWGN channel prove that the channel capacity with infinite bandwidth is given by 1.44 S/N_0 bits /sec

4C. How does code division multiple access (CDMA) separate the individual signal in the receiver.

(5+3+2)

5A. The binary data 011100101 are applied to the input of a modified duo binary system.

i) Construct the modified duo binary coder output and corresponding receiver output with and without a precoder at the transmitter.

ii) Suppose that due to error during transmission, the level produced by the third digit is reduced to zero, without the new receiver output without a pre coder.

5B. Explain the baseband binary data transmission system and give the reasons for inter-symbol interference.

5C. A discrete source generates five messages S_1, S_2, S_3, S_4 and S_5 with probability of transmission 1/16, 1/8, 1/4, 1/16 and 1/2 respectively. Obtain Shannon-Fano coding and average information H.

(5+3+2)

6A. With block diagram, explain the coherent frequency shift keying and obtain the expression for probability of error. Draw the signal constellation diagram.

6B. Obtain the expression for bound on aliasing error.

6C. With block diagrams, explain differential phase-shift keying.

(5+3+2)