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 **ALL** questions.
- Missing data may be suitably assumed.

1A. Show that the impulse response of an optimum filter is a time reversed and delayed version of the input signal $\phi(t)$.

1B. A signal s(t) of duration 'T' sec is defined as, $s(t) = \begin{cases} +a/2, & 0 \le t \le T/2 \\ -a/2, & T/2 \le t \le T \end{cases}$

(i) Determine impulse response of a filter matched to this signal and sketch it as a function of time.

(ii) What is the peak value of output?

1C. 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 the average information H.

(5+3+2)

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

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

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

2C. 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)

3A. Discuss the Delta modulation with suitable sketches and mention its drawbacks. How these drawbacks can be minimized?

3B. Obtain an expression for the maximum output signal to noise ratio for the delta modulated sinusoidal information signal.

3C. A PCM system uses an uniform quantizer followed by 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)

4A. With block diagram, explain the coherent frequency shift keying and obtain an expression for probability of error. Draw the signal constellation diagram.

4B. Explain the baseband binary data transmission system and give the reasons for inter-symbol interference.

4C. A communication channel of bandwidth 75 KHz is required to transmit binary data at the rate of 0.1Mb/s using raised cosine pulses. Determine the roll off factor α.

(5+3+2)

5A. Consider a four-stage linear feedback shift register shown in Figure 5A. The initial state of the register is 1111. 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.

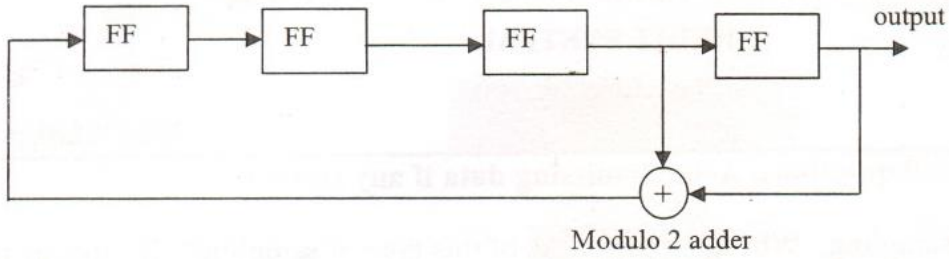

Figure 5A

5B. Assuming an ideal AWGN channel prove that the channel capacity with infinite bandwidth is given by 1.44 S/N_0 bits /sec

5C. How code division multiple access (CDMA) separates the individual signal in the receiver.

(5+3+2)