Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

SIXTH SEMESTER B.Tech. (E & C) DEGREE END SEMESTER EXAMINATION
APRIL 2018
SUBJECT: DIGITAL COMMUNICATION (ECE - 3201)

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

Instructions to candidates
- Answer **ALL** questions.
- Missing data may be suitably assumed.

1A. Derive an expression for the output Signal-to-Noise ratio (SNR) of a matched filter receiver and show that the maximum SNR equals $2E/N_o$, assuming AWGN channel.

1B. A discrete memoryless source has an alphabet of symbols with probabilities for its output, as described in the table below:

Symbol	S_0	S_1	S_2	S_3	S_4	S_5
Probability	0.25	0.25	0.125	0.125	0.125	0.125

Compute the Huffman code for this source. Find code efficiency and code redundancy.

1C. For the signals $s_1(t)$ & $s_2(t)$ shown in FIG1C, find the orthonormal basis functions.

(5+3+2)

2A. Explain the practical aspects of sampling and recovery of the original signal from its samples. Evaluate the effects of practical deviations from the ideal condition.

2B. The signals $g_1(t) = 10\cos(100\pi t)$ and $g_2(t) = 10\cos(50\pi t)$ are both sampled at times $t_n = n/f_s$ where, n = 0, ±1, ±2, …..,, and $f_s = 75$ samples/sec. Are the two sequences of samples thus obtained identical? Justify your answer. What is this phenomenon called?

2C. In a certain binary communication system, the signal space representation for symbol 1 and symbol 0 is $s_1 = \left[\sqrt{A/T} \quad 0\right]$ and $s_2 = \left[0 \quad \sqrt{A/T}\right]$ respectively. Suppose s_1(t) is received without noise at the input of a correlator receiver, determine the output of the correlators and hence find the estimated output. Draw the correlator receiver diagram.

(5+3+2)

3A. Starting from fundamentals, obtain the probability of error expression for channel noise when symbol 1 is sent.

3B. Explain the tradeoff between bandwidth and S/N for a Gaussian channel. Obtain the expression for Shannon's bound.

3C. What will be the output of the quantizers when the input is zero? Discuss it briefly.

(5+3+2)

4A. Consider a random binary sequence where bits are statistically independent and equally likely. Determine the power spectral density of (i) RZ unipolar format (ii) RZ polar format.

4B. A PCM system uses a uniform quantizer followed by a 7 bit binary encoder. The bit rate of the system is $50*10^6$ bits/second.

a) What is the maximum message signal bandwidth for which the system operates satisfactorily?

b) Calculate the output signal to quantization noise ratio when a full-load sinusoidal modulating wave of 2 MHz frequency is applied at the input.

4C. What is an eye pattern? Sketch the general structure of an eye pattern and explain related parameters.

(5+3+2)

5A. Derive the expression for average probability of error for the binary frequency shift keying modulation scheme. Draw the signal constellation diagram, transmitter and receiver blocks.

5B. For a pseudo-sequence generator shown in FIG 5B, find the output sequence of the shift register, if the initial state of the shift register is 1000. Demonstrate the balance and run property of the PN sequence. Also calculate and plot the autocorrelation function of the generated PN sequence.

5C. Give the neat block diagram for transmitter and receiver of differential phase shift keying system.

(5+3+2)

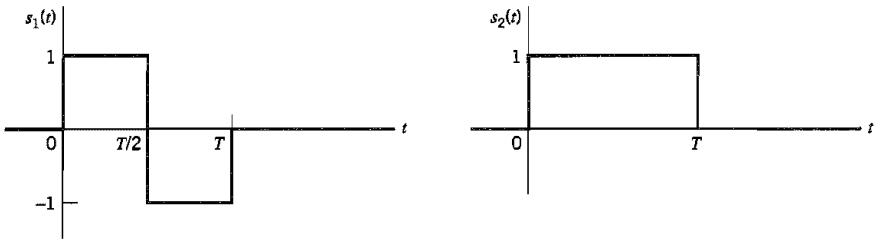

FIG 1C

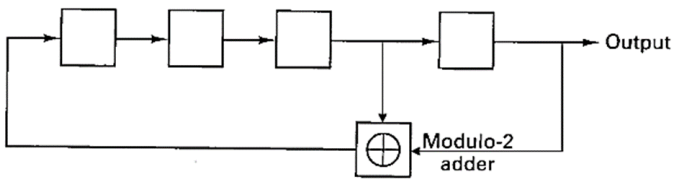

FIG 5B