Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

SIXTH SEMESTER B.TECH. (E & C) DEGREE END SEMESTER EXAMINATION
JUNE 2019
SUBJECT: DIGITAL COMMUNICATIONS (ECE - 3201)

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

Instructions to candidates

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

1A. Assuming an ideal AWGN channel, show that the channel capacity is $C = B\log_2\left(1+\frac{S}{N}\right)$ bits/sec for a channel of bandwidth of *'B'* Hz.

1B. A discrete source generates five message symbols S_1, S_2, S_3, S_4 and S_5 with probability of occurrence 1/16, 1/8, 1/4, 1/16 and 1/2 respectively. Perform source encoding using Shannon-Fano coding and Huffman coding techniques. Compare the coding efficiency of both techniques.

1C. Explain the concept of generation of PN sequences considering three flip-flops and initial state having binary sequence 100. Explain the properties of maximum length sequence.

(4+3+3)

2A. Determine and plot the power spectral density of a unipolar RZ data format. Assume statistically independent and equally likely message bits.

2B. With a neat diagram explain Generalized correlative coding. Construct a correlative coder which has tap weights $w_0 = +1,$ and $w_1 = -1.$ Encode the binary sequence 011011010 using the same coder.

2C. With a neat diagram of transmitter and the receiver, derive the expression for the probability of error of the coherent Quadriphase shift Keying.

(4+3+3)

3A. Compare Matched filter receiver and correlation receiver. With proper derivation, explain how the matched filter receiver maximizes the signal to noise ratio at the output of the receiver.

3B. Determine whether or not $s_1(t) = \cos(2\pi f_1 t + \emptyset)$ and $s_2(t) = \cos(2\pi f_2 t + \emptyset)$ are orthogonal over the interval $(-1.5T < t < 1.5T)$, where $f_2 = 1/T$ and $f_1 = \frac{f_2}{3}$.

3C. Explain the functioning of Sample-and-Hold circuit in reconstructing a sampled signal with necessary diagrams and equations.

(4+3+3)

4A. Prove that if a signal is uniformly sampled in time domain, it results in a periodic spectrum in the frequency domain with a period equal to the sampling rate.

4B. What is quadrature sampling? Explain quadrature sampling and reconstruction of band-pass signals with necessary diagrams.

4C. If a signal g(t) = 2 sinc(2t-1) is sampled at t= 1, ±1, ±2, …….. Find the upper bound on the aliasing error.

(4+3+3)

5A. A Delta modulator system is designed to operate at 3 times the Nyquist rate for a signal with a 3 kHz bandwidth. The quantising step size δ is 250 mV.
a) Determine the maximum amplitude of a 1 kHz input sinusoid to avoid slope overload.
b) Determine the post filtered output SNR for the signal in part (a).

5B. In certain PCM system, the peak value of the input signal is $x_{max} = 20V$ and L=256 quantizing levels are employed, what is the voltage between levels when there is no compression? For $\mu = 255$, what is the smallest and the largest effective separation between levels, knowing that the smallest separation is closest to origin and largest separation close to 1(input $|x|$ normalized with respect to x_{max}).

5C. What is idle channel noise? Explain the same with respect to PCM and DM communication systems.

(4+3+3)