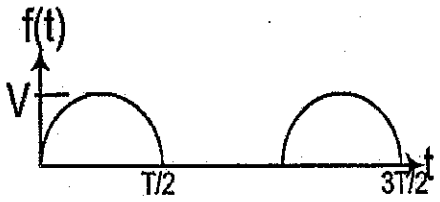
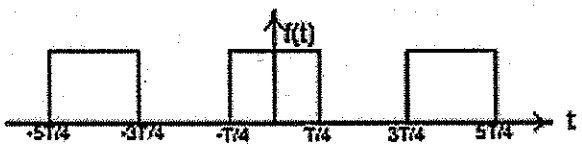
Ref. No. : EX/IT/T/214/2019

B. E. Information Technology Second Year First Semester – 2019

Subject: PRINCIPLES OF COMMUNICATION ENGINEERING

Time: 3 hours **Full Marks: 100**

Answer all the *Five Questions*. Each question has an alternative choice.

Q. No.		Marks
1.	(a) Explain with proper mathematical representation Energy and Power Signals? For most of the signals how can the energy and power be related? (b) Define the causality, linearity and time-invariant property of a system. (c) Deduce the exponential form of Fourier Series. (d) Find an expression for the half-wave rectified output shown in the adjacent figure.  **OR** (a) What are the Dirichlet's conditions in framing a Fourier Series function? (b) Find the Fourier Series expansion of the periodic rectangular waveform shown below considering the amplitude as 'A':  (c) Find the Fourier Transform of i) $x(t) = e^{-at}u(t)$ & *ii)* $x(t) = sgn(t)$. (d) Plot the magnitude and phase spectrum of $x(t)$.	**20**
2.	(a) Using a Complex Exponential generate mathematically the expressions for Amplitude Modulation scheme. (b) How is an impulse response looked upon in a communication system? (c) For an AM signal, estimate the modulation index and modulation depth. Justify why high percentage modulation is desired. (d) Determine the maximum sideband power if the carrier output is 1 kW and hence calculate the total maximum transmitted power. **OR** (a) A portable AM transmitter needs to transmit an average power of 10 Watts in each sideband when modulation depth k = 0.3. Assuming the transmitter is powered by a 12 Volt battery; calculate the total power and the battery current. Justify the selection of single or double sideband considering the device to be a portable one. (b) Considering an old-fashioned analog black-and-white TV with a resolution of 525 × 700, and scanning rate of 30 times per second, calculate the bandwidth needed for a worst-case scenario of displaying alternating black and white pixels. (c) Compare AM, FM, PM with reference to the bandwidth requirement. (d) How can FM signals be demodulated using a PLL?	**20**
3.	(a) Comment on the contribution of Shannon in resolving the problem of transmission of data even over noisy channel and hence relate the Channel capacity and data rate. (b) As per definition by Nyquist how is sampling rate calculated to reconstruct a band-limited signal? (c) What are the various effects studied while choosing a particular channel for the purpose of data communication? (d) How can the various sources of errors in a communication system be controlled? (e) How can noise be quantitatively defined and measured in a communication system? **OR** (a) Explain the different types of sampling techniques using relevant illustrations. (b) How is a continuous signal digitized in a PCM system? (c) What are the basic elements of a PCM system? (d) What are the different Quantization effects? (e) How does a non-uniform quantizer work? Cite the variations as per American and Asian standards.	**20**

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Answer all the *Five Questions*. Each question has an alternative choice.

4.	(a) For a biased coin with probabilities of getting head, tail and the coin landing on its side be 0.49, 0.49 and 0.02 respectively, calculate the amount of self-information for each case. (b) What are the various objectives for using Line Coding techniques? (c) Compare the different line codes based on the principle of self-synchronization, error probability and channel characteristics. (d) Draw the waveforms considering the various line coding schemes taking the code (1 0 1 1 0 1). **OR** (a) Comment on the idea of Shannon in introducing the idea of self-information in determining the information content of a signal. (b) Considering a sequence, say (1 2 1 2 4 4 1 2 4 4 4 4 4 4 1 2 4 4 4 4 4 4) determine the number of bits required to transmit them. (c) Assume we need to download text documents at the rate of 100 pages per minute. What is the required bit rate of the channel? (d) The loss in a cable is usually defined in decibels per kilometer (dB/km). If the signal at the beginning of a cable with −0.3 dB/km has a power of 2 mW, what is the power of the signal at 5 km? (e) A network with bandwidth of 10 Mbps can pass only an average of 12,000 frames per minute with each frame carrying an average of 10,000 bits. What is the throughput of this network?	**20**
5.	(a) Explain the fundamental aspects in modulating a signal using the keying techniques. (b) Compare the various performance metrics of such modulation schemes. (c) Why is the term Keying used to define such a modulation scheme? (d) For an available bandwidth of 100 kHz which spans from 200 to 300 kHz, what are the carrier frequency and the bit rate if the data is modulated by using ASK with d (modulating / filtering value) = 1? (e) Briefly justify how the concept of Poles and Zeros helps in designing a communication system. **OR** (a) Present a block diagrammatic view of a typical digital communication system and discuss the various blocks involved. (b) Represent the block diagram of a PAM TDM system. (c) Compare the TDM and FDM techniques. (d) On what factors the choice for TDM or FDM technique will depend? (e) What do we mean by Synchronous TDM process?	**20**