B. E. Information Technology Second Year First Semester – 2018

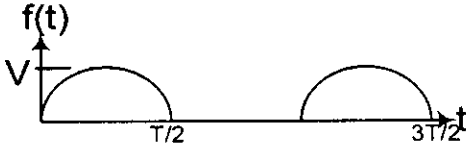### Subject: PRINCIPLES OF COMMUNICATION ENGINEERING

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

Answer *Any Five Questions*. All Questions carry equal marks.

Q. No.		Marks
1.	(a) Deduce the exponential form of Fourier Series. (b) Using a Complex Exponential generate mathematically the expressions for Amplitude Modulation scheme. (c) Find the Fourier Transform of i) $x(t) = e^{-at}u(t)$ & ii) $x(t) = sgn(t)$. Plot the magnitude and phase spectrum of $x(t)$	20
2.	(a) How is an impulse response looked upon in a communication system? (b) Deriving an expression for Convolution Integral, comment on the essence of the integral form so derived in communication engineering. (c) Calculate the coefficients considered in the expression of the Fourier Series for even function. (d) Find an expression for the half-wave rectified output shown below. 	20
3.	(a) State and deduce Parseval's Theorem and hence obtain an expression for Energy Spectral Density. (b) Present a block diagrammatic view of a typical digital communication system and discuss the various blocks involved. (c) Based on Shannon's definition explain entropy. Hence calculate the Entropy (in bits) considering a sequence(1 6 6 6 1 6 6 6 6 6 1 6). Comment on the choice of combination of patterns.	20
4.	(a) Deduce expressions for Total Power, Modulation Index for a sinusoidal signal passed through an AM modulator. What are the variations observed in the output response while varying the modulation index? (b) Explain the various line coding schemes available. What is the usefulness of such design schemes? Draw the waveforms considering the various line coding schemes taking the code (1 1 0 1 1 1 0 1 1).	20
5.	(a) Explain the fundamental aspects in modulating a signal using the ON-OFF keying techniques. Compare the bandwidths of such modulation schemes. (b) Model a two-port network where a couple of similar systems are cascaded together. Comment on the choice of the Network parameters and explain them. (c) Any communication circuit designed with transistors is best modeled with h-parameters. Explain with proper mathematical reasoning.	20

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6.	(a) A sinusoidal signal of 2 kHz frequency is applied to a delta modulator. The sampling rate and step-size (Δ) of the delta modulator are 20,000 samples per second and 0.1 V respectively. To prevent slope overload, what will be the maximum amplitude of the sinusoidal signal? (b) Compare PCM and Delta Modulation and discuss the pros & cons of both the systems. (c) Compare the TDM and FDM processes. On what factors the choice for TDM or FDM technique will depend?	20
7.	(a) What are the various sources of errors in a communication system? (b) How can noise be defined and measured in such a system? (c) Present a simple model to represent AWGN for a transmission channel. Comment on the choice of the name "AWGN". (d) From Shannon's Channel Capacity Theorem express the Channel Capacity with the respect to the power of the signal and noise.	20
8.	(a) An analog signal is band-limited to f_m Hz and sampled at Nyquist rate. The samples are quantized into 4 levels. Each level represents one symbol. Thus there are 4 symbols. The probabilities of occurrence to these 4 levels (symbols) are $P(x_1) = P(x_4) = \frac{1}{8}$ & $P(x_3) = P(x_4) = \frac{3}{8}$. Obtain the information rate of the source. (b) An angle-modulated signal with a carrier frequency $\omega_c = 2\pi \times 10^5$ is described as $\varphi_{EM}(t) = 10\cos(\omega_c t + 5\sin 3000t + 10\sin 2000\pi t)$. Find the (i) power of the modulated signal, (ii) frequency deviation Δf, (iii) deviation ratio β, (iv) phase deviation $\Delta\phi$, (v) bandwidth of $\varphi_{EM}(t)$. (c) Compare the Diode and Coherent Detection in an Amplitude Modulation Design scheme.	20
9.	Write short notes on the following topics:- (a) Phase Locked Loop in Communication System (b) Unit Impulse & Unit Step function and the relation between them (c) ADSL & Cable Modem (d) Study of Poles and Zeros for a Network function	20