

Register No.: Name:

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

FIFTH SEMESTER B.TECH DEGREE EXAMINATION (R,S), DECEMBER 2023

ELECTRONICS AND COMMUNICATION ENGINEERING

(2020 SCHEME)

Course Code : 20ECT305

Course Name: Analog and Digital Communication

Max. Marks : 100

Duration: 3 Hours

PART A

(Answer all questions. Each question carries 3 marks)

1. Explain how wideband FM can be generated from narrowband FM.
2. Plot the frequency spectrum of AM wave using the equation of modulated wave.
3. If $X(t)$ is a random process with mean is 3 and $R_{xx}(t) = 9 + e^{-0.2t}$. Find mean square value of the random Process.
4. Let X be a continuous random variable with probability density function

$$f_x(x) = \begin{cases} ke^{-4x}, & x \geq 0 \\ 0, & \text{otherwise} \end{cases}$$
 Find the value of the constant k .
5. State source coding theorem and channel coding theorem.
6. Describe the need of regenerative repeater in PCM system.
7. State the Nyquist criterion for distortionless baseband transmission in the absence of noise.
8. Explain raised cosine spectrum. Plot the frequency response for different roll of factors.
9. In a BPSK system, the bit rate of a polar NRZ data sequence is 1 Mbps and carrier frequency of transmission is 100 MHz. Determine the symbol rate of transmission and the minimum bandwidth of channel.
10. Draw the block diagram of coherent binary PSK receiver.

PART B

(Answer one full question from each module, each question carries 14marks)

MODULE I

11. a) The equation of the amplitude modulated wave is given by $S(t) = 20[1 + 0.8\cos(2\pi \times 10^3 t)]\cos(4\pi \times 10^5 t)$. Find the carrier power, the total sideband power and bandwidth of the AM wave. (6)
- b) With suitable block diagram, explain the Weaver's method of SSB-SC generation. (8)

OR

12. a) A carrier wave of frequency 100MHz is frequency modulated by a sinusoidal wave of amplitude 20V and frequency 100kHz. The frequency sensitivity of the modulator is 25kHz per Volt. Determine the approximate bandwidth and frequency deviation of the FM signal. What will happen to the bandwidth if modulating signal amplitude and frequency are doubled. (8)
- b) Explain the direct method of FM transmission with the help of block diagram, (6)

MODULE II

13. a) Derive the expression for differential entropy of a Gaussian random variable X with mean μ and variance σ^2 . (10)
- b) Explain cumulative distribution function, probability density function and their properties. (4)

OR

14. a) Consider a random process $X(t) = A \cos(2\pi f_c t + \phi)$ where A and f_c are constant, ϕ is uniformly distributed between $(0, 2\pi)$. Show that $X(t)$ is a WSS process. (10)
- b) State and explain the relation between auto correlation and power spectral density function. (4)

MODULE III

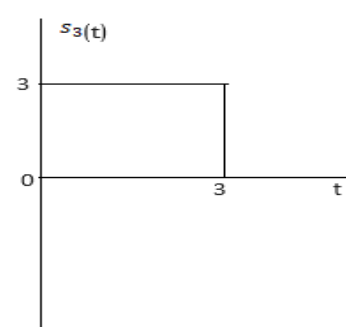
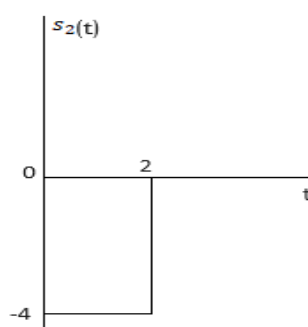
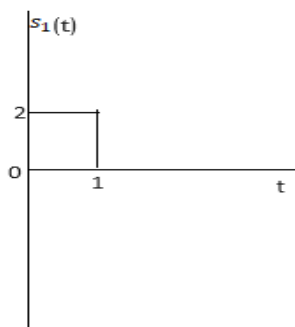
15. a) Draw the block diagram of a PCM system. Justify the need of sampler, quantizer and encoder in PCM transmitter. (5)
- b) A television signal having a bandwidth of 4.2MHz is transmitted using binary PCM system. Given that the number of quantization levels is 512. Determine (9)
- (i) Code word length
- (ii) Transmission Bandwidth.
- (iii) Final bit rate.

OR

16. a) Describe delta modulation system with block diagram. Also illustrate quantization error in delta modulation. (9)
- b) How DPCM signal is reconstructed? (5)

MODULE IV

17. Consider the signals $s_1(t)$, $s_2(t)$, $s_3(t)$ given below. Find the orthogonal basis for these set of signals using Gram- Schmidt orthogonalization procedure. (14)



OR

18. Derive the impulse response and frequency response of a duobinary encoder with the help of neat diagram. (14)

MODULE V

19. a) Consider a QPSK system having a bit rate of 9600bps. Determine the bandwidth required by the QPSK signal using raised cosine filter with roll-off factor of 0.35 and 0.5. (6)
- b) What is QAM. Explain the system with mathematical expression. Draw the constellation diagram of a 16-QAM signal. (8)

OR

20. a) Explain QPSK transmitter and receiver with the help of block diagrams. (8)
- b) Draw and explain the signal constellation diagram for QPSK. (6)
