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Question Paper Code : 16378

B.E. / B.TECH. DEGREE EXAMINATION, NOVEMBER / DECEMBER 2020

Third Semester

Common to B.E. – Computer Science and Engineering & B.Tech. – Information Technology

19IT303 – PRINCIPLES OF COMMUNICATION

(Regulations: Mepco – R2019)

Duration: 3 Hours Max. : 100 Marks

Answer ALL Questions

BTL, CO

PART A – (10 × 2 = 20 Marks)

U, CO1 1. What is the predominant advantage of AM DSBFC?

A, CO1 2. In Frequency Modulation, if the bandwidth required to transmit the FM signal is estimated to be 200 kHz using Carson's rule and maximum frequency deviation produced is 75 kHz, then the frequency of the modulating signal is _____.

A) 125 kHz B) 275 kHz C) 25 kHz D) 75 kHz

Justify your answer.

A, CO2 3. In a PCM code, for a dynamic range of 25 dB, the minimum number of bits required is _____. Justify your answer.

R, CO2 4. List the four most common methods of pulse modulation.

A, CO3 5. For a telephone circuit with SNR = 25 dB and a bandwidth of 3.3 kHz, calculate the information capacity. State your inference from the answer.

A, CO3 6. The minimum bandwidth required for 64-PSK modulation technique is _____ and its bandwidth efficiency is _____. Justify your answer.

A) 64, 6 B) $f_b/6$, 6 C) 32, 5 D) $f_b/5$, 5

U, CO4 7. Which of the following initial state is not suitable for the generation of Pseudo Noise Sequence in a Linear Feedback Shift Register? Justify your answer.

A) 0000 B) 1111 C) 0011 D) 1100

U, CO4 8. In Fast frequency hopping spread spectrum modulation, the _____ rate is an integer multiple of _____ rate. Justify your answer.

A) Hop, Symbol B) Symbol, Hop

C) Both A and B D) None of the above

R, CO5 9. List the advantages and disadvantages of geosynchronous satellites.

U, CO5 10. Explain the difference between a PIN diode and an APD.

PART B – (5 × 16 = 80 Marks)

A, CO1 11. a) i. An DSBFC AM wave is represented by

$$V_{am}(t) = 5(1 + 0.5\sin 200\pi t + 0.5\sin 400\pi t)\sin 2500\pi t$$

A) Calculate the minimum and maximum amplitude of the AM wave

B) Identify the various frequency components that are contained in the above modulated wave

C) Plot the frequency spectrum of the AM wave

D) Calculate the amplitude of each frequency component in the above mentioned AM signal

E) Plot the voltage spectrum

F) Calculate the Bandwidth required to transmit the above signal. (12 Marks)

A, CO1 11. a) ii. For an Superhetrodyne receiver with f_{RF}=980 KHz and f_{IF}=455 KHz, determine the f_{LO} and f_{Image} (Assume High Side Injection is used). (4 Marks)

OR

A, CO1 11. b) i. From the following signal $V_{FM}(t) = 12\sin(6*10^8 t + 5\sin 1250t)$, determine the carrier frequency, modulating signal frequency, modulation index and maximum frequency deviation. Estimate the approximate bandwidth required to transmit this FM signal. Also, find out what power will the FM wave dissipate in a 10 Ω resistance. (12 Marks)

A, CO1 11. b) ii. In an FM system, when the audio frequency (AF) is 500 Hz and the AF voltage is 2.4 V, the frequency deviation is 4.8 kHz. If the AF voltage is now increased to 7.2 V, what is the new frequency deviation? If the AF voltage is raised to 10 V while the AF is dropped to 200 Hz, what is the deviation? Find the modulation index in each case. (4 Marks)

A, CO2 12. a) i. A PCM system has the following parameters:
Maximum analog input frequency = 5 kHz
Maximum decoded voltage at the receiver = ± 5.52 V
Minimum dynamic range = 38 dB
Determine the following:
A) Minimum sample rate
B) Minimum number of bits used in the PCM code
C) Resolution
D) Quantization error (8 Marks)

U, CO2 12. a) ii. With a neat sketch of PCM system with analog companding, describe how analog companding is performed. (8 Marks)

OR

A, CO2 12. b) i. In a digital companding system, a 12-bit linear PCM code is compressed into an 8-bit code. For an analog input voltage of 2.56 V, determine the following: (Assume resolution as 0.01 V)

A) 12-bit linear PCM code

B) 8-bit compressed code

C) Decoded 12-bit code

D) Decoded voltage (8 Marks)

U, CO2 12. b) ii. With a suitable diagram, show how the analog signal can be recovered from the single-bit PCM codes. What are the problems that are associated with the recovery of analog signals? (8 Marks)

U, CO3 13. a) i. Illustrate the working principle of BPSK transmitter and receiver. Also, sketch the signal state space diagram for BPSK signals. (12 Marks)

A, CO3 13. a) ii. For a binary FSK signal with mark frequency of 45 KHz, a space frequency of 49 KHz and an input bit rate of 3 Kbps, determine the following:

A) Peak frequency deviation

B) Minimum bandwidth (4 Marks)

OR

U, CO3 13. b) i. Explain in detail the generation and coherent detection of 8-PSK signal with neat diagrams. (12 Marks)

A, CO3 13. b) ii. Determine the minimum double sided Nyquist bandwidth and the baud rate for a QPSK modulator with an input data rate equal to 12 Mbps and a carrier frequency of 60 MHz. (4 Marks)

U, CO4 14. a) i. What is meant by Multiple access? Explain the various types of multiple access with their merits and demerits. (10 Marks)

A, CO4 14. a) ii. A Direct Sequence Spread Spectrum communication system has the following parameters:

Information Bit duration (T_b) = 2.047 ms

PN Chip duration (T_c) = 1 μs

E_b/N_o = 10 (in order to have average probability of error < 10^{-5})

Determine the Processing Gain and Jamming Margin. State your inference from the results obtained. (6 Marks)

OR

U, CO4	14. b) i.	Illustrate the concept of Slow Frequency Hopping Spread Spectrum Modulation technique with an example.	(10 Marks)
A, CO4	14. b) ii.	A pseudo noise (PN) sequence is generated using a Linear Feedback Shift Register of length m = 5. The chip rate is 10^6 chips per second. Find the following parameters: A) PN sequence length B) Chip duration of the PN sequence C) PN sequence period	(6 Marks)
U, CO5	15. a) i.	With neat sketches, explain the following satellite system link model: A) Uplink model B) Downlink model	(10 Marks)
U, CO5	15. a) ii.	Briefly explain the characteristics of the following satellite orbits: A) Low earth orbit B) Medium earth orbit C) Geostationary earth orbit	(6 Marks)

OR

U, CO5	15. b) i.	Briefly classify the optical fiber types based on their Refractive Index (RI) profile and number of modes. Highlight their characteristics.	(10 Marks)
U, CO5	15. b) ii.	Tabulate and compare the characteristics of LEDs and LASERs used in Optical Transmitters.	(6 Marks)