Question Paper Code : 19329

B.E. / B.TECH. DEGREE EXAMINATION, NOVEMBER / DECEMBER 2022

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)

A, CO1   1.   State Carson's rule. Also, calculate the approximate bandwidth required to transmit a 3 kHz message signal using Frequency Modulation with a maximum frequency deviation of 75 kHz.

A, CO1   2.   Consider the following amplitude modulated signal:

$$v(t) = \cos(2\pi 1000t) + 5\cos(2\pi 1400t) + \cos(2\pi 1800t)$$

The ratio of the power contained in the sidebands to the power of the carrier signal is _____. Justify your answer.
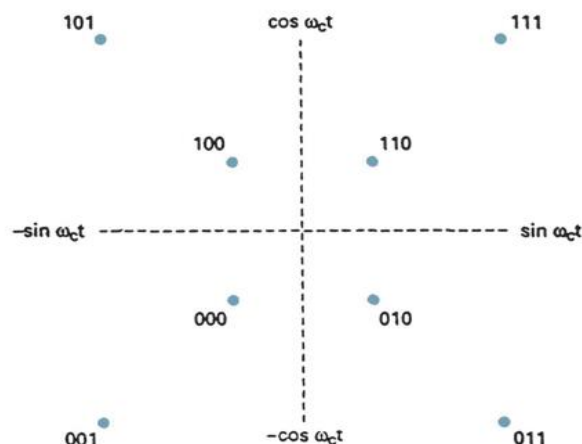
A, CO2   3.   The SQR_{dB} for a 2-v_{rms} signal and a quantization interval of 0.03 V is _____. Justify your answer.

R, CO2   4.   What is meant by Inter Symbol Interference? Suggest a suitable way to measure it.

U, CO3   5.   From the constellation diagram given below, identify the underlying modulation technique. Justify your answer.

A) BPSK   B) QPSK   C) 8-PSK   D) 8-QAM

A, CO3   6.   Define bandwidth efficiency. Also, determine the bandwidth efficiency for QPSK modulator with input bit rate f_b = 20 Mbps.

R, CO4   7.   What does OFDM refers to? List its advantages.

A, CO4   8.   Consider a maximal length sequence generator with m = 5, feedback taps = [5, 2] and initial state = 10000. The length of the maximal length sequence produced by the sequence generator is _____. Justify your answer.

U, CO5   9.   Compare and contrast non-synchronous satellites from synchronous satellites.

A, CO5   10.   A multimode step-index fiber with a core diameter of 50 μm, a core refractive index of 1.6, a cladding refractive index of 1.584 and a wavelength of 1300 nm has approximately _____ possible modes. Justify your answer.

     A) 237   B) 327   C) 372   D) None of the above

PART B – (5 × 16 = 80 Marks)

U, CO1   11. a) i.   Prove that the number of frequencies contained in amplitude modulation is five whenever a high-frequency sinusoidal carrier is amplitude modulated by a two-tone modulating signal.   (8 Marks)

A, CO1   11. a) ii.   A carrier wave of frequency 10 MHz and peak value 10 V is amplitude modulated by a 5 kHz sine wave of amplitude 6 V. Determine the following:

A) Modulation index

B) Sideband frequencies

C) Amplitude of sideband components

D) Draw the frequency spectrum.   (8 Marks)

OR

U, CO1   11. b) i.   What is superheterodyne principle? Explain the function of each stage of superheterodyne receiver with the help of a block diagram.   (8 Marks)

A, CO1   11. b) ii.   For an FM modulator with modulation index m = 2, the details of the Bessel function co-efficients are as follows:

m	J_0	J_1	J_2	J_3	J_4	J_5
2	0.22	0.58	0.35	0.13	0.03	-

Given that the modulating signal $v_m(t) = v_m \sin(2\pi 3000 t)$ and unmodulated carrier $v_c(t) = 10\sin(2\pi 100k t)$,

A) Determine the number of sets of significant sidebands

B) Determine the amplitudes of the sideband's frequencies

C) Draw the frequency spectrum showing the relative amplitude of the sideband's frequencies

D) Determine the bandwidth. (8 Marks)

U, CO2   12. a) i.   With suitable diagrams, illustrate the principle of operation of Delta modulation transmitter. (8 Marks)

A, CO2   12. a) ii.   A 12-bit linear PCM code is digitally compressed into eight bits. Assume the resolution as 0.1 V. Determine the following for an analog input voltage of 1.25 V:

     A) 12-bit linear PCM code

     B) Eight-bit compressed code

     C) Decoded 12-bit code

     D) Decoded voltage (8 Marks)

OR

U, CO2   12. b) i.   With a suitable diagram, illustrate the principle of operation of an analog-companded PCM system. (8 Marks)

A, CO2   12. b) ii.   For the following resolutions and the eight-bit sign-magnitude PCM codes, determine the equivalent voltage range.

PCM Code	Resolution (V)
00011101	0.01
00011100	0.03
11100001	0.05
01010101	0.07

(8 Marks)

U, CO3   13. a) i.   Explain the principle of operation of the 4-PSK transmitter with a neat diagram. Also, illustrate how the digital data can be retrieved from a 4-PSK signal with an example. Construct the constellation and phasor diagram for 4-PSK. (10 Marks)

A, CO3   13. a) ii.   For a binary FSK modulation system with a mark frequency of 21 kHz, a space frequency of 25 kHz and an input bit rate of 4 kbps, determine the following:

     A) Peak frequency deviation

     B) Minimum bandwidth

     C) Baud rate (6 Marks)

OR

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U, CO3	13. b) i.	Is it possible to vary both the amplitude and phase of the carrier signal based on the digital input data? If yes, explain the underlying process with a relevant diagram. If no, justify your answer.	(10 Marks)

A, CO3	13. b) ii.	For an 8-PSK modulation system, operating with an information bit rate of 60 kbps, determine the following:	

     A) Baud rate

     B) Minimum bandwidth

     C) Bandwidth efficiency   (6 Marks)

U, CO4	14. a) i.	Describe in detail how Direct sequence spread spectrum modulation system helps to achieve covert communication.	(10 Marks)

A, CO4	14. a) ii.	Verify the various properties of the maximal-length sequences on the sequence '1110100' generated by a linear feedback shift register.	(6 Marks)

OR

U, CO4	14. b) i.	Elucidate the operation of slow-frequency hop spread spectrum modulation system with an example.	(10 Marks)

A, CO4	14. b) ii.	A pseudo random sequence is generated using a feedback shift register of length m = 5. The chip rate is 10^6 chips per second. Calculate the following:	

     A) PN sequence length

     B) Chip duration of PN sequence

     C) PN sequence period   (6 Marks)

U, CO5	15. a)	Write a short note on the following terminologies related to satellite communication:	

     A) Kepler's laws

     B) Uplink model

     C) Downlink model

     D) Transponder   (16 Marks)

OR

U, CO5	15. b)	Write a short note on the following terminologies related to Optical fiber communication:	

     A) Modes

     B) Refractive index profile

     C) ILD

     D) PIN diode   (16 Marks)

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