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QUESTION BANK

SUB CODE: EC8395
SUB NAME: COMMUNICATION ENGINEERING

UNIT I ANALOG MODULATION 9

Amplitude Modulation – AM, DSBSC, SSBSC, VSB – PSD, modulators and demodulators – Angle modulation – PM and FM – PSD, modulators and demodulators – Superheterodyne receivers

PART A (2 Marks)

1. State the need for modulation.
2. Define the modulation index of FM.
3. Draw the frequency spectrum of AM.
4. What is super heterodyne receiver?
5. Obtain the relationship between phase and frequency modulation.
6. Mention the advantages and disadvantages of SSB transmission
7. Summarize modulation coefficient and percent modulation
8. Describe the envelope of AM waveform and its significance?
9. A carrier signal with power of 40 watts is amplitude modulated by a sinusoidal signal. Calculate the power of the modulated signal if the modulation index is 0.7.
10. Interpret pre-emphasis? How is it used to improve the signal to noise ratio of the FM transmission?
11. When a super heterodyne receiver is tuned 555 kHz, its local oscillator provides the mixer with an input at 1010 kHz. Calculate the image frequency.
12. Compare AM and FM.
13. Explain Carson's rule of FM bandwidth.
14. A 107.6 MHz carrier is frequency modulated by a 7 kHz sine wave. The resultant FM signal has a frequency derivation of 50 kHz. Analyse the modulation index of the FM wave.
15. AM Transmitter radiates 9 kW with the unmodulated carrier and 10.125 kW when the carrier is modulated. Estimate the modulation index

16. The carrier frequency of a broadcast signal is 100 MHz. The maximum frequency deviation is 75 kHz. If the highest audio frequency modulating the carrier is limited to 15 kHz, formulate the approximate bandwidth of the modulating signal?

PART – B (13 Marks)

1. (i) Identify an Expression for the amplitude modulated wave, its current and power relations. (9)
(ii)How would you explain double conversion AM receiver? (4)

2. With the neat circuit diagram explain the operation of round travis detector and ratio detector.(13)

3. i) Describe a method of generating of an amplitude modulated signal and sketch the time domain waveform of message, carrier and modulated signals. (8)
ii) Name the methods used for suppression of unwanted sideband in AM transmission? Discuss the working of any one of them. (5)

4. i) Draw the block diagram for generation and demodulation of a VSB signal and explain the principle of operation. (8)
ii) How FM is generated with the help of varactor diode? Explain with the help of neat diagram.(5)

5. i) Explain a method of generating a DSBSC using balanced modulators. (7)
ii) Discuss the principle of AM super heterodyne receiver with block diagram. (6)

6. i) With suitable sketch discuss about Envelope and square law detector.(7)
ii) Demonstrate high level and low level transmitters. (6)

7. i) Interpret the expressions for narrowband and Wideband FM wave.(8)
ii) Relate the circuit diagram of FET reactance modulator with its operation.(5)

8. Illustrate the Armstrong method of FM generation and compare NBFM and WBFM. (13)

9. Analyse the operation of Foster-seeley discriminator with the Schematic diagram and Vector diagrams (13)

10. Discuss two transmitters that generate FM by modulating the carrier frequency directly(13)

11. A telephone transmitter using AM has unmodulated carrier output power of 20 kW and can be modulated to a maximum depth of 80% by a sinusoidal modulating voltage without causing overloading. Evaluate the value to which unmodulated carrier power may be increased without resulting in overloading if the maximum permitted modulation index is restricted to 60%. (13)

PART – C (15 Marks)

1. i) Summarize the operation of diode detector in the process of demodulating of AM Signal. (8)
ii) Discuss the Armstrong method for the generation of FM Signal.(7)

2. i) Derive the expression for the power calculation in DSB-SC –AM wave. (8)
ii) A broadcast transmitter radiates 20KW when the modulation percentage is 75%. Calculate carrier power and power of each sidebands.(7)

3. Construct frequency discrimination method of generating SSB modulated wave and a method to demodulate it. Discuss the design issues involved in this method of generation. What is the cause and effect of phase error in demodulated signal? (15)

4. Compare the various analog communication systems with appropriate waveforms and expressions. (15)

UNITII PULSE MODULATION 9

Low pass sampling theorem – Quantization – PAM – Line coding – PCM, DPCM, DM, and ADPCM And ADM, Channel Vocoder – Time Division Multiplexing, Frequency Division Multiplexing

PART – A (2 Marks)

1. List out the few demerits of DPCM.
2. Define sampling theorem.
3. What is the principle of delta modulation?
4. Describe the methods of pulse modulation?
5. Illustrate the term slope overload noise.
6. How would you explain aliasing?
7. State Nyquist rate and Nyquist interval.
8. Compare between PAM and PWM.
9. Can you elaborate on Companding?

PART – B (13 Marks)

1. .i) Explain PCM systems with neat diagram.(8)
   ii) Evaluate the process of "Companding" and its Characteristics(5)

2. With a neat block diagram, describe the PAM modulation and demodulation process and develop an expression for PAM wave.(8)

3. With neat sketch explain the generation of DM signals. State the drawbacks of DM and suggest a method to correct it. (13)

4. How does ADM differ from DM, Support your answer with block diagram and waveform.(6)

5. Explain DPCM with required diagram. How does it differ from PCM?(13)

6. Tell about uniform quantization, noise and SNR in PCM.(7)

7. State and prove sampling theorem. Obtain the reconstructed signal and explain about aliasing? (13)
8. Explain channel vocoder in detail (13)

PART – C (15 Marks)

1. The information in an analog signal voltage waveform is to be transmitted over a PCM system with an accuracy of ± 0.1% (full scale). The analog voltage waveform has a bandwidth of 100Hz and an amplitude range of -10 to +10V.
(i) **Predict** the maximum sampling rate require. (4)
(ii) **Invent** the number of bits in each PCM word. (4)

(iii) **Generate** the minimum bit required in the PCM signal. (4)
(iv)**Design** the minimum absolute channel bandwidth required for the transmission of the PCM signal. (3)

2. i)Explain in detail Time division multiplexing and Frequency division multiplexing. (8)
   ii)Compare and contrast TDM and FDM (7)

UNIT III DIGITAL MODULATION AND TRANSMISSION 9

Phase shift keying – BPSK, DPSK, QPSK – Principles of M-ary signaling M-ary PSK & QAM – Comparison, ISI – Pulse shaping – Duo binary encoding – Cosine filters – Eye pattern, equalizers

PART – A (2 Marks)

1. List the primary differences between QPSK and MSK systems.
2. What are the elements of digital communication systems?
3. Show the difference between coherent and non-coherent receiver.
4. Write the advantages of GMSK.
5. Sketch ASK, FSK, PSK signal for the data stream 1101001.
6. Analyze the advantages of QPSK.
7. Explain why binary ASK is called on-off keying?
8. Formulate the performance of FSK and PSK based on power and BW efficiency.
9. Determine the minimum bandwidth for a BPSk modulator with a carrier frequency 40MHz and an input bit rate of 500kbps.
10. Define ISI
11. What is pulse shaping?

PART – B (13 Marks)

1. List the advantages of digital carrier system and describe MSK techniques with neat diagram.(13)
2. Explain in detail the applications of digital modulation techniques. (7)
   ii) Briefly describe the concept of QAM and draw the constellation diagram of 16 QAM.(6)

3. Explain with the block diagram QPSK Transmitter and Receiver. Also analyse about the bandwidth considerations for QPSK.(13)

4. With a neat block diagram, explain BPSK transmitter and receiver. Also analyse the spectrum and bandwidth considerations of BPSK. (13)

5. (i) Describe in detail Frequency shift keying method with necessary diagrams.(7)

   (ii) Discuss GMSK with advantages and disadvantages. (6)

6. (i) Discuss about the working principle of ASK modulator and detector with neat diagram (6)

   ii) What is DPSK? Discuss its operation with the required diagrams.(7)

7.(i) Compare between ASK, BPSK, QPSK and FSK digital modulation techniques(7)

(ii) Represent QPSK signals in the signal space to find the distance between the signal points. Give the spectrum of QPSK signal.(6)

8.Explain in detail the Duo binary encoding

9.Explain the working of cosine filters

PART C(MARKS)

1. Draw the transmitter and receiver block diagram of Binary Phase shift keying scheme and compare its error performance with Binary Frequency Shift keying scheme.(15)
2. i) Explain the QPSK modulation schemes with its constellation diagram.(10)
ii) Briefly describe the concept of QAM and draw the constellation diagram of QAM.(5)
3. i) A data bit sequence consists of the following string of bits10 11 10 10. Evaluate and draw the nature of waveform transmitted by BPSK transmitter.(8)
(ii) For an 8 PSK modulator with an input data rate equal to10 Mbps & a carrier frequency of 70 MHz, measure minimum double sided Nyquist bw, Baud rate, Sketch the output spectrum. Judge the results with BPSK & QPSK modulators.(7)
4. How would you compare the various digital communication systems?(15)
5. .Explain in detail the eye pattern and equalizers.(15)

UNIT IV INFORMATION THEORY AND CODING 9

Measure of information – Entropy – Source coding theorem – Shannon–Fano coding, Huffman Coding, LZ Coding – Channel capacity – Shannon-Hartley law – Shannon's limit – Error control codes – Cyclic codes, Syndrome calculation – Convolution Coding, Sequential and Viterbi decoding

PART – A (2 Marks)

1. What is entropy and give its mathematical equation.
2. Define source coding. State the significance of source coding
3. Draw the NRZ and RZ waveform for the pulse stream10101011.
4. Name few error control codes.
5. Why is Huffman code called as minimum redundancy code?
6. Describe information rate?
7. Outline the features of convolutional code?
8. An event has six possible outcomes with probabilities {1/2, 1/4, 1/8, 1/16, 1/32, 1/32}. Solve for the entropy of the system.
9. Interpret how many errors can be detected and corrected by a(7, 4) Hamming code?
10. Calculate the amount of information if pk=1/4.

11. Compare block and convolution codes.
12. Evaluate the Hamming distance between the following code words C1={1,0,0,0,1,1,1} and C2={0,0,0,1,0,1,1}.
13. Explain the disadvantages of convolutional codes
14. How would you list the main methods used for error control coding
15. Can you elaborate on syndrome?

PART – B (13 Marks)

1. Enumerate Shannon's Fano algorithm and Huffman coding with a suitable example. (13)
2. Explain convolutional coding with time domain and transform domain approach. (13)
3. Brief the properties of entropy. (8)
4. Describe about the Viterbi algorithm by showing the possible path through the trellis of a coder. Assume the state diagram of any coder. (13)
5. Six symbols of the alphabet of discrete memory less source and their probabilities are given below, S={S0, S1,S2,S3,S4) P(S)={0.4,0.19,0.16,0.15,0.15}. Code the symbols using Huffman coding and Shannon Fano coding and compare the efficiency. (13)

6. The parity check matrix of a particular (7,4) linear block code is given by, [H]=[111110 101 010101100 0 0 1]

i) Find the generator matrix (G).
ii) List all the code vectors.
iii) What is the minimum distance between code vectors?
iv) How many errors can be detected? How many errors can be corrected? (13)

7. Write short notes on :
i) Code tree, trellis and state diagram for convolutional encoder. (7)
ii) Sequential decoding for convolutional codes. (6)

8i) Compare Linear and Convolution codes. (4)

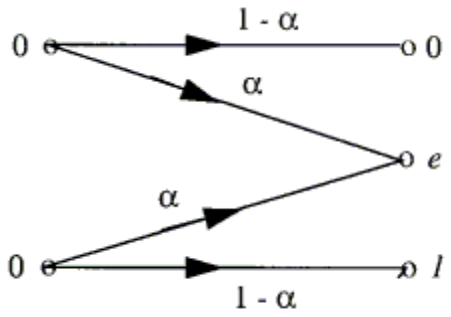
ii) Analyse the conditions which hamming codes has to satisfy. (4)
iii) Explain the following terms Code efficiency, Channel data rate and code rate. (5)

9. A rate 1/3 convolution encoder has generating vectors as g1=(1 0 0) , g2=(1 1 1) and g3 = (1 0 1)
i) Sketch the encoder configuration. (7)
ii) Draw the code tree, state diagram and trellis diagram. (6)

PART – C (15 Marks)

1. The source of information A generates the symbols {A0, A1, A2, A3 & A4} with the corresponding probabilities {0.4, 0.3, 0.15, 0.1 and 0.05}. Encoding the source symbols using binary encoder and Shannon-Fano encoder and compare its efficiency. (15)

2. i) Predict the main idea of Source Coding Theorem with suitable examples. (8)
ii) The binary erasure channel has two inputs and three outputs. The inputs are labeled 0 and 1, and the outputs are labeled 0, 1 and e. A fraction α of the incoming bits are erased by the channel. Measure the capacity of the channel. (7)



The generator polynomial of a (15, 11) Hamming code is given by $(X)=1+X+X2$. Design encoder and syndrome calculator for this code using systematic form.

(15)

UNIT V SPREAD SPECTRUM AND MULTIPLE ACCESS 9

PN sequences – properties – m-sequence – DSSS – Processing gain, Jamming – FHSS –

Synchronisation and tracking – Multiple Access – FDMA, TDMA, CDMA,

PART A (2 Marks)

1. List the primary applications of FDMA.
2. Explain about DSSS technique
3. Define Pseudo noise sequence.
4. List out the merits of TDMA system.
5. Explain CDMA technique.
6. Give out the merits of FDMA system.
7. Demonstrate about FHSS technique.
8. Mention the applications of multiple access techniques in wired communication.
9. Classify SS techniques based on modulation employed.
10. Explain about the working principle of TDMA.
11. Describe briefly about FDMA.
12. Summarize the application of spread spectrum modulation
13. Compare TDMA and FDMA.
14. Difference between multiple access and multiplexing.
15. Give the advantage of CDMA system.

PART –B (13 Marks)

1. (i) Distinguish between FDMA and TDMA technique. (8)
   (ii) Explain the application of CDMA in wireless communication. (5)

2. State the need for spread spectrum modulation and explain its operation with neat block diagram. (13)
3. List out various multiple access techniques and explain any two in detail. (13)
4. Explain the principle of operation of direct sequence spread spectrum with its noise performance parameters. How pseudo noise is generated? (13)

5. With neat block diagram explain the frequency division multiple access technique. Discuss its application in communication. (13)
6. What is Code Division Multiple Access technique in detail and mention its merits and demerits. (13)
7. Explain the principle of operation of FHSS with necessary diagrams. (13)
8. How is interference avoided by using code division multiplexing? Explain. (7)
9. (i) Compare the performance of TDMA, FDMA and CDMA. (8)
   (ii)Describe briefly about the applications of SS modulation. (5)
10. Illustrate the operation of a typical TDMA system with neat block diagram. And compare it with FDMA. (13)
11. Demonstrate how TDMA is used in mobile communication. (13)
12. Draw the block diagram and explain in detail the model of spread spectrum digital communication system. (13)
13. Classify SS modulation technique based upon the operating concept and explain in detail DSSS and FHSS. (13)

PART – C (15 Marks)

1. i) Validate the properties of Pseudo noise sequences. (5)

   ii) Summarize the direct sequence spread spectrum techniques with neat block diagram. (10)

2. i) A spread spectrum communication system is characterised by the following parameters Tb=4.09ms, Tc=1μs. Propose the processing gain and jamming margin if Eb/N0=20 and the average probability of error Pe=0.5×10-5. (5)

   ii) A PN sequence generator using a feedback shift register of length 4. If the chip rate is 108 chips/sec. Calculate the chip and PN sequence duration. (5)

   iii) A slow FH/MFSK system has the following paramters: The number of bits/MFSK symbol=4, The number of MFSK symbol per hop =10. Estimate the processing gain in dB. (5)

3. i) In the AMPS system, the system bandwidth is 12.5mHz, the channel spacing is 30KHz, and the edge guard spacing is 10KHz. The number of channel allocated for control signalling is 21. Evaluate

   a) The number of channels available for message transmission.

   b) Spectral efficiency of FDMA. (8)

   ii) If a normal GSM time slot consists of six trailing bits, 8.25 guard bits 26 training bits, and two traffic bursts of 58 bits of data, find the frame efficiency? (7)

4. Discuss in detail the multiple access techniques that are used in wireless communications. What difference is taken into account here as the channel is now wireless? (15)