B.E DEGREE EXAMINATIONS: NOV/DEC 2024
(Regulation 2014)
SIXTH Semester
ELECTRONICS AND COMMUNICATION ENGINEERING
U14ECT601**:** Digital Communication

COURSE OUTCOMES

CO1: Recall fundamentals of Digital communication system
CO2: Demonstrate digital pulse modulation techniques
CO3: Apply channel coding techniques for data transmission
CO4: Apply line coding and pulse shaping techniques for data transmission
CO5: Analyze digital modulation schemes
CO6: Describe synchronization techniques

Time: Three Hours   **Maximum Marks: 100**

Answer all the Questions:-
PART A (10 x 1 = 10 Marks)

1. Matching type item with multiple choice code   CO1   [K2]

List I	List II
A. Pair of wires	1. Information transmitted acoustically
B. Optical fiber	ii. Signal radiated over antenna
C. Under water ocean channel	iii. Carries modulated light beam
D. Free space	iv. Carries electrical signals

	A	B	C	D
a)	iv	iii	ii	i
b)	iv	iii	i	ii
c)	iii	iv	ii	i
d)	iii	iv	i	ii

2. In the process of Analog to Digital signal conversion arrange the following sequence in order   CO1   [K2]

    1. Quantization

    2. Encoding

    3. Sampling

    Which of the following sequence is correct?

    a)   1,2,3   b)   3,1,2

    c)   1,3,2   d)   3,2,1

3. Calculate the signaling rate of an audio signal having spectral components in the range of 300Hz to 3300Hz. A PCM signal is generated by sampling the audio signal fs = 8KHz. The minimum SNR is 30dB.   CO2 [K₃]

   a) 40Kbps   b) 48Kbps

   c) 38Kbps   d) 45Kbps

4. Assertion: Prediction gain of DPCM should be maximum   CO2 [K₂]

    Reason : Variance of prediction gain must be maximum

   a) Both A and R are Individually true and   b) Both A and R are Individually true but
       R is the correct explanation of A   R is not the correct explanation of A

   c) A is true but R is false   d) A is false but R is true

5. The number of detectable and correctable errors of a linear block code with $D_{min} = 5$ are   CO3 [K₂]

   a) 4,2   b) 2,2

   c) 4,4   d) 2,1

6. Consider the following points with respect to Convolutional codes.   CO3 [K₂]
   1. Longer constraint lengths produce more powerful codes, but the complexity of the Viterbi algorithm increases exponentially with constraint lengths, limiting these more powerful codes to deep space missions where the extra performance is easily worth the increased decoder complexity.
   2. A convolutional encoder is a finite state machine. An encoder with n binary cells will have n states.
   3. Convolutional codes are widely used as channel codes in practical communication systems for error correction.
   4. Convolutional codes are commonly described by using the parameters: code rate and constraint length.
   Which of these statements are correct?
   a) 1,3,4   b) 2,3.4

   c) 1,2   d) 1,2,3

7. Match list I with list II and select the correct answer using the codes given below   CO4 [K₂]

List I	List II
A. Linear Equalizer	1. Telephone channel
B. Zero-forcing equalizer	2. MSE equalizer
C. Non Linear Equalizer	3. Noise Enhancement
D. Adaptive equalization	4. Decision Feedback equalizer

   a) A-3,B-1,C-4,D-2   b) A-4,B-3,C-2,D-1

   c) A-2,B-3,C-4,D-1   d) A-3,B-4,C-1,D-2

8. Consider the following points with respect to ISI.   CO4   [K$_2$]

   1.The ISI arises due to the imperfections in the overall frequency response of the system.
   2.Equalizers can be used to reduce ISI and its effects.
   3. In the reduction procedure of ISI, smaller roll-off factor offers high bandwidth but larger tails are more sensitive to timing errors.
   4. By adding ISI to the transmitted signal in a controlled manner, it is possible to achieve a bit rate of 4Bo bits per second in a channel of bandwidth Bo Hz.
   Which of these statements are correct?
   a) 2,4   b) 1,2

   c) 3,4   d) 1,3

9. The DPSK receiver output for the sequence $0\ 0\ \pi\ \pi\ 0\ \pi\ 0\ \pi$ is……….   CO5   [K$_2$]
   a) 1 1 0 1 0 0 0 0   b) 0 0 1 1 1 1 0 1

   c) 0 0 0 0 0 1 1 1   d) 1 0 0 0 1 1 1 1

10. A pair of sinusoidal waves that differ only in a relative phase shift of 180° are referred to as   CO5   [K$_2$]
   a) Uni polar signals   b) Anti podal signals

   c) Polar signals   d) Bi polar signals

PART B (10 x 2 = 20 Marks)
(Answer not more than 40 words)

11.	State the advantages of digital communication over analog communication	CO1 [K$_2$]
12.	Draw the elements of Digital Communication System	CO1 [K$_2$]
13.	A message has zero mean value and a peak value of 10V. It is to be quantized using step size of 0.1V. Find the number of bits required for encoding he quantized signal.	CO2 [K$_3$]
14.	Represent A-law companding in terms of equation and draw its characteristics.	CO2 [K$_3$]
15.	Mention the code words of (5,1) Repetition codes	CO3 [K$_2$]
16.	Indicate the significance of minimum distance between Linear Block codes.	CO3 [K$_2$]
17.	Describe adaptive equalization in short.	CO4 [K$_2$]
18.	Compare BPSK and DPSK.	CO5 [K$_2$]
19.	Sketch the waveform of FSK and PSK for the binary sequence 1100101	CO5 [K$_3$]
20.	What is carrier synchronization?	CO6 [K2]

Answer any FIVE Questions: -
PART C (5 x 14 = 70 Marks)
(Answer not more than 300 words)

Q.No. 21 is Compulsory

21. (i) Write a detailed note on a technique that is used to improve the performance of a (8)   CO2   [K$_2$]
    delta modulator with a neat sketch.
    (ii) Describe the two types of quantization error that occurs due to delta modulation.   (6)

22. i) Give a detailed note on the various mathematical models used for representing the communication channels. (10) CO1 [K$_2$]

    ii) Write short notes on AWGN channel. (4)

23. i) Consider a (7,4) linear block code with the generator matrix G given by (10) CO3 [K$_3$]

$$G = \begin{bmatrix} 1 & 1 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 & 1 & 0 & 0 \\ 1 & 1 & 1 & 0 & 0 & 1 & 0 \\ 1 & 0 & 1 & 0 & 0 & 0 & 1 \end{bmatrix}$$

   Construct all possible code words and State the properties of syndrome. (4)

    ii) Suppose that the received word is 1010101. Decode this received word by finding the location of the error and the transmitted data bits.

24. i) Generator sequence for a convolutional encoder are described by (10) CO3 [K$_4$]

    g$_1$= [1 0]   g$_2$= [1 1]

      a) Draw the state diagram, tree diagram, and trellis diagram.
      b) Assume that a received message from this encoder is 1 1 0 0 1 0. Determine the transmitted sequence using Viterbi algorithm.

    ii) Sketch the cyclic encoder for the polynomial g(D) =1+D^2+D^3 and find the code word for the Message bits 1101. (4)

25. i) Obtain the expression for the overall frequency response of Duobinary signaling scheme. The binary data 001101001 is applied to the input of a duo binary system. Construct the duo binary coder output and corresponding receiver output, with a precoder. (10) CO4 [K$_3$]

    ii) Explain the principle of adaptive channel equalizer with neat block diagram. (4)

26. With necessary equations explain briefly about FSK system and determine its probability of error. CO5 [K$_2$]

27. i) Write a note on costas loop for carrier synchronization. (7) CO6 [K$_2$]

    ii) Explain the principle of early late gate synchronization technique with necessary diagrams. (7)

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