



**B.E DEGREE EXAMINATIONS: APRIL /MAY 2024**

(Regulation 2018)

Sixth Semester

**ELECTRONICS AND COMMUNICATION ENGINEERING**

U18ECI6201: Communication Engineering II

**COURSE OUTCOMES**

**CO1:** Demonstrate digital communication system and estimation techniques used in the receiver.

**CO2:** Apply and verify source coding techniques.

**CO3:** Apply and analyze channel coding techniques for data transmission.

**CO4:** Examine the interference effects in band limited communication systems.

**CO5:** Compare and implement the performance of various digital modulation techniques.

**CO6:** Describe various synchronization techniques.

**Time: Three Hours**

**Maximum Marks: 100**

**Answer all the Questions:-**

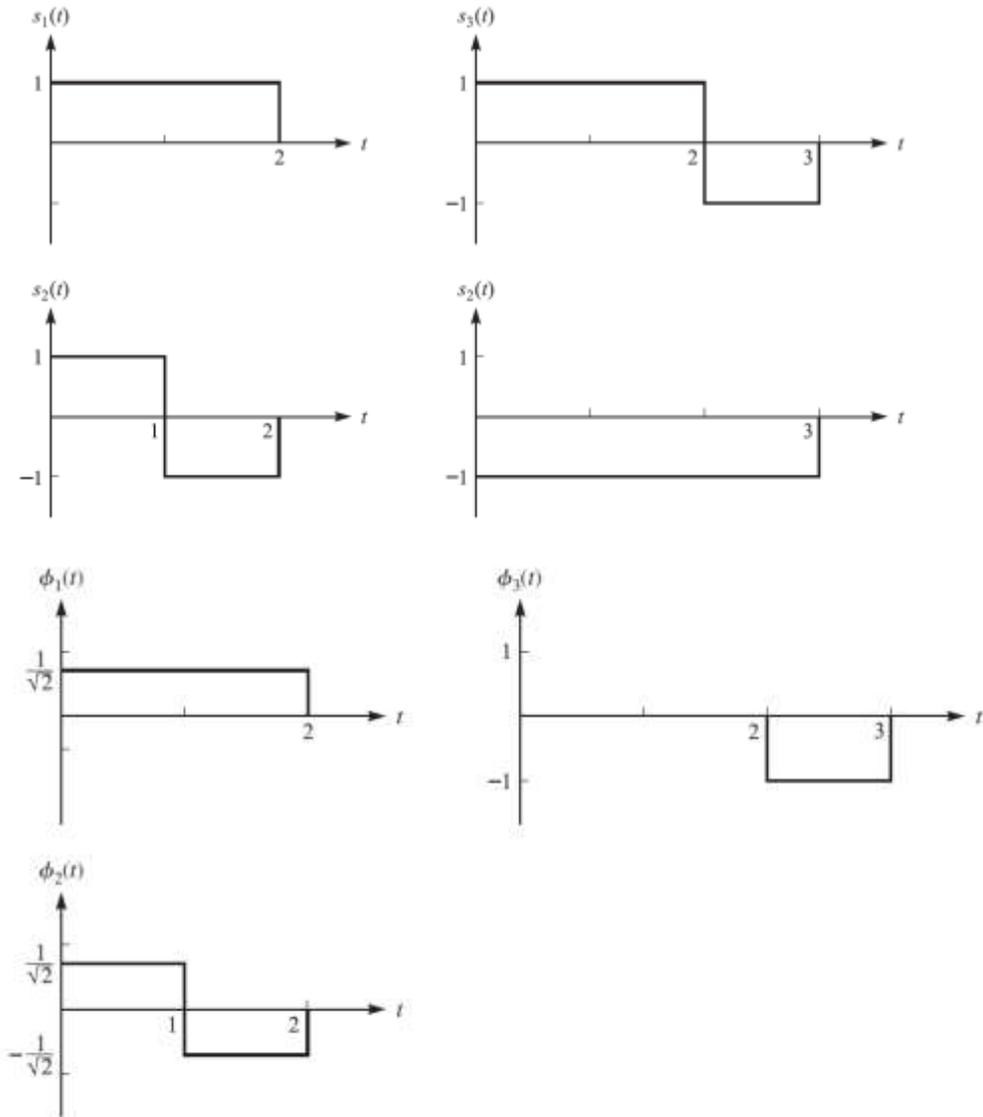
**PART A (10 x 2 = 20 Marks)**

**(Answer not more than 40 words)**

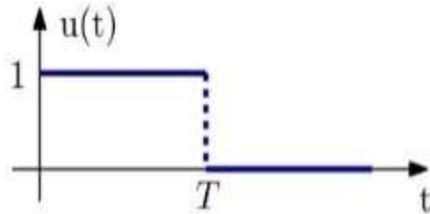
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|---|-----|-------------------|
| 1. What are the advantages of digital communication systems?  | CO1 | [K <sub>2</sub> ] |
| 2. Find the basis function for the NRZ polar signalling scheme.   | CO1 | [K <sub>3</sub> ] |
| 3. State source coding theorem.   | CO2 | [K <sub>2</sub> ] |
| 4. Consider a telephone channel with a bandwidth of 6 KHz. The Signal to Noise ratio of 104 dB is required to meet the receiver requirements. Determine the maximum data rate that the channel can accommodate.         | CO2 | [K <sub>3</sub> ] |
| 5. Determine the number of detectable and correctable errors of a (7,1) repetition code.  | CO3 | [K <sub>3</sub> ] |
| 6. The binary sequence 1001011 is the input to a precoder whose output is used to modulate a modified duobinary transmitting filter. Construct a table showing the precoded sequence, the transmitted amplitude levels. | CO4 | [K <sub>3</sub> ] |
| 7. Draw the eye pattern of a BPAM signal and indicate the various inferences that can be learnt about the noisy channel from the diagram.   | CO4 | [K <sub>2</sub> ] |
| 8. Draw the signal space diagram of the 8- PSK signal. If the signalling rate is 1000 signals/sec, what is the data rate of the scheme?   | CO5 | [K <sub>3</sub> ] |
| 9. Find the phase of the DPSK signal for the binary sequence 1 1 0 0 1 0 1 0.   | CO5 | [K <sub>3</sub> ] |
| 10. Differentiate between Coherent and non-coherent detection systems.  | CO5 | [K <sub>2</sub> ] |

**Answer any FIVE Questions: -**  
**PART B (5 x 16 = 80 Marks)**  
**(Answer not more than 400 words)**

11. a) The signals  $s_1(t), s_2(t), s_3(t)$  and  $s_4(t)$  and its orthonormal basis signals  $\phi_1(t), \phi_2(t)$  and  $\phi_3(t)$  are given in the figure. Draw the signal space diagram. 10 CO1 [K<sub>3</sub>]



- b) Design the matched filter impulse response for the signal  $u(t)$ . Demonstrate that the output of the filter is the energy of the signal  $u(t)$  for the matched signal input. 6 CO1 [K<sub>3</sub>]



12. a) A discrete memoryless source produces outputs  $\{a_1, a_2, a_3, a_4, a_5, a_6\}$ . The corresponding output probabilities are 0.7, 0.1, 0.1, 0.05, 0.04, and 0.01. 8 CO2 [K<sub>3</sub>]
- i. Design a binary Huffman code for the source. Find the average codeword length.
  - ii. Compare it to the minimum possible average codeword length.
  - iii. Is it possible to transmit this source reliably at a rate of 1.5 bits per source symbol? Why?
- b) The parity check matrix of a linear block code is given below: 8 CO3 [K<sub>3</sub>]
- $$H = \begin{bmatrix} 1 & 1 & 0 & 1 & 1 & 0 & 0 & 0 \\ 1 & 0 & 1 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 1 & 1 & 0 & 0 & 1 & 0 \\ 1 & 1 & 1 & 0 & 0 & 0 & 0 & 1 \end{bmatrix}$$
- i. Determine the generator matrix for this code in systematic form.
  - ii. Find the number of codewords.
  - iii. Write all possible code words. What is the  $d_{\min}$  for this code?
  - iv. Using hard decision decoding, how many errors can this code correct?
13. a) A  $\frac{1}{2}$  rate convolutional code is described by  $g_1 = [101]$ ,  $g_2 = [111]$ , 10 CO3 [K<sub>2</sub>]
- i. Draw the encoder corresponding to this code.
  - ii. Draw the trellis diagram for this code.
- Encode the sequence 101 and decode it from the code word using Viterbi algorithm.
- b) Design a cyclic encoder for the a (7,4) systematic cyclic codes with the  $g(X) = 1 + X + X^3$  and demonstrate its operation for the message pattern 1001. 6 CO3 [K<sub>3</sub>]
14. a) Derive the spectrum and impulse response of the duo binary signalling scheme. 8 CO4 [K<sub>3</sub>]

- b) Explain in detail how the adaptive filter is used in channel equalization using a block diagram. 8 CO4 [K<sub>3</sub>]
15. a) Explain the generation and detection of BPSK and derive the probability of error for the BPSK signalling scheme. 10 CO5 [K<sub>3</sub>]
- b) Elucidate the operation of Costas loop carrier synchronization technique. 6 CO6 [K<sub>2</sub>]
16. a) Draw the signal space diagram of the QPSK signal. Also, explain the transmitter and receiver logical diagram in detail. 8 CO5 [K<sub>3</sub>]
- b) What is the need for symbol synchronization in digital transmission? Explain the Early-Late logic for symbol synchronization using a block schematic diagram. 8 CO6 [K<sub>2</sub>]

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