

**ADVANCED DIGITAL COMMUNICATION TECHNIQUES
(ECEN 5201)**

Time Allotted : 2 hrs.

Full Marks : 70

Figures out of the right margin indicate full marks.

*Candidates are required to answer Group A and
any 5 (five) from Group B to E, taking at least one from each group.*

Candidates are required to give answer in their own words as far as practicable.

**Group - A
(Multiple Choice Type Questions)**

1. Choose the correct alternative for the following: **10 × 1 = 10**
- (i) The spectral density of a real valued random process has
(a) an even symmetry (b) an odd symmetry
(c) a conjugate symmetry (d) no symmetry.
- (ii) For a correctly received code, the error syndrome value will be
(a) One (b) zero
(c) variable (d) a function of the coding process.
- (iii) Convolutional codes can be defined by (n, k, m) where n represents:
(a) encoder output (b) input bits
(c) constraint length (d) none of these.
- (iv) Entropy of a symbol can be
(a) negative (b) zero
(c) positive (d) either (b) or (c)
- (v) Delta modulation is considered as
(a) Carrier modulation (b) Amplitude Modulation
(c) Phase Modulation (d) 1 bit PCM.
- (vi) In QASK signal carrier signal parameter that changes with the symbol level is
(a) frequency only (b) amplitude only
(c) amplitude and frequency (d) amplitude and phase.
- (vii) Thermally generated noise in a piece of register follows one distribution given below
(a) Binomial (b) Poisson's (c) Laplacian (d) Gaussian.
- (viii) A bit in spreading signal in DSSS is called
(a) Block (b) Datagram (c) Chip (d) Quantile.

- (ix) Which is better to avoid jamming?
(a) Direct sequence spread spectrum
(b) Frequency hopping spread spectrum
(c) Time hopping spread spectrum
(d) None of the mentioned.
- (x) Decision region in signal space is used for finding
(a) Inter symbol interference
(b) minimum error probability
(c) Bandwidth efficiency
(d) code rate.

Group - B

2. (a) Explain the functions of 'Source Encoding' and 'Channel Encoding'. Show the schematic diagram for Linear Gaussian Channel model and write the expression for the output, $Y(t)$.

- (b) What is a linear equalizer? Draw the block diagram of a linear adaptive equalizer.

$$(3 + 5) + (2 + 2) = 12$$

3. (a) What is ISI in digital communication and why does it occur?

- (b) Explain the ISI phenomenon using the baseband equivalent channel model.

- (c) Derive the equation for ISI.

$$2 + 4 + (3 + 3) = 12$$

Group - C

4. (a) What is the difference between uni-polar and polar formats of binary representation? Draw the waveforms for: (i) 01011001 and (ii) 10100010 in both the formats.

- (b) Give mathematical representation for FSK. Draw the FSK waveform for 110010.

- (c) Draw and explain the block diagram for FSK detection circuit.

$$4 + 3 + 5 = 12$$

5. (a) How does multi-carrier CDMA system work?

- (b) Explain with block diagrams for OFDM transmitter and OFDM receiver.

- (c) How is OFDMA derived from OFDM?

$$2 + (4 + 4) + 2 = 12$$

Group - D

6. (a) State the important features of TDMA. Why does GSM use FDMA/TDMA technique? Explain.

- (b) Show with diagram how DS-SS is generated. State two advantages of using DS-SS system.

(3 + 3) + (3 + 3) = 12

7. (a) Explain with a block diagram the operation of a FH-SS System.

- (b) Explain how RAKE receivers help quality reception in CDMA systems. Explain the operation of a RAKE receiver with the help of a block diagram.

4 + (4 + 4) = 12

Group - E

8. (a) Why is source coding applied in digital communication? Name at least 3 algorithms applied. Define mathematically discrete, memory less source.

- (b) An ideal source emits five symbols with probabilities of {0.55, 0.15, 0.15, 0.10 and 0.05}. Find out the Shannon Fano Code and calculate the efficiency.

4 + 8 = 12

9. (a) A code has the given parity check matrix.

$$[H] = \begin{bmatrix} 110100 \\ 011010 \\ 101001 \end{bmatrix}$$

Assume that a data string (111011) is received at the destination.

Determine if an error has occurred and if so, determine the correct decoded codeword.

- (b) What are MIMO and SIMO systems? Why is SIMO preferred? Draw the block diagram for a SIMO system.

6 + (2 + 2 + 2) = 12

Department & Section	Submission Link
ECE	https://classroom.google.com/w/MzExOTE0NzUzNTAw/tc/MzcxNjY1MTc1MTgx