ADVANCED DIGITAL COMMUNICATION TECHNIQUES
(ECEN 5201)

Time Allotted : 2½ hrs   **Full Marks : 60**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and
<u>any 4 (four)</u> from Group B to E, taking <u>one</u> from each group.

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

Group – A

1. Answer any twelve: **12 × 1 = 12**

Choose the correct alternative for the following

(i) An analog signal has significant spectral components from 1 kHz to 5 kHz. What is the Nyquist sampling rate for this signal?
(a) 5 k samples/s   (b) 8 k samples/s
(c) 10 k samples/s   (d) 4 k samples/s

(ii) The sequence of operations in which PCM is done is
(a) sampling, quantizing, encoding   (b) quantizing, encoding, sampling
(c) quantizing, sampling, encoding   (d) none of the above

(iii) Equalization is used to compensate:
(a) Peak signal to noise ratio   (b) Inter-symbol interference
(c) Channel fading   (d) Noises present in the signal

(iv) BER in a link is
(a) directly proportional to SNR   (b) equal to SNR
(c) inversely proportional to SNR   (d) none is true

(v) An 16 –PSK modulated signal has the bit rate 4000bps; baud rate is (symbols/sec):
(a) 2000   (b) 4000   (c) 8000   (d) 1000

(vi) In QAM both identities are varied.
(a) amplitude and phase   (b) frequency and phase
(c) bit rate and phase   (d) baud rate and phase

(vii) Synchronization of signals is done using
(a) Pilot clock
(b) Extracting timing information from the received signal
(c) Transmitter and receiver connected to master timing source
(d) All of the above

(viii) Matched filter technique is used to _____ SNR at receiver output.
(a) increase   (b) decrease
(c) increase & decrease   (d) none of these

(ix) Some advantages of spread spectrum are
(a) Low susceptibility   (b) Immunity to jamming
(c) Reduced interference   (d) All of the mentioned

(x) Which of the following is the drawback for cordless telephones?
(a) Wireless technology   (b) Limited coverage area
(c) Mobile   (d) Security

Fill in the blanks with the correct word

(xi) Quantization error can be reduced by increasing the _____ _____.

(xii) BW of MSK is _____than that of QPSK.

(xiii) In OFDM system number of _____ is very _____ and are transmitted at _____ power.

(xiv) CSMA-CA protocol is applicable for _____ networks.

(xv) In source coding, a lower probability event requires _____ bits.

Group - B

2. (a) Draw and explain the Tx & Rx section of a DM system.   *[(CO2)(Understand/LOCQ)]*
   (b) Explain the limitations of Delta modulation. How are those overcome in ADM?
                                                                    [(CO2)(Analyse/IOCQ)]
   6 + 6 = 12

3. (a) Explain inter symbol interference. Show mathematically how this is produced and how to eliminate it.   *(CO4)(Analyse/HOCQ)]*
   (b) Draw and explain the function of a linear adaptive equalizer. Use three or more moments. Also, show the equivalent structure.   *[(CO6)(Understand/IOCQ)]*
   6 + 6 = 12

Group - C

4. (a) Compare the transmission bandwidth requirement of ASK, FSK and PSK modulation systems with the modulated signals representation in frequency domain.   *[(CO2)(Analyse/IOCQ)]*
   (b) Find the (i) peak frequency deviation (ii) minimum bandwidth (iii) baud rate for FSK signal with a bit 0 frequency of 49 kHz, bit 1 frequency of 51 kHz and input bit rate of 2 kbps.   *[(CO3)(Remember/LOCQ)]*
   6 + 6 = 12

5. (a) How OFDMA can be generated from FDMA? Compare OFDMA with FDMA.
                                                    [(CO2)(Understand/IOCQ)]

(b) Draw the block diagram of an OFDMA wireless link from the base station to the user terminal. Explain the operations of the CP and IFFT blocks.

[(CO2) (Understand/IOCQ)]

6 + 6 = 12

Group - D

6. (a) What is the full form of CSMA? Where is it used? Why is it so useful?

[(CO4)(Understand/LOCQ)]

(b) Compare CSMA-CD and CSMA-CA for all the important features. Which one is used for wireless networks and why? *[(CO4)(Understand/LOCQ)]*

4 + 8 = 12

7. (a) FHSS is another SS technique. Compare the two-DSSS and FHSS.

[(CO3)(Understand/LOCQ)]

(b) DSSS is better in case of narrowband interference whereas FHSS works better to avoid jamming. In which popular family of devices, do we use FHSS? Mention the limitation of FHSS. *[(CO3)(Understand/IOCQ)]*

6 + 6 = 12

Group - E

8. (a) When can we apply ML decision rule? Derive the equation for ML detection in an AWGN channel. *[(CO4)(Analysis/HOCQ)]*

(b) Why are the estimation etc. processes carried out at the receiver? Which parameters of the received signal affect the estimation most? *[(CO4)(Understand/IOCQ)]*

8 + 4 = 12

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

[(CO5)(Analyse/IOCQ)]

(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.

[(CO5)(Apply/HOCQ)]

6 + 6 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	31.25	47.92	20.83