ANALOG AND DIGITAL COMMUNICATION
(ECEN 3223)

Time Allotted : 3 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) If the deviation is 75 kHz and maximum modulating frequency is 5 kHz, then the bandwidth of an FM wave is,
(a) 80 kHz (b) 160 kHz (c) 40 kHz (d) 320 kHz

(ii) The intermediate frequency used for AM in superheterodyne receiver is
(a) 10.7 MHz (b) 455 kHz (c) 900 kHz (d) 950 kHZ

(iii) In commercial FM broadcasting, the maximum frequency deviation is normally
(a) 5 kHz (b) 15 kHz (c) 75kHz (d) 200 kHz

(iv) FM is superior to AM in the sense that
(a) FM is more immune to noise (b) FM requires less bandwidth
(c) FM generation is easy (d) all of these.

(v) The transmitted power in an FM system is,
(a) dependant on the number of sidebands
(b) always constant
(c) dependant on the carrier power and sidebands
(d) none.

(vi) Armstrong method is
(a) direct method to generate FM (b) indirect method to generate FM
(c) direct method to generate PM (d) indirect method to generate PM.

(vii) BW of MSK _____ that of QPSK
(a) higher than (b) lower than
(c) equal to (d) less than or equal to

(viii) Which of the following modulation techniques is most noise immune?
(a) ASK (b) PSK (c) FSK (d) AM.

(ix) In Delta modulation, the granular noise occurs when the
(a) modulating signal increases rapidly
(b) modulating signal remains constant
(c) pulse rate decreases
(d) pulse amplitude increases.

(x) The bit rate for a digital communication system is 34Mbps. The modulation scheme is QPSK. The baud rate of the system is
(a) 68 Mbps (b) 17 Mbps (c) 34 Mbps (d) 85 Mbps.

Group - B

2. (a) Explain briefly, why modulation is needed in communication system. [(CO1)(Remember/LOCQ)]
Draw the spectrum of (i) AM (ii) DSB-SC signal (iii) SSB-SC modulated signal. [(CO1&CO2)(Analyse/IOCQ)]

(b) A transmitter radiates 10 kW with carrier unmodulated and 12 kW when carrier is sinusoidally modulated. Calculate the modulation index. If another sine wave corresponding to 50% modulation is transmitted simultaneously, determine the total radiated power. [(CO2)(Evaluate/HOCQ)]

(2 + 4) + 6 = 12

3. (a) Discuss the performance comparison of FM and PM systems. Explain image rejection process in super heterodyne receiver. [(CO2,CO3)(Analyse/IOCQ)]

(b) An FM wave is described by the equation f (t) = 10sin (5 × 10^8 t + 4sin 1250 t). Find the (a) Carrier and modulating frequency (b) Modulation index and frequency deviation (c) Power dissipated by the FM signal in a 5 ohm register. [(CO3)(Apply/IOCQ)]

(3 + 4) + 5 = 12

Group - C

4. (a) Draw the block diagram of digital Communication system. [(CO1)(Remember/LOCQ)]

(b) Differentiate between Aliasing effect and Aperture effect. [(CO1&CO2)(Analyse/IOCQ)]

(c) Estimate that in a PCM system, the output signal to quantization noise ratio (SNR) dB ≤ 4.8 + 6n, where n is the number of bits of the quantizer. [(CO2)(Evaluate/HOCQ)]

2 + 4 + 6 = 12

5. (a) To transmit a bit sequence of 011001011010110, draw the resulting waveform using (i) Unipolar NRZ and RZ (ii) Polar-NRZ and RZ (iii) Bipolar NRZ or AMI (iv) Manchester Coding. [(CO4)(Apply/IOCQ)][(CO4) (Understand/LOCQ)]

(b) A DM system is designed to operate at 5 times the Nyquist rate for a signal with a 3 KHz Bandwidth. Determine the maximum amplitude of a 2 KHz input

sinusoid for which the DM does not show slope-overload. Quantization step size is 250 mV. [(CO4)(Evaluate/HOCQ)]

6 + 6 = 12

Group - D

6. (a) What id bit error rate or probability of error of BPSK? What do you mean by coherent BASK (explain with diagram). [(CO5)(Apply/IOCQ)]
   (b) With suitable diagram, explain the working principle of QPSK transmitter and draw its signal space diagram. [(CO5)(Understand/LOCQ)]
   (c) What are the advantage and disadvantages of DPSK. [(CO5)(Understand/LOCQ)]

(2 + 2) + 5 + 3 = 12

7. (a) What is the difference between M-ary PSK and M-ary QAM signal? [(CO5) (Understand/LOCQ)]
   (b) How the problems faced in QPSK are solved in MSK? [(CO5)(Analysis/IOCQ)]
   (c) How OFDMA carriers are generated? What do you mean by DSSS and FSSS? [(CO5)(Understand/LOCQ)]

4 + 4 + 4 = 12

Group - E

8. (a) What are the key differences between FDMA, TDMA and CDMA systems? [(CO5&CO6)(Analysis/IOCQ)]
   (b) What is a need for frequency reuse? Why dynamic channel assignment strategy is preferred over fixed one?
   (c) How handoff is done for GSM? What do you mean by soft handoff and hard hand off? [(CO6)(understanding/IOCQ)]

4 + 4 + 4 = 12

9. Write short notes on any three of the following: **(4 × 3) = 12**
   (i) GSM
   (ii) Bluetooth
   (iii) Satellite Communication
   (iv) CDMA. [CO6]Understand/LOCQ]

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	39.58	41.67	18.75

Course Outcome (CO):

After the completion of the course students will be able to

1. Explain the necessity of communication, its history, evolution , the role of efficient communication in the present day.
2. Understand & apply the concepts of various types of signals, techniques for signal transmission and signal modulation from the knowledge gathered earlier.
3. Identify various parameters associated with Amplitude and frequency Modulation, time and frequency domain representations, side band frequencies etc and apply these knowledge to solve numerical problems.
4. Apply sampling theorem to sample analog signal properly and differentiate among pulse modulation & demodulation techniques and understand PCM, DPCM.
5. Analyze performance of various digital modulation & demodulation techniques and understand concept of OFDM and Spread Spectrum Modulationsystem.
6. Analyze various multiplexing and Multiple access techniques and compare modern multiple access schemes, explain the concept of frequency reuse, channel assignment strategies and make use of wireless communication tools

*LOCQ: Lower Order Cognitive Question; IOCQ: Intermediate Order Cognitive Question; HOCQ: Higher Order Cognitive Question