COMMUNICATION TECHNIQUES
(AEIE 3131)

Time Allotted : 3 hrs   **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and
<u>any 5 (five)</u> from Group B to E, taking <u>at least one</u> 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)   Consider the amplitude modulated (AM) signal $A_c \cos \omega_c t + 2 \cos \omega_m t \cos \omega_c t$. For demodulating the signal using envelope detector, the minimum value of A_c should be
   (a) 1   (b) 2   (c) 3   (d) 4

   (ii)   A modulated signal is given by, $s(t) = m_1(t) \cos(2\pi f_c t) + m_2(t) \sin(2\pi f_c t)$, where the baseband signal $m_1(t)$ and $m_2(t)$ have bandwidths of 10 kHz and 15 kHz, respectively. The bandwidth of the modulated signal, in kHz, is
   (a) 10 kHz   (b) 15 kHz   (c) 20 kHz   (d) 30 kHz

   (iii)   A 10 MHz carrier is frequency modulated by a sinusoidal signal of 500 Hz, the maximum frequency deviation being 50 kHz. The bandwidth required, as given by the Carson's rule is
   (a) 101 kHz   (b) 10 MHz   (c) 50 kHz   (d) 500 Hz

   (iv)   QPSK system uses a phase shift of
   (a) Π   (b) Π/2   (c) Π/4   (d) 2Π

   (v)   The modulation scheme commonly used for transmission from GSM mobile terminals is
   (a) Walsh-Hadamard Orthogonal codes   (b) 4-QAM
   (c) Gaussian Minimum Shift Keying (GMSK)   (d) 16-PSK

   (vi)   The bit rate of digital communication system is R Kbit/s. The modulation used is 32-QAM. The minimum bandwidth required for ISI free transmission is
   (a) R/10 Hz   (b) R/10 KHz   (c) R/5 Hz   (d) R/5 KHz

   (vii)   The interference caused by the adjacent pulses in digital transmission is called
   (a) inter symbol interference   (b) white noise
   (c) transit time noise   (d) image frequency interference

(viii) In digital transmission, the modulation technique that requires minimum bandwidth is
(a) PCM   (b) DPCM   (c) PAM   (d) Delta modulation

(ix) What are co-channel cells?
(a) Cells using same frequency   (b) Cells using different frequency
(c) Cells using adjacent frequency   (d) Cells having different base stations

(x) What is the access point (AP) in a wireless LAN?
(a) Device that allows wireless devices to connect to a wired network
(b) Both device that allows wireless devices to connect to a wired network and Wireless devices itself
(c) Wireless devices itself
(d) All the nodes in the network.

Group- B

2. (a) Explain the square law modulator with a neat block diagram and deduce an expression for the output. [(CO1) (Analyze/IOCQ)]

(b) Implement FM from PM and vice versa. [(CO1) (Apply/IOCQ)]

(4 + 2) + 6 = 12

3. (a) An angle modulated wave with a carrier frequency $\omega_c = \pi \times 10^5$ rad/s is given as $f(t) = 5\cos(\omega_c t + 3\sin 2000t + 5\sin 2000\pi t)$.
Detect: (i) frequency deviation, (ii) deviation ratio, (iii) phase deviation and (iv) the bandwidth. [(CO1) (Evaluate/HOCQ)]

(b) An FM transmitter with a carrier frequency of 80 MHz has deviation sensitivity of 4 kHz/V. For a modulating signal $f_m(t) = 12\sin(2\pi \times 2000t)$, determine the frequency deviation and the modulation index. [(CO1) (Evaluate/IOCQ)]

(c) Describe the working principle of rectifier detector. [(CO1)(Understand/LOCQ)]

4 + (2 + 2) + 4 = 12

Group - C

4. (a) Explain the principle of I/Q modulation and concept of I and Q channel.
[(CO2) (Analyze/IOCQ)]

(b) List the advantages of M-ary signaling scheme. [(CO2) (Remember/LOCQ)]

(c) Compare between standard FSK and MSK. [(CO2) (Analyze/IOCQ)]

(d) Differentiate coherent and noncoherent methods of signal detection.
[(CO2) (Analyze/IOCQ)]

4 + 2 + 3 + 3 = 12

5. (a) Compare among DSSS, FHSS and THSS techniques. [(CO2) (Analyze/IOCQ)]

(b) Define chip rate and processing gain for spreadspectrum modulation techniques.   [(CO2) (Remember/LOCQ)]

(b) Draw the constellation diagram for BPSK, QPSK, 8PSK, 16 QAM and 64 QAM systems.   [(CO2) (Apply/IOCQ)]

3 + 2 + 7 = 12

Group - D

6 (a) A delta modulator system is designed to operate at five times the Nyquist rate for a signal having abandwidth equal to 3 kHz. Verify that the maximum amplitude of a 2 kHz input sinusoidal signal will be 596.83 mV to avoid slope overload, if the quantizing step size is 250 mV.   [(CO4) (Evaluate/HOCQ)]

(b) Compare between ARQ and Hamming Code.   [(CO2) (Analyze/IOCQ)]

(c) What is hamming distance?   [(CO2) (Remember/LOCQ)]

(d) A TDM link has 24 signals and each channel is sampled 8000times/sec. Each sample isrepresented by 8 binary bits and an additional bit for synchronization. Validate that the total bit rate made from the TDM link is more than 1600kbps.
[(CO3)(Evaluate/HOCQ)]
4 + 3 + 1 + 4 = 12

7. (a) Discuss the importance of quantization process in digital transmission of information signal.   [(CO4) (Remember/LOCQ)]

(b) Explain Nyquist criterion for distortion less base-band binary transmission. Define coding efficiency. [(CO3) (Understand/LOCQ)]

6 + (4 + 2) = 12

Group - E

8. (a) Examine hand-off process in different generations of cellular communications. Explain the factorsthatinfluence the hand-off process.[(CO5) (Analyze/IOCQ)]

(b) Evaluate the role of 'frequency reuse' in cellular communication.
[(CO5) (Evaluate/HOCQ)]
(3 + 4) + 5 = 12

9. (a) With neat diagram briefly describe the components of WLAN as per IEEE 802.11 standards.   [(CO6) (Understand /LOCQ)]

(b) With proper flow chart explain CSMA-CD protocol. [(CO6) (Analyze/IOCQ)]
6 + 6 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	28.13%	50.0%	21.87%

Course Outcome (CO):

After the completion of the course students will be able to:

1. Identify and apply detailed knowledge of analog modulation and demodulation techniques.
2. Examine the merits and short comings of the basic digital modulation techniques.
3. Compare the characteristics of standard multiplexing techniques and select the suitable one for specific requirement.
4. Evaluate the performance of coding techniques.
5. Analyze cellular concept and the strategies associated with cellular communication.
6. Explain the role of wireless local area networks in communication systems.

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

Department & Section	Submission Link
AEIE	https://classroom.google.com/c/NDA1MzQxNDQwMjQw/a/NDY0MjEwNzU4NjU1/details