

**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 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 minimum antenna height for a modulated signal of frequency 1 MHz is  
(a) 7 Km                      (b) 7.5 Km                      (c) 75 metre                      (d) 7.5 meter.
- (ii) When L is the signal level, in line coding the relation between bit rate (bps) and pulse rate(pps) is  
(a)  $\text{pps} = \text{bps} \times \log_2 L$                       (b)  $\text{bps} = \text{pps} \times \log_2 L$   
(c)  $\text{bps} = 2 \times \text{pps} \times L$                       (d)  $\text{pps} = 2 \times \text{bps} \times L$
- (iii) Which of the following is used as frequency modulator?  
(a) PLL                      (b) LPF                      (c) VCO                      (d) BPF.
- (iv) Which of the following analog modulation scheme requires the minimum transmitted power and minimum channel band-width?  
(a) VSB                      (b) DSB-SC                      (c) SSB                      (d) AM.
- (v) By companding which of the following is achieved?  
(a) Uniform quantization                      (b) Non uniform quantization  
(c) Both (a) and (b)                      (d) None of (a), (b) & (c).
- (vi) An AM signal is detected using an envelope detector. The carrier frequency and modulation signal frequency are 1 MHz and 2 KHz respectively. An appropriate value for the time constant of the envelope detector is  
(a) 500  $\mu\text{s}$                       (b) 100  $\mu\text{s}$                       (c) 0.5  $\mu\text{s}$                       (d) 0.1  $\mu\text{s}$ .
- (vii) The percentage modulation of FM signal having frequency deviation of 12 KHz with maximum allowable deviation 20 KHz is given by,  
(a) 60%                      (b) 40%                      (c) 10%                      (d) 30%.
- (viii) What conditions must be fulfilled in a good digital communication system?  
(a) High data rate                      (b) High fidelity  
(c) Low transmit power                      (d) All of the mentioned.

- (ix) The line code that has zero dc component for pulse transmission of random binary data is
- (a) non-return to zero (NRZ) (b) return to zero (RZ)  
(c) alternate mark inversion (AMI) (d) both (a) and (b).
- (x) For an AMDSBFC envelop with  $V_{\max} = 30$  volt and  $V_{\min} = 6$  volt, the peak amplitude of carrier signal is
- (a) 18 volt (b) 12 volt (c) 36 volt (d) 24 volt.

### Group - B

2. (a) What are the advantages of modulation in a communication system? [(CO1)(Remember/LOCQ)]
- (b) What is modulation index in amplitude modulation? With necessary diagram find the expression of modulation index in terms of maxima & minima of amplitude modulated wave. [(CO1)(Analyze/IOCQ)]
- (c) A carrier frequency of 8 MHz and peak amplitude 7 volt is amplitude modulated by 6 KHz sine wave of amplitude 5 volt. Determine modulation index, upper and lower side band frequencies and their amplitudes. [(CO1)(Evaluate/HOCQ)]  
**3 + (1 + 4) + 4 = 12**
3. (a) Find the expression of frequency modulated wave. [(CO1)(Analyze/IOCQ)]
- (b) Define deviation ratio, percentage modulation and bandwidth of FM signal. [(CO1)(Understand/LOCQ)]
- (c) The equation of FM wave is given by,  $e(t) = 8 \sin (10^7 t + 2 \sin 10^3 t)$ . Calculate the carrier and modulating frequencies, the modulation index and, frequency deviation and the power dissipated in 100 ohms resistor. [(CO1)(Evaluate/HOCQ)]  
**4 + 4 + 4 = 12**

### Group - C

4. (a) For an FSK signal with a mark frequency of 85 kHz and space frequency of 93 kHz, with an input rate of 5 kbps, determine the peak frequency deviation and baud rate. [(CO2)/Evaluate/HOCQ]
- (b) An FSK transmitter, using a carrier frequency of 750 kHz, is sending 10 kbps and a frequency deviation of 200 kHz. Calculate the amount of transmission bandwidth needed for this purpose. [(CO2)(Evaluate/HOCQ)]
- (c) What is Shannon's limit for information capacity? For an 8PSK system operating at an information bit rate of 36 kbps, find the baud, minimum bandwidth and bandwidth efficiency. [(CO2)(Evaluate/HOCQ)]  
**3 + 3 + (2 + 4) = 12**
5. (a) Draw the block diagram of QPSK modulator and explain its operation. [(CO2)(Apply/IOCQ)]/[(Analyze/IOCQ)]
- (b) Compare among ASK, FSK and PSK. [(CO3)(Analyze/IOCQ)]

- (c) Describe the use of spread spectrum modulation techniques in wireless communication. [[CO2](Understand/LOCQ)]  
**(3 + 3) + 3 + 3 = 12**

**Group - D**

6. (a) What are the expressions for unipolar RZ , NRZ, polar RZ, NRZ and AMI. [[CO4](Understand/LOCQ)]  
 (b) Draw waveforms using:  
 (i) AMI, (ii) NRZ Technique, (iii) RZ Technique, (iv) Manchester Coding with the message signal (10011011). [[CO4](Evaluate/HOCQ)]  
 (c) What are signal level and data level? [[CO4](Understand/LOCQ)]  
**5 + 4 + 3 = 12**
7. (a) Draw the block diagram of a PAM/TDM system. Explain how this system works for transmitting multiple data to remote end. [[CO3](Remember/LOCQ)]  
 (b) What is crosstalk in a PAM/ TDM system? How it is reduced? [[CO3](Evaluate/HOCQ)]  
 (c) Find the Nyquist rate and the Nyquist interval for the signal  $x(t) = (1/2\pi) * [\cos(3000 \pi t)\cos(1000\pi t)]$ . [[CO4](Evaluate/HOCQ)]  
**(2 + 4) + (1 + 2) + 3 = 12**

**Group - E**

8. (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**
9. (a) Describe Fixed Channel Assignment and Dynamic Channel Assignment. Describe hand-off. State its importance. [[CO5](Analyse/IOCQ)]  
 (b) Differentiate between co-channel interference and adjacent channel interference. [[CO5](Analyze/IOCQ)]  
**(4 + 3 + 2) + 3 = 12**

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	31.25	37.5	31.25

**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