

**COMMUNICATION TECHNIQUES
(AEIE 3101)**

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 maximum power efficiency of an AM modulator is
(a) 25% (b) 50% (c) 33% (d) 100%.
- (ii) The noise voltage (V_n) and the signal bandwidth (B) are related as
(a) V_n is directly proportional to B (b) V_n is directly proportional to \sqrt{B}
(c) V_n is inversely proportional to B (d) V_n is inversely proportional to \sqrt{B}
- (iii) For a message signal $m(t) = \cos(2\pi f_m t)$ and carrier of frequency f_c , which of the following represents a single side-band (SSB) signal?
(a) $\cos(2\pi f_m t)\cos(2\pi f_c t)$ (b) $\cos(2\pi f_c t)$
(c) $\cos[2\pi(f_c + f_m)t]$ (d) $[1 + \cos(2\pi f_m t)] \cdot \cos(2\pi f_c t)$
- (iv) Advantages of digital communication are
(a) Easy multiplexing (b) Easy processing
(c) Reliable (d) All of the mentioned.
- (v) Guard band is
(a) The small unused bandwidth between the frequency channels to avoid interference
(b) The bandwidth allotted to the signal
(c) The channel spectrum
(d) The spectrum acquired by the noise between the signals.
- (vi) In delta modulation, the slope overload distortion can be reduced by
(a) decreasing the step size (b) decreasing the granular noise
(c) increasing the step size (d) decreasing the sampling noise.
- (vii) Calculate the minimum sampling rate to avoid aliasing when a continuous time signal is given by $x(t) = 5 \cos 400\pi t$
(a) 100 Hz (b) 200 Hz (c) 400 Hz (d) 250 Hz.

- (viii) In Differential Pulse Code Modulation techniques, the decoding is performed by
(a) Quantizer (b) Accumulator (c) Sampler (d) PLL.
- (ix) The process of transferring a mobile station from one base station to another is
(a) Switching (b) Roaming
(c) Hand off (d) Clustering.
- (x) GSM is an example of
(a) TDMA cellular systems (b) FDMA cellular systems
(c) CDMA cellular systems (d) SDMA cellular systems.

Group – B

2. (a) Explain the principle of Amplitude Modulation. What is Modulation index? Compare between DSB and SSB modulation.
- (b) Draw the block diagram of a phase locked loop and explain its operation.
(3 + 2 + 3) + 4 = 12
3. (a) For any given electromagnetic field, explain displacement current, reflection coefficient and transmission coefficient. What do you mean by lumped and distributed parameters?
- (b) Consider an angle modulated signal $x(t) = 4 \cos [2\pi 104 t + 5 \sin (2\pi 103 t)]$ Find (i) its instantaneous frequency at time, $t = 0.8$ milliseconds and (ii) maximum phase deviation & maximum frequency deviation.
(2 + 2 + 2 + 2) + 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 5kbps, determine the peak frequency deviation and baud rate.
- (b) Explain with block diagram the operation of BPSK modulator and demodulator.
- (c) A 16PSK system has baud rate of 2000/s. Examine the bit rate of this system. Identify the baud rate of a QPSK system having the same bit rate.
- (d) 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.
2 + 5 + 3 + 2 = 12
5. (a) What are the main features of delta modulation? Explain the operation of a delta modulation encoder.
- (b) Write short note on quadrature amplitude modulation.
- (c) Why are spread spectrum modulation techniques used in wireless communication? What are the types of spread spectrum modulation techniques?
(3 + 3) + 4 + (1 + 1) = 12

Group – D

6. (a) With neat sketch explain the working principle of frequency division multiplexing system.
- (b) What is companding? Define inter symbol interference.
- (c) Define eye pattern.

6 + (2 + 2) + 2 = 12

7. (a) Why are source coding, line coding & channel coding used in communication? Give suitable example of each coding.
- (b) Draw waveforms using:
(i) AMI, (ii) NRZ Technique, (iii) RZ Technique, (iv) Manchester Coding with the message signal : (1010000101)₂

(5 + 3) + 4 = 12

Group – E

8. (a) From the concept of frequency reuse, analyze channel capacity and cluster. Prove that for a hexagonal geometry, the co-channel reuse ratio is given by $Q = \sqrt{3N}$, where $N = i^2 + ij + j^2$.
- (b) A total of 33 MHz bandwidth is allocated to a FDD cellular system with two 25 KHz simplex channels to provide full duplex voice and control channels. Compute the number of channels available per cell if the system uses (i) 4-cell and (ii) 7-cell reuse technique.

Assume 1 MHz of spectrum is allocated to control channels. Give a distribution of voice and control channels.

(3 + 5) + 4 = 12

9. (a) What do mean by Fixed Channel Assignment and Dynamic Channel Assignment. What is hand-off? Why is it important?
- (b) Differentiate between co-channel interference and adjacent channel interference.

(4 + 3 + 2) + 3 = 12

Department & Section	Submission link:
AEIE	https://classroom.google.com/c/Mjc0MDU2MjA4NjYw/a/Mjc0MDU2MjA4Njk5/details