B.TECH/AEIE /5TH SEM/ AEIE 3101/2017
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 term Transponder is related to
(a) Satellite communication (b) Fibre optic communication
(c) GSM communication (d) CDMA communication.

(ii) Consider an FM wave $f(t) = \cos[2\pi f_c\, t + \beta_1 \sin 2\pi f_1 t + \beta_2 \sin 2\pi f_2 t]$. The maximum deviation of the instantaneous frequency from the carrier frequency f_c is
(a) $\beta_1 f_1 + \beta_2 f_2$ (b) $\beta_1 f_2 + \beta_2 f_1$ (c) $\beta_1 + \beta_2$ (d) $f_1 + f_2$.

(iii) The Nyquist sampling interval, for the signal $sinc\,(700\,t) + sinc\,(500\,t)$ is
(a) $1/350\ sec$ (b) $\pi/350\ sec$ (c) $1/700\ sec$ (d) $\pi/175\ sec$.

(iv) A video transmission system transmits 625 picture frames per second. Each frame consists of a 400 × 400 pixel grid with 64 intensity levels per pixel. The data rate of the system is
(a) 16 Mbps (b) 100 Mbps (c) 600 Mbps (d) 6.4 Gbps.

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

(vi) The bit rate of digital communication system is Rkbit/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) According to Maxwell's first equation in a point form for the static field, the electric flux per unit volume by leaving a small value is equal to
(a) zero (b) magnetic field intensity
(c) current density (d) volume charge density.

(viii) AMPS utilizes
(a) TDMA techniques (b) FDMA techniques
(c) CDMA techniques (d) SDMA techniques.

(ix) Consider an angle modulation signal $x(t)=6cos[2\pi\times10^3+2\sin(8000\pi t)+4\cos(8000\pi t)]V$. The average power of $x(t)$ is
(a) 10 W (b) 18 W (c) 20 W (d) 28 W.

(x) 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.

Group – B

2. (a) What do you mean by depth of modulation? What is the total modulating index if a carrier is simultaneously modulated by two sine waves with modulating indices of 0.3 and 0.4?

(b) An AM transmitter produces 15 kW with 60% modulation. How much of it is carrier power? How much power is saved if SSB transmission takes place?

(c) Explain the scheme of envelope detector. What do you mean by diagonal peak clipping and negative peak clipping?

(2 + 2) + (1 + 1) + (4 + 1 + 1) = 12

3. (a) Explain the principle of Angle Modulation.

(b) Consider an angle modulated signal **$x(t) = 2\cos[2\pi\,105\,t + 3\sin(2\pi\,102\,t)]$.**
Find: (i) its instantaneous frequency at time t = 0.4 milliseconds and
(ii) maximum phase deviation & maximum frequency deviation.

(c) With neat sketch briefly explain the working principle of balanced ring modulator.

3 + (2 + 2) + 5 = 12

Group – C

4. (a) Compare the various types of digital modulation techniques. Explain with block diagram the operation of BFSK modulator and demodulator.

(b) What is Shannon's limit for information capacity? For an 8PSK system operating at an information bit rate of 36kbps, find the baud, minimum bandwidth and bandwidth efficiency.

(3 + 5) + (1 + 3) = 12

5. (a) Explain the principle of I/Q modulation and concept of I and Q channel. Write short note on quadrature amplitude modulation.

(b) What are the main features of delta modulation? Explain the operation of a delta modulation encoder. Distinguish between delta modulation and adaptive delta modulation.

(2 + 3) + (2 + 3 + 2) = 12

Group – D

6. (a) What do you mean by uniform quantizer and non-uniform quantizer? What is quantization noise?

(b) Explain nyquist criterion for distortion less base-band binary transmission. What is coding efficiency?

(4 + 2) + (4 + 2) = 12

7.(a) Why are source coding, line coding & channel coding used in communication? Give suitable example of each coding.

(b) Briefly explain any coding technique for error detection and correction.

(5 + 3) + 4 = 12

Group – E

8.(a) What do mean by Fixed Channel Assignment and Dynamic Channel Assignment. What is hand-off? Why is it important?

(b) Compare among CDMA, TDMA and FDMA.

(4 + 3 + 2) + 3 = 12

9.(a) Explain the signal processing techniques in GSM. Write down the name of the different channels used in GSM.

(b) If an AMPS cellular operator is allocated 12.5 MHz for each simplex band and if channel bandwidth is 30 kHz, total spectrum allocation is 12.5 MHz, Guard BW is 10 kHz, find the number of channels available in an FDMA

(5 + 2) + 5 = 12