**Code: AE21**          **Subject: DIGITAL COMMUNICATI**

## AMIETE – ET (OLD SCHEME)

**Time: 3 Hours**          **JUNE 2012**          Max. Marks: 100

*PLEASE WRITE YOUR ROLL NO. AT THE SPACE PROVIDED ON EACH PAGE IMMEDIATELY AFTER RECEIVING THE QUESTION PAPER.*

**NOTE: There are 9 Questions in all.**

• **Question 1 is compulsory and carries 20 marks. Answer to Q.1 must be written in the space provided for it in the answer book supplied and nowhere else.**

• **The answer sheet for the Q.1 will be collected by the invigilator after 45 minutes of the commencement of the examination.**

• **Out of the remaining EIGHT Questions answer any FIVE Questions. Each question carries 16 marks.**

• **Any required data not explicitly given, may be suitably assumed and stated.**

**Q.1** **Choose the correct or the best alternative in the following:** **(2×10)**

a. Bandwidth of MSK is _____ that of QPSK.

    **(A)** Higher than                **(B)** Lower than
    **(C)** Equal to                    **(D)** Less than or equal to

b. Which of the following modulation schemes provides 4 bits per baud?

    **(A)** QPSK                    **(B)** 8-PSK
    **(C)** 16-QAM                 **(D)** 64-QAM

c. Hamming weight $\omega(S_i)$ of a code $S_i$ is defined as the

    **(A)** No. of 0's in codeword $S_i$
    **(B)** No. of 1's in codeword $S_i$
    **(C)** No. of 1's in even locations of $S_i$
    **(D)** No. of 0's in even locations of $S_i$

d. In the eye pattern, as eye closes,

    **(A)** ISI increases            **(B)** ISI decreases
    **(C)** Timing Jitter increases     **(D)** Timing Jitter decreases

e. The CRC circuit is basically

    **(A)** Decoder circuit        **(B)** Multiplexer circuit
    **(C)** Shift Register circuit     **(D)** Adder circuit

f. In a PCM system, the amplitude levels are transmitted in a 7 unit code. The sampling is done at rate of 10 kHz. The bandwidth should be

    **(A)** 5 kHz                **(B)** 35 kHz
    **(C)** 70 kHz               **(D)** 5 MHz

g. CDMA technique is not used in satellite communication because of

**(A)** wastage of bandwidth          **(B)** wastage of power
**(C)** increase in delay             **(D)** complexity of operation

h. Which encoding method uses alternating positive and negative values for 1s?

**(A)** NRZ-I                         **(B)** RZ
**(C)** Manchester                    **(D)** AMI

i. The use of non-uniform quantization levels leads to

**(A)** Reduction in transmission bandwidth
**(B)** Increase in maximum SNR
**(C)** Increase in SNR for low level signals
**(D)** Simplification of quantization process

j. In Fast Frequency Hopping (FFH)

**(A)** Hopping rate is equal to or greater than the bit rate of baseband signal.
**(B)** Hopping rate is equal to or less than the bit rate of baseband signal.
**(C)** The desired privacy and interference protection is less.
**(D)** None of the above.

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**Answer any FIVE Questions out of EIGHT Questions.**
**Each question carries 16 marks.**

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**Q.2**  a. Explain the following terms:

(i)  Aliasing.
(ii) SNR bandwidth trade off.                                      **(8)**

b. The signal $f(t) = 10\cos(20\pi t)\cos 200\pi t$ is sampled at a rate of 250 times/sec. Determine the spectrum of the resulting signal. What is the Nyquist rate?                                      **(8)**

**Q.3**  a. What is the basic difference between uniform and non uniform quantization?                                      **(8)**

b. Explain the operation and sketch the receiver of a differential PCM.     **(8)**

**Q.4**   Demodulation is recovery of waveform and detection is decision making process of selecting the digital meaning of that waveform. Explain it and show in a neatly labelled block diagram, the two basic steps involves in demodulation/detection of digital signals. What is equalizing filter? What is a matched filter?                                      **(16)**

**Q.5**  a. Explain the Non-Coherent detection of FSK.                      **(8)**

b. Find the bit error probability for a BPSK system with a bit rate of 1Mbit/s. The received waveforms $s_1(t) = A\cos\omega_0 t$ and $s_2(t) = -A\cos\omega_0 t$ are coherently detected with a matched filter. The value of A is 10 mV. Assume that the single sided noise power spectral density is $N_0 = 10^{-11}$ W/Hz and signal power and energy per bit are normalized relative to a 1Ω load. **(8)**

**Q.6** a. In the case of orthogonal signalling such as MFSK, why does error performance improve with higher dimensional signalling? **(8)**

b. Explain the principle behind Antijam capabilities of spread spectrum signal. **(8)**

**Q.7** a. Explain the following terms:
(i)   Hamming distance **(2)**
(ii)  Weight of a code **(2)**
(iii) Hamming Bound **(2)**

b. A (7, 4) linear block code is having parity check matrix H given by

$$H = \begin{bmatrix} 1 & 1 & 1 & 0 & 1 & 0 & 0 \\ 1 & 1 & 0 & 1 & 0 & 1 & 0 \\ 1 & 0 & 1 & 1 & 0 & 0 & 1 \end{bmatrix}$$

Code Word received in 1000011 for a transmitted code word C. Find the corresponding data transmitted. **(10)**

**Q.8** a. Explain decoding of a convolutional code using Viterbi decoding. What do you mean by hard decision and soft decision decoding? **(10)**

b. Draw a state transition diagram for rate ½ convolutional encoder as given in the figure below:- **(6)**
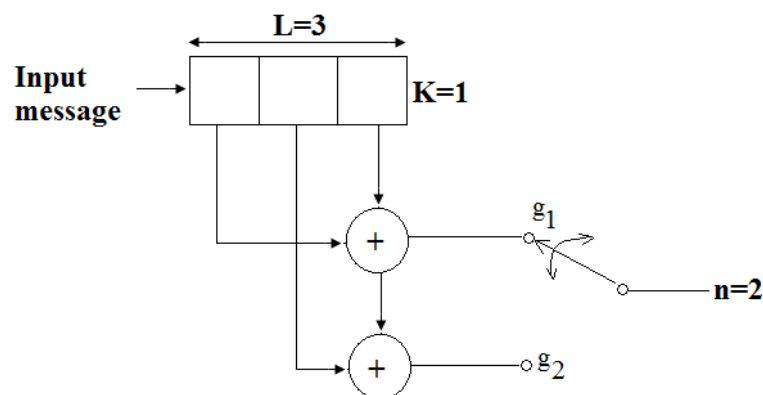


**Q.9** Explain short notes on any **TWO**:

(i)   Jamming considerations.
(ii)  Frequency Hopping Acquisition scheme.
(iii) PN Auto Correlation function. **(8+8)**