MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

Paper Code : CS-401

COMMUNICATION ENGINEERING & CODING THEORY

Time Allotted : 3 Hours *Full Marks* : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : $10 \times 1 = 10$

i) What is the maximum transmission efficiency of A.M. signal ?
   a) 67.3% b) 50.2%
   c) 33.3% d) 46.6%.

ii) Square law diode modulation is the example of
   a) Low level AM modulator
   b) Medium level AM modulator
   c) Very low level AM modulator
   d) High level AM modulator.

iii) In TV system, picture and sound respectively use
   a) AM, FM b) FM, FM
   c) FM, AM d) AM, AM.

iv) If f_m is the frequency of the message signal then bandwidth of narrow band frequency modulated (FM) signal is
   a) f_m b) $2f_m$
   c) Infinity d) None of these.

v) The modulation index of an AM wave is changed from 0 to 1. The transmitted power will be
   a) unchanged
   b) halved
   c) doubled
   d) increased by 50 per cent.

vi) In an Envelope detection of AM signal
   a) only the diode is used
   b) only the capacitor is used
   c) the diode and capacitor are used
   d) the inductor and capacitor are used.

vii) PWM signal can be generated by
   a) a monostable multivibrator
   b) an astable multivibrator
   c) integrating the PPM signal
   d) differentiating the PPM signal.

viii) Which one is the digital modulation scheme ?
   a) PCM b) PAM
   c) PPM d) PWM.

ix) The Nyquist sampling rate for a signl band limited to 4 kHz is
   a) 4kHz b) 8kHz
   c) 2kHz d) 16kHz.

x) Quantization occurs in
   a) TDM b) FDM
   c) PCM d) PWM.

xi) In QAM both identities are ..... varied.
   a) amplitude and phase b) frequency and phase
   c) bit rate and phase d) baud rate and phase.

xii) Entropy is basically a measurement of
   a) Rate of information
   b) Average information
   c) Probability of information
   d) Disorder of information.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. Draw and explain the basic block diagram for the communication system. Why is modulation required ? 3 + 2
3. Show that in case of AM with modulation index equal to 1 only 33.33% of the transmitted power is used to carry information.
4. State and prove the Sampling theorem. What do you mean by aliasing effect ? 3 + 2
5. Explain with sketch the difference between PWM, PAM and PPM.
6. Explain the Delta modulation with proper waveform.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

7. a) Derive the expression for power contents in AM wave. What is the transmission efficiency of AM signal ? 3 + 2
   b) A 500 W carrier is modulated on the depth of 50%. Calculate the total power and efficiency of the modulated wave in the following forms of AM (i) DSB-FC, (ii) DSB-SC. 5
   c) How can a balanced modulator be used to generate a DSB-SC signal ? 5
8. a) How can you produce FM using PM modulation and PM using FM modulation ? 5
   b) Explain with neat diagram how PLL works as FM demodulator. 5
   c) Define the Carson's rule of FM bandwidth. Find the bandwidth of a commercial FM transmission, if frequency deviation is 75 kHz and modulation frequency is 15 kHz. 2 + 3

9. a) Draw the block diagram for the generation and detection process of a PCM and explain its various blocks. What is quantization error ? 8 + 2
   b) Consider the binary sequence 101011001. Draw the waveform of the following formats :
      (i) Unipolar NRZ
      (ii) Unipolar RZ
      (iii) Polar RZ
      (iv) Polar NRZ
      (v) Bipolar NRZ. 5
10. a) With the help of block diagrams explain working principle of ASK modulator and demodulator. 6
    b) With the help of block diagram, explain the working principles of coherent FSK detection technique. 5
    c) Draw the waveforms of ASK, PSK, QPSK and FSK for the input bit sequence : 01011011. 4
11. a) Define source entropy and information rate. Write down the Shannon's theorem. 2 + 4
    b) An event has six possible outcomes with the probabilities

    $P_1 = \frac{1}{2}$; $P_2 = \frac{1}{4}$; $P_3 = \frac{1}{8}$; $P_4 = \frac{1}{2}$; $P_5 = \frac{1}{16}$ and $P_6 = \frac{1}{32}$. Find the entropy of the system.

    Also find the rate of information if there are 16 outcomes per second. 5
    c) What do you mean by channel capacity ? Calculate the capacity of a channel with bandwidth of 1 MHz and SNR of 40dB. 2 + 2
12. Write short notes on any *three* of the following : 3 × 5
    a) Envelope Detector
    b) Foster-Seely Discriminator
    c) TDM and FDM systems
    d) Inter Symbol Interference (ISI)
    e) Eye Pattern.