



# MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

Paper Code : OE-601B/OE-EE601B Communication Engineering

UPID : 006747

Time Allotted : 3 Hours

Full Marks : 70

The Figures in the margin indicate full marks.

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

## Group-A (Very Short Answer Type Question)

1. Answer any ten of the following :

[ 1 x 10 = 10 ]

- (I) Which system uses QAM
  - a) Dial up modem
  - b) Digital Microwave Relay
  - c) Peak value/ RMS value
  - d) Both a and b
- (II) The relation between entropy and mutual information is
  - a)  $I(X;Y) = H(X) - H(X/Y)$
  - b)  $I(X;Y) = H(X/Y) - H(Y/X)$
  - c)  $I(X;Y) = H(X) - H(Y)$
  - d)  $I(X;Y) = H(Y) - H(X)$
- (III) FM stands for \_\_\_\_\_
  - a) Frequency Modulation
  - b) Frequency Modulator
  - c) Frequent Multiplier
  - d) Frequency Mixer
- (IV) PDM is generated by \_\_\_\_\_
  - a) Bistable multivibrator
  - b) Monostable multivibrator
  - c) Astable multivibrator
  - d) Schmitt trigger
- (V) QPSK symbol contains \_\_\_\_\_
  - a) a byte
  - b) 4 bits
  - c) a dibit
  - d) 8 bits
- (VI) The information I contained in a message with probability of occurrence P is given by (k is constant)
  - a)  $I = k \log_2 1/P$
  - b)  $I = k \log_2 P$
  - c)  $I = k \log_2 1/2P$
  - d)  $I = k \log_2 1/3P$
- (VII) Which signal is called as energy signal?
  - a) Finite energy and zero power
  - b) Finite energy and non-zero power
  - c) Infinite energy and zero power
  - d) Infinite energy and non-zero power
- (VIII) Pulse shaping is done by which block or system?
  - a) Encoder
  - b) Baseband modulator
  - c) Pulse code modulator

d) Demodulator

(IX) What is necessary for digital communication?

- a) Precision timing
- b) Frame synchronization
- c) Character synchronization
- d) All of the mentioned

(X) The channel capacity is

- a) The maximum information transmitted by one symbol over the channel
- b) Information contained in a signal
- c) The amplitude of the modulated signal
- d) All of the above

(XI) Satellite communication takes place in

- a) Ultra high frequency band
- b) Super high frequency band
- c) Ultra & Super high frequency band
- d) None of the mentioned

(XII) The distortion in quantization is called as

- a) Round off error
- b) Truncation error
- c) Round off & Truncation error
- d) None of the mentioned

#### Group-B (Short Answer Type Question)

Answer *any three* of the following :

[ 5 x 3 = 15 ]

2. What is quadrature amplitude modulation (QAM), and how does it improve the efficiency of digital data transmission? [5]
3. Define entropy and mutual information in the context of information theory. Explain how they are used to measure the efficiency of data compression and transmission. [5]
4. Explain the difference between amplitude shift keying (ASK) and frequency shift keying (FSK) modulation techniques. [5]
5. Define pulse shaping and explain its role in baseband pulse transmission. What are the commonly used pulse shapes in baseband transmission and why? [5]
6. How is the bit error rate (BER) affected by the signal-to-noise ratio (SNR) in digital modulation systems? [5]

#### Group-C (Long Answer Type Question)

Answer *any three* of the following :

[ 15 x 3 = 45 ]

7. (a) What is digital baseband transmission? [ 5 ]  
(b) What is a pulse code modulation (PCM), and how is it used in digital baseband transmission? [ 5 ]  
(c) What is a line code, and what are some examples of commonly used line codes in digital baseband transmission? [ 5 ]
8. (a) What is the difference between bit rate and baud rate in digital communication systems? [ 5 ]  
(b) A communication system uses a modulation scheme that transmits 4 bits per symbol. If the symbol rate is 10,000 baud, what is the bit rate of the system? [ 10 ]
9. (a) What is source coding, and how is it used to represent a source of information with a minimum number of bits? [ 5 ]  
(b) What is channel capacity and how is it related to the mutual information between a transmitted signal and the received signal in a communication system? [ 5 ]  
(c) What is the channel coding theorem in information theory? [ 5 ]
10. (a) Explain the concept of pulse modulation and its advantages over analog modulation techniques. Provide examples of pulse modulation techniques used in communication systems. [ 5 ]

- (b) What is pulse amplitude modulation (PAM), and how does it differ from pulse width modulation (PWM) and pulse position modulation (PPM)? Provide examples of applications where each technique is used. [ 5 ]
- (c) What is the Nyquist-Shannon sampling theorem, and how is it used to determine the minimum sampling rate required for PCM? What is aliasing? [ 5 ]
11. (a) Suppose a source produces the following symbols with the given probabilities: [ 10 ]
- | Symbol | Probability |
|--------|-------------|
| A      | 0.4         |
| B      | 0.2         |
| C      | 0.2         |
| D      | 0.1         |
| E      | 0.1         |
- (a) What is the average number of bits required to encode each symbol using a binary code?
- (b) Using the Shannon Fano algorithm, find the binary codeword for each symbol and calculate the average number of bits required to encode each symbol.
- (b) Explain basic principle of error control and coding. [ 5 ]

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