

**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 dabit
 - 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?
- Precision timing
 - Frame synchronization
 - Character synchronization
 - All of the mentioned
- (X) The channel capacity is
- The maximum information transmitted by one symbol over the channel
 - Information contained in a signal
 - The amplitude of the modulated signal
 - All of the above
- (XI) Satellite communication takes place in
- Ultra high frequency band
 - Super high frequency band
 - Ultra & Super high frequency band
 - None of the mentioned
- (XII) The distortion in quantization is called as
- Round off error
 - Truncation error
 - Round off & Truncation error
 - None of the mentioned

Group-B (Short Answer Type Question)

Answer *any three* of the following :

[$5 \times 3 = 15$]

- What is quadrature amplitude modulation (QAM), and how does it improve the efficiency of digital data transmission? [5]
- 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]
- Explain the difference between amplitude shift keying (ASK) and frequency shift keying (FSK) modulation techniques. [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]
- 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 :

[$15 \times 3 = 45$]

- (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]
- (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]
- (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]
- (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]

*** END OF PAPER ***