



Name : .....

Roll No. : .....

Invigilator's Signature : .....

**CS/M.Sc.(SE)/SEM-2/MI-205/2013**

**2013**

**INFORMATION 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 the following :

10 × 1 = 10

- i) Which of the following is the simplest error-detection method ?
  - a) Parity
  - b) Longitudinal redundancy checking
  - c) Checksum checking
  - d) Cyclic redundancy checking.
- ii) Which type of error detection uses binary division ?
  - a) Parity
  - b) Longitudinal redundancy checking
  - c) Checksum checking
  - d) Cyclic redundancy checking.



- iii) Which of the following is also called forward error correction ?
- a) Simplex
  - b) Retransmission
  - c) Detection-error coding
  - d) Error-correction coding.
- iv) The failure density function,  $f(t)$  is used to give the probability of failure during an interval of time. It is known as
- a) Probability density distribution
  - b) Cumulative probability distribution
  - c) Cumulative density distribution
  - d) Failure probability distribution.
- v) The error represented by the difference between the original and quantized signals set a fundamental limitation to the performance of PCM systems known as
- a) dynamic range
  - b) quantization noise
  - c) detection-error
  - d) correction-error.
- vi) Automatic Repeat request ( ARQ ) mechanism is
- a) whenever one side sends a message to another, the other side sends a short acknowledgement ( ACK ) message back
  - b) ARQ is especially useful in cases of dealing with detecting errors
  - c) an ARQ scheme can be added to guarantee delivery if a transmission error occurs
  - d) all of these.



- vii) Capacity of a system is
- the number of signal levels =  $2^n$
  - the number of signal levels =  $n^2$
  - the number of signal levels =  $2^{n+1}$
  - none of these.
- viii) In Shannon's Theorem the capacity of a system in the presence of noise is
- $C = B \log_2 (1 + \text{SNR})$
  - $C = B \log_2 (1 + \text{SNR})$
  - $C = B \log_2$
  - none of these.
- ix) Entropy of  $X$  conditional on knowing  $Y$  is
- $H(X | Y) = H(X, Y) - H(Y)$
  - $H(X | Y) = H(Y) + H(X, Y)$
  - $H(X | Y) = H(Y) \times H(X, Y)$
  - none of these.
- x) Huffman code is a
- Prefix code
  - Infix code
  - Postfix code
  - None of these.

### GROUP - B

#### ( Short Answer Type Questions )

Answer any *three* of the following.  $3 \times 5 = 15$

- Write the scope of information theory and basic set-up of information theory.
- What is coding theory ?
- Write a short note on Channel capacity.



5. Does the Nyquist theorem bit rate agree with the intuitive bit rate described in baseband transmission ?
6. Write the Shannon's Theorem with an example.
7. Explain the strategies for handling channel errors. Also explain the different types of Forward Error Correction ( FEC ) mechanisms.
8. Write the definition of Shannon's Entropy. Give an example of Shannon's noiseless coding theorem.
9. Write a note on Binary Symmetric Channel ( BSC ).

**GROUP - C**  
**( Long Answer Type Questions )**

Answer any *three* of the following.       $3 \times 15 = 45$

10. What is information ? Briefly explain the properties of information.
11. What is the coding principle and purpose of error control coding ? Explain the different types of coding and channels.
12. What is entropy ? Write the basic properties of Von Neumann's entropy. Write the application of entropy with an example.
13. What is Data Compaction ? Explain the source coding schemes of data compaction.
14. What are mutual information and conditional mutual information ? Explain the chain rules of mutual information. Write the applications of mutual information.
15. Define discrete Memoryless Channel. Give an example of Discrete Memoryless Channel. What is information Capacity Theorem ? Write the implications of the Information Capacity Theorem.