CS/B.TECH/ECE/EVEN/SEM-6/EC-604B/2018-19

MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

Paper Code : EC-604B

INFORMATION THEORY AND CODING

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) A binary memory less source X with two symbols x_1, x_2. The Entropy of source $H(X)$ is maximum when

   a) both x_1 and x_2 are equiprobable

   b) $x_1 \geq x_2$

   c) $x_2 \geq x_1$

   d) none of these.

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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) An encoder for a (4. 3. 5) convolution code has a memory of order   http://www.makaut.com

 a) 4   b) 2

 c) 3   d) 5.

iv) DMS X with two symbols x_1 and x_2 and $P(x_1) = 0 \cdot 9$. $P(x_2) = 0 \cdot 1$. Find efficiency and redundancy of this code.

 a) 45%. 55%   b) 40%. 80%

 c) 46·9%. 53·1%   d) 90%. 90%.

v) If the SNR of the signal is increased. then the channel capacity

 a) is increased

 b) is decreased

 c) remains constant

 d) cannot be determined.

vi) A (8. 4) linear code has code rate of

    a) 8   b) 4

    c) 0·5   d) 2.

vii) For a (7. 4) cyclic code generated by $g(x) = 1 + x + x^3$ the syndrome for the error pattern $e(x) = x^3$ is

    a) 101   b) 111

    c) 110   d) 011.

viii) In $GF(2^3)$, α^7 equal to

    a) 1   b) α^{14}

    c) α^{21} d) all of these.

ix) Relation between message rate(r) and information rate(R) is

    a) $R = rH$ b) $r = RH$

    c) $r = R^2H$ d) $R = r^2H$.

x) The code in convolution coding is generated using

    a) EX-OR logic   b) AND logic

    c) OR logic   d) None of these.

xi) For decoding in convolution coding. in a code tree

    a) diverge upward when a bit is 0 and diverge downward when the bit is 1

    b) diverge downward when a bit is 0 and diverge upward when the bit is 1

    c) diverge left when a bit is 0 and diverge right when the bit is 1

    d) diverge right when a bit is 0 and diverge left when the bit is 1.

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GROUP – B
(Short Answer Type Questions)
Answer any *three* of the following.   3 × 5 = 15

2. a) State the advantages and disadvantages of fiber optic cable.

    b) Explain the operation of 2-wire to 4-wire hybrid system.   2 + 3

3. What is the significance of side tone in telephone conversation ?

4. Explain subscriber local loop architecture.

5. Explain associated and non-associated common channel signaling.

6. Explain the differences between circuit switching and packet switching.

GROUP – C
(Long Answer Type Questions)
Answer any *three* of the following.   3 × 15 = 45

7. a) Define Simplex communication and Half-Duplex and Full-Duplex communication.

    b) Define Trunk lines and subscriber lines.

    c) What is point to point communication ? Mention the disadvantages of the point to point communication.

    d) If the number of nodes in point-to-point communication is 770, find out the total number of links required for full connectivity.

    3 + 3 + (3 + 3) + 3

8. a) Explain the touch tone dial arrangement with proper diagram.

    b) What are the advantages of automatic exchanges over manual exchanges ?

    c) Classify the switching systems Compare the electromechanical and electronic switching systems.

    d) Describe how an uniselector rotary switch can be used as selector hunter.   3 + 3 + (2 + 2) + 5

c) Given an AWGN channel with 4 KHz bandwidth and the noise power spectral density $\eta/2 = 10^{-12}$ W/Hz. The signal power required at the receiver is $\upsilon0\cdot1$ mW. Calculate the capacity of this channel. http://www.makaut.com   3 + 6 + 6

9. a) Prove that $f(X) = 1 + X + X^3$ is a primitive polynomial over GF (2).

b) What do you mean by minimal polynomial ? Find out the minimal polynomials over the field $GF(2^3)$. Given $P(X) = 1 + X + X^3$.

c) Determine the generator sequence of double error correcting $(n. k)$ BCH code over the field $GF(2^3)$. Evaluate n and k. Where, symbols have their usual meanings.   5 + 5 + 5

10. a) Analyse with proper diagram the encoding of a convolutional code.

b) Analyse Viterbi algorithm using Trellis diagram for error detection and error correction of convolutional code.

c) Consider a convolutional encoder having generator sequence g = (11001). Determine the output sequence for the input sequence u = (110101).

   4 + 5 + 6

11. Write short notes on any three of the following : 3 × 5

 a) Shortened & Extended Code

 b) Dual code

 c) Code Tree

 d) Turbo Code

 e) Reed-Solomon code.

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