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SEAT No. :

P3636

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APR-15/ENGG.-121

T.E. (E & TC) (In Sem - Semester - II)

**Information Theory & Coding Techniques
(2012 Pattern)**

Time : 1 Hour]

[Max. Marks : 30

Instructions to the candidates:

- 1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 5) *Assume suitable data, if necessary.*

Q1) a) A source generates four types of symbols A, B, C, D with probabilities 0.5, 0.25, 0.125 and 0.125 respectively **[6]**

- i) Using Huffman coding technique design source encoder.
 - ii) Find coding efficiency.
 - iii) If following message is generated by source, What will be output of the source encoder ABADCABA.
- b) What is Lempel-Ziv compression technique? Explain with suitable example. **[4]**

OR

Q2) a) What is mutual information? State and prove any one property of mutual information. **[4]**

- b) Find all entropies, mutual information of channel where channel matrix is given as

$$P(Y / X) = \begin{bmatrix} 0.7 & 0.3 \\ 0.3 & 0.7 \end{bmatrix}$$

Take $P(x_1) = 0.6$ and $P(x_2) = 0.4$.

[6]

P.T.O.

Q3) a) A voice grade telephone channel has a bandwidth 3400 Hz. If the signal-to-noise ratio is 30 dB; determine the capacity of the channel. If above channel is used to transmit data at a rate 48 kbps, What is minimum required SNR? [4]

b) For a (6, 3) linear block code, following generator matrix is used. [6]

$$G = \begin{bmatrix} 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 1 & 1 & 1 \end{bmatrix}$$

- i) Find error correction & detection capability of the code
- ii) Is this a perfect code? Justify.

OR

Q4) a) Prove that the capacity of noiseless channel is \log_2^m , where m is number of symbols generated by the source. [6]

b) State Shannon's second theorem. A Gaussian channel has a bandwidth of 1 MHz. Calculate capacity of channel if signal-to-noise power spectral density ratio is 10^5 Hz. [4]

Q5) a) Using generator polynomial $g(x) = x^3 + x + 1$ generate systematic cyclic code for following messages. [6]

i) 1011

ii) 1010

b) Using primitive polynomial $P(x) = x^3 + x + 1$, find all elements of $GF(2^3)$. [4]

OR

Q6) a) For a (7, 4) cyclic code, generator polynomial $g(x) = x^3 + x + 1$ is used. Draw the circuit for generating syndrome. Find syndrome for received code word 0011000. [6]

b) What is Galois field? Write properties finite field. [4]

