

**333652(33)**

**BE (6<sup>th</sup> Semester)  
Examination, Nov.-Dec., 2017**

**(New Scheme)**

**Information Theory and Coding**

*Time Allowed : 3 hours*

*Maximum Marks : 80*

*Minimum Pass Marks : 28*

**Note :** (i) Attempt all questions. Part (a) of each question is compulsory. Attempt any two parts from (b), (c) and (d) of each question. Assume suitable data if required.

(ii) The figures in the right-hand margin indicate marks.

1. (a) What is mutual information ? [2]  
 (b) What is information ? Explain the following terminology : [7]  
 (i) Self-information  
 (ii) Mutual information  
 (iii) Conditional self-information  
 (c) What is Shannon's concept of information and how the information is measured ? [7]

- (d) What is communication ? Explain with various communication models. [7]  
 2. (a) What is entropy ? [2]  
 (b) Consider the source  $X$  which generates 4 symbols with probabilities  $P(x_1)=0.5$ ,  $P(x_2)=0.3$ ,  $P(x_3)=0.1$  and  $P(x_4)=0.1$ . Calculate entropy for the source. [7]

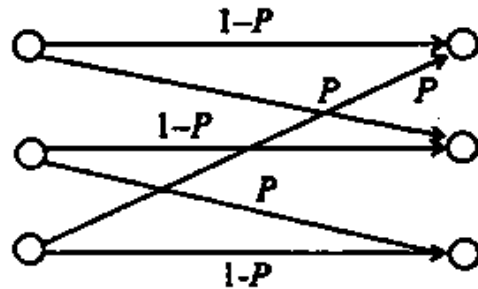
(c) Consider the source symbols and their respective probabilities listed below :

Symbol	Probability	Self-information	Codeword
$X_1$	0.50	1.00	1
$X_2$	0.30	1.7370	00
$X_3$	0.20	2.3219	01

Calculate the following : [7]

- (i) Entropy of the source  
 (ii) Average no. of binary digit per symbol  
 (iii) Efficiency of this code  
 (d) Consider discrete memory-less channels with 7 possible symbols  $x_i$ ,  $i = 1, 2, \dots, 7$  and the corresponding probability  $P(x_1)=0.37$ ,  $P(x_2)=0.33$ ,  $P(x_3)=0.16$ ,  $P(x_4)=0.07$ ,  $P(x_5)=0.04$ ,  $P(x_6)=0.02$ ,  $P(x_7)=0.01$ . Calculate codeword for this information. Also calculate entropy for this source. [7]  
 3. (a) Give equation for channel capacity. [2]  
 (b) Explain information capacity theorem. [7]

- (c) What is BSC ? Explain the various properties of mutual information. [3+4]
- (d) Determine the channel capacity of the channel shown in the figure below : [7]



4. (a) What is error ? http://www.csvtuonline.com [2]
- (b) Consider the following generator matrix :

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

- (i) Generate all possible codewords.
- (ii) Find parity check matrix.
- (iii) Find generator matrix of an equivalent systematic code. [7]
- (c) Show that if  $C$  is binary linear code, then the code obtained by adding an overall parity check bit to  $C$  is also linear. [7]

- (d) Show that  $C = \{0000, 1100, 0011, 1111\}$  is a linear code. What is the minimum distance ? [7]
5. (a) What is the role of cyclic code ? [2]
- (b) Consider the polynomial  
 $g(x) = x^6 + 3x^5 + x^4 + x^3 + 2x^2 + 2x + 1$   
 Find : [7]
- (i) Parity check matrix  $H$
- (ii) The minimal distance of this code
- (iii) The code rate of this code
- (c) What is Trellis coded modulation scheme ? [7]
- (d) Explain the working of turbo decoder. [7]

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