APJ ABDULKALAM TECHNOLOGICAL UNIVERSITY
08 PALAKKAD CLUSTER

Q. P. Code : CSP0817151A-J   (Pages: 3)   Name ....

Reg. No: ....

FIRST SEMESTER M.TECH. DEGREE EXAMINATION DECEMBER 2017

08EC 6251(A) INFORMATION THEORY

Branch: Electronics and Communication Engineering

Specialization: Communication Engineering and Signal Processing

Time:3 hours   Max.marks: 60

Answer all six questions.

Modules 1 to 6: Part 'a' if any of each question is compulsory and answer either part 'b' or part 'c' of each question.

Q.no.	Module 1	Marks
1.a	Define mutual information	
	Answer b or c	3
b	Consider a discrete memoryless source with source alphabet $S=\{S_0\,S_1\,S_2\}$ and statistics $\{0.7, 0.15, 0.15\}$.	6
	(i) Calculate the entropy of the source	
	(ii) Calculate the entropy of the second order extension of the source.	
C	Find the overall channel capacity of two binary symmetric channels connected in cascade. Assume that both channels have same transition probability.	6

Q.no.	Module 2	Marks
2.a	Mention the applications of Kraft's inequality.	3
	Answer b or c	
b	State and prove Kraft's inequality.	6
c	Find the Shannon-Fano Elias code for the source with statistics $\{0.25, 0.25, 0.2, 0.15, 0.15\}$	6

1

Q.no.	Module 3	Marks

3.a State and prove Shanon's source coding theorem.   3

Answer b or c

b Explain the steps of arithmetic coding with an example.   6

c Compute the Huffman for the source with statistics {0.25, 0.25, 0.125, 0.125, 0.125, 0.0625,0.625}. Find the average code word length and efficiency of the source code.   6

Q.no.	Module 4	Marks

4.a Define channel capacity and explain its properties.   3

Answer b or c

b Find the capacity of the channel with channel matrix   6

$$P = \begin{bmatrix} p & p & 0 & 0 \\ p & p & 0 & 0 \\ 0 & 0 & p & p \\ 0 & 0 & p & p \end{bmatrix}$$

c Find the capacity of the channel with channel matrix and plot it as function of p 6

$$P = \begin{bmatrix} 1 & 0 & 0 \\ 0 & p & p \\ 0 & p & p \end{bmatrix}$$

Q.no.	Module 5	Marks

5.a Show the relation between the differential entropy and discrete entropy.   4

2

8

b Compute the differential entropy of normal distribution.

8

c Consider the continuous random variable Y defined by $Y = X + N$, where X and Y are statistically independent. Show that the conditional differential entropy of Y given X equals,

$$h(Y|X) = h(N)$$

where h(N) is the differential entropy of N.

Q.no.	Module 6	Marks

4

6.a Define Rate distortion function and explain its properties.

Answer b or c

8

b A voice grade channel of the telephone network has bandwidth of 3.4kHz.

(i) Calculate the information capacity of the telephone channel for a signal-to-noise ratio of 30dB.

(ii) Calculate the minimum signal to noise ratio required to support information transmission through the telephone channel at the rate of 9,600 b/s.

c

8

Compute the rate distortion function for a binary source.

3