Roll No .....

MCIT - 101

M.E./M.Tech., I Semester

Examination, June 2014

Mathematical Foundation for IT

Time : Three Hours

Maximum Marks : 70

Note : Attempt any five questions. All questions carry equal marks.

1. a) Show that mutual information of a channel is symmetric.
   b) Explain Shannon's concept of information and Shannon's measures of information.

2. a) Write short notes on:
      i) Block codes
      ii) Tree codes
      iii) Hamming codes
   b) Explain information capacity theorem.

3. a) Describe the concept of a fuzzy sets.
   b) Let A, B be fuzzy sets defined on a universal set x, the prove that $|A|+|B|=|A\cup B|+|A\cap B|$.

4. a) Explain fuzzy ordering relations.
   b) Let $f: x \to y$ be any arbitrary crisp function. Then, for any $A_i \in F(x)$ and any $B_i \in F(y)$, $i \in I$ show that the following properties of functions obtained by the extension principle hold:
      i) $A_1 \subseteq A_2$, then $f(A_1) \subseteq f(A_2)$
      ii) $f\left(\bigcup_{i\in I} A_i\right) = \bigcup_{i\in I} f(A_i)$

5. a) Find P(A/B) if
      i) $A \cap B = \phi$
      ii) $A \subset B$
      iii) $B \subset A$
   b) Two cards are drawn at random from a deck. Find the probability that both are aces.

6. a) A continuous random variable x having values only between 0 and 4 has a density function given by $p(x)=\frac{1}{2}-ax$, where a is a constant.
      i) Calculate a.
      ii) Find Pr {1 < x < 2}
   b) Find (a) $E(x)$, (b) $E(x^2)$, (c) $E\left[\left(x-x^{-2}\right)\right]$ for the probability distribution shown in following table

x	8	12	16	20	24
$P(x)$	1/8	1/6	3/8	1/4	1/12

7. a) Calculate the 4 point DFT of F [n] = {1, 1, 0, 0}.
   b) State and prove Parseval's theorem for the DFT.

8. a) Use 4-point Fast Fourier transform to compute DFT of the periodic discrete time signal with period 4 given by $f[-1] = 2, f[0] = i, f[1] = 1, f[2] = i$.
   b) Explain wavelet transform.

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