

**MCIT-101**  
**M. E./M. Tech. (First Semester)**  
**EXAMINATION, June, 2012**  
**(Grading/Non-Grading)**

**MATHEMATICAL FOUNDATIONS FOR IT**  
**(MCIT-101)**

*Time : Three Hours*

*Maximum Marks :  $\begin{cases} GS : 70 \\ NGS : 100 \end{cases}$*

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

1. (a) A source emits an independent sequence of symbols from an alphabet consisting of five symbols  $A, B, C, D$  and  $E$  with symbol probability  $\frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \frac{1}{16}, \frac{1}{16}$  respectively. Find the entropy of the source.
- (b) In a message conveyed through long sequence of dots and dashes, the probability of occurrence of dash is one third of that of a dot. Calculate the information.
2. (a) The generator material for a  $(6, 3)$  block code is given. Find all code vectors of this code :
 
$$G = \begin{bmatrix} 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 & 1 & 0 \end{bmatrix}.$$
- (b) The generator polynomial of a  $(7, 4)$  cyclic code is  $g(x) = 1 + x + x^2$ . Find all the code words of this code.
3. (a) If  $X = \{x, y, z, +\}$  be universal set and :
 
$$A = \{(x, 0.4), (y, 0.6), (z, 0.2), (+, 0)\}$$
 and
 
$$B = \{(x, 0.7), (y, 0), (z, 0.4), (+, 0.3)\}$$
 are two fuzzy subsets of  $X$ , find  $A \cup B$ .
- (b) Define all standard operations on a fuzzy set.
4. (a) Write short notes on the following :
  - (i) Discrete Fourier transform
  - (ii) Fast Fourier transform.
- (b) Solve the initial value problem :
 
$$\frac{dy}{dx} = \frac{y-x}{y+x}, \quad y(0) = 1$$
 for  $x = 0.1$  by Euler's method.
5. (a) Apply the fourth order Runge-Kutta method to solve :
 
$$\frac{dy}{dx} = x^2 + y^2, \quad y(0) = 1$$
 taking step size  $h = 0.1$  and determine approximations to  $y(0.1)$  and  $y(0.2)$ , correct to four decimal places.
- (b) Write a note on Wavelet Transform and its applications.

6. (a) A fair coin is tossed four times. Find the probability that they are all heads if the first two tosses results in head.
- (b) Find the mean and variance of the binomial distribution.
7. (a) Find the probability that at most 5 defective diodes will be found in a pack of 600 diodes, if previous data shows that 3% of such diodes are defective.
- (b) State and prove Baye's theorem for probability.
8. (a) Define the following ;
  - (i) Hamming Codes
  - (ii) Block Codes.
- (b) A problem in mathematics is given to three students, whose chances of solving the problem are  $\frac{1}{2}, \frac{1}{3}, \frac{1}{4}$ . What is the probability that the problem is solved ?

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