MCSE/MSE - 101
M.E./M.Tech., I Semester
Examination, June 2014
Advanced Computational Mathematics

Time : Three Hours

Maximum Marks : 70

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

1. a) Show that the mapping $T : R^2 \rightarrow R^3$ defined by $T(x, y) = (x-y, y-x, -x) \forall x, y \in R$ is a linear transformation from R^2 into R^3.

   b) Define orthogonality of hermite polynomial and prove that: $H_{n+1}(x) = 2x H_n(x) - 2n H_{n-1}(x)$

2. a) Define the following terms:
      i) Wavelet transform   ii) Haar transform

   b) Solve the heat equation by the method of separation of variable.

3. a) Find mean and standard deviation of Poisson distribution.

   b) The mean height of 500 students is 151 cms and standard deviation 15 cms. Assuming that the heights are normally distributed find the number of student whose heights lies between 120 and 155 cms. given that area between [z = 0 to z = 2.07 is 0.4808 and z = 0 to z = 0.27 is 0.1064.]

4. a) In a railway marshalling yard, goods trains arrive at a rate of 30 trains per day. Assuming that the inter arrival time follows an exponential distribution and the service time distribution is also exponential with an average 36 mins calculate

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   i) The average number of trains in the queue.

   ii) The probability that the queue size exceeds 10.

   b) Define the following:
      i) Markov process
      ii) Transition probability
      iii) Transition diagram
      iv) State transition matrix

5. a) Define fuzzy sets and prove that every fuzzy complement has at most one equilibrium.

   b) What is MATLAB? How it is better than other programming languages.

6. a) Define the following terms:
      i) α-cut and strong α-cut
      ii) Extension principal and fuzzy relation

   b) Obtain the steady state difference equation for the queuing model (M/M/1) : (N/FCFS).

7. a) Find the Fourier sine transform of e^{-x} hence show that

   $$\int \frac{x \sin mx}{1+x^2} dx = \frac{\pi e^{-m}}{2}$$

   b) Define subspace with example. Give necessary and sufficient condition for a subset to be a subspace.

8. a) A coin was tossed 400 times and the head turned up 316 times. Test the hypothesis that the coin is unbiased.

   b) Explain with the help of examples, the application of M-files, script files and function files in MATLAB.

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