Roll No...........................................

# MCSE/MSE-101

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

Examination, December 2017

### Advanced Computational Mathematics

*Time : Three Hours*

*Maximum Marks : 70*

*Note:* i) Answer any five questions out of eight questions.

ii) All questions carry equal marks.

1. a) Show that the vector $(1, 2, 0)$, $(0, 3, 1)$, $(-1, 0, 1)$ forms linearly independent set over the field R.

   b) Find the matrix of the linear transformation

   $T : v_3(R) \to v_3(R)$ given by

   $T(x, y, z) = (2y + z, x - 4y, 3x)$

2. a) Write a short note on the followings :

   i) Hash function

   ii) Error function

   b) Prove the following formula for Hermite polynomial.

   $$H_n(x) = (-1)^n e^{x^2} \frac{d^n}{dx^n}\left\{\exp(-x^2)\right\}$$

3. a) Solve $\dfrac{\partial u}{\partial x} = 2\dfrac{\partial u}{\partial t} + u$ by the method of separation of variables, where $u(x, 0) = 6e^{-3x}$.

   b) Solve the elliptic equation $u_{xx} + u_{yy} = 0$ for the following square mesh with boundary values as shown :



4. a) Find Fourier sine transform of $\dfrac{e^{-ax}}{x}$

   b) Solve the equation $\nabla^2 u = -10\left(x^2 + y^2 + 10\right)$ over the square with sides $x = 0 = y$, $x = 3 = y$ with $u = 0$ on the boundary and mesh length = 1.

5. a) A random variable X has following distribution :

   | $x$ | $-2$ | $-1$ | 0 | 1 | 2 |
   |------|------|------|------|------|------|
   | $p(x)$ | 0.2 | 0.1 | 0.3 | 0.3 | 0.1 |

   Find :

   i) E(X)

   ii) Var (X)

b) Two cards are drawn successively, with replacement, from a well shuffled pack of 52 cards. Find the probability distribution of the number of kings.

6. a) Assuming one in 80 births is a case of twins. Calculate the probability of 2 or more case of twins on a day when 30 births occur.

b) Write a short note on the followings:

    i) Point estimate

    ii) Interval estimate

    iii) Hypothesis testing

    iv) Sampling distribution

7. a) In a railway yard, goods train arrive at a rate of 30 trains per day. Assuming that inter-arrival time follows an exponential distribution and the service time (the time taken to hump a train) distribution is also exponential with an average 36 minutes. Calculate the followings.

    i) The average number of train in a queue

    ii) The probability that the queue size exceeds 10.

b) If the arrivals are completely random, prove that number of arrivals in a fixed time interval follows a Poisson distribution.

8. Write a short note on the followings:

    i) MATLAB and areas of its application

    ii) Nested functions in MATLAB

    iii) Fuzzy sets Vs Crisp sets

    iv) Operations of fuzzy sets.

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