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## MCSE/MSE-101

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

Examination, December 2020

### Advanced Computational Mathematics

Time : Three Hours

Maximum Marks : 70

**Note:** i) Attempt any five questions.

ii) All questions carry equal marks.

1. a) Verify that  $T(x, y, z) = (x - y + 2z, 2x + y, x - 2y + 2z)$  is a linear transformation or not. 7  
b) Examine whether the set of vectors  $\bar{a}_1 = (3, 0, 2, 2)$ ,  $\bar{a}_2 = (-6, 42, 24, 54)$  and  $\bar{a}_3 = (21, -21, 0, -15)$  are linearly dependent or independent vector. 7
2. Solve the Poisson's equation  $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = -10(x^2 + y^2 + 10)$  over the square with sides  $x=0=y$ ,  $x=3=y$  with  $u(x, y) = 0$  on the boundary and mesh length = 1. 14
3. a) The probability distribution of a random variable X is given below : 7  

X :	-2	-1	0	1	2
P(X) :	0.2	0.1	0.3	0.3	0.1

Find

  - i)  $E(x)$
  - ii)  $\text{Var}(x)$
  - iii)  $E(2X - 3)$
  - iv)  $\text{Var}(2X - 3)$

b) Find the mean and variance of Poisson's distribution. 7

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4. a) In a normal distribution, 7% of the items are under 35 and 89% are under 63. Determine the mean and variance of the distribution. 7
- b) A random sample of size 100 has a standard deviation of 5. What can you say about the maximum error with 95% confidence? 7
5. a) Define the following : 7
- i) The input or arrival pattern
- ii) Queue discipline
- b) A self service store employs one cashier at its counter. Eight customers arrive on an average every 5 minutes. Assuming Poisson distribution for arrival rate and exponential distribution for services, find 7
- i) Average number of customers in the system.
- ii) Average length of the queue.
- iii) Average waiting time in the system.
6. a) Draw the graph for the Markov chain with the following transition probability matrix. 7
- $$\begin{bmatrix} 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 \\ \frac{1}{2} & \frac{1}{2} & 0 & 0 \\ 0 & 0 & 1 & 0 \end{bmatrix}$$
- b) Three boys A, B and C are throwing a ball to each other. A always throws the ball to B and B always throws the ball to C, but C is just as likely to throw the ball to B as to A. Show that the process is Markovian. Find the transition matrix and classify the states. Do all the states are ergodic? 7

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7. a) What is MATLAB programming? Give its features and discuss the applications of MATLAB. 7
- b) Define Fuzzy sets and Fuzzy logic. Define fuzzy set operation with example. 7
8. Write a short note on the followings :
- a) Linear transformation 3
- b) Sampling distribution 4
- c) Point estimation 3
- d) Interval estimation 4

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