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Roll No.....

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 $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = -10\left(x^2 + y^2 + 10\right)$ 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) Var(*x*)

   iii) E(2X – 3) iv) Var(2X – 3)

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

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 employees 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

$$\begin{bmatrix} 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 \\ 1/2 & 1/2 & 0 & 0 \\ 0 & 0 & 1 & 0 \end{bmatrix}$$

   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

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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