Roll No ....

MEDC/MEVD/MEIC/MEPE/MEHP/ MEPS/MTPS/MTPA-101

M.E./M.Tech., I Semester
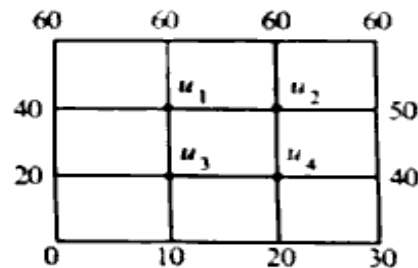
Examination, June 2023

Advanced Mathematics

Time : Three Hours

Maximum Marks : 70

Note: i) Attempt any five questions.

ii) All questions carry equal marks.

1. a) Solve $\dfrac{\partial^2 z}{\partial x^2} - 2\dfrac{\partial z}{\partial x} + \dfrac{\partial z}{\partial y} = 0$, by the method of separation of variables.

   b) Solve the elliptic equation $\dfrac{\partial^2 u}{\partial x^2} + \dfrac{\partial^2 u}{\partial y^2} = 0$; for the square mesh with boundary values as shown in figure

2. a) Solve the Poisson's equations

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

   over the square with sides $x = y = 0$, $x = y = 3$ with $u(x, y) = 0$ on the boundary and mesh length = 1.

   b) Find the Fourier complex transform of

$$f(x) = \begin{cases} x^2, & |x| < a \\ 0, & |x| > a \end{cases}$$

3. a) Find the mean and variance of the Poisson distribution.

   b) Six dice are thrown 729 times. How many times do you expect at least three dice to show a five or six?

4. a) Fit Poisson's distribution to the following and calculate theoretical frequencies $\left[e^{-0.5} = 0.61\right]$

Deaths :	0	1	2	3	4
Frequency :	122	60	15	2	1

   b) Assume the mean height of soldiers to be 68.22 inches with a variance of 10.8 (in)^2. How many soldiers in a regiment of 1000 would you expect to be over 6 feet tall? Given that the area under the standard normal curve between $t = 0$ and $t = 0.35$ is 0.1368 and between $t = 0$ and $t = 1.15$ is 0.3746.

5. a) Write a note on stochastic process.
   b) Draw the transition graph for the Markov Chain with the following transition probability matrix

$$\begin{bmatrix} 0.6 & 0.3 & 0.1 \\ 0.8 & 0.2 & 0 \\ 1 & 0 & 0 \end{bmatrix}$$

6. a) Find the long-range trend for the Markov Chain

$$\begin{bmatrix} 0.65 & 0.28 & 0.07 \\ 0.15 & 0.67 & 0.18 \\ 0.12 & 0.36 & 0.52 \end{bmatrix}$$

   b) Define single server queuing model - I :
   (M/M/1) : (∞/∞/FCFS)

7. a) Define fuzzy logic and its characteristics.
   b) Define following for MATLAB.
      i) Command Window
      ii) Command History

8. a) Write a note on reliability.
   b) Write a note on concepts of fault tolerant analysis.

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