

Roll No. ....

**MEIC/MEPE/MEHP/MEPS/MTPS/  
MEDC/MEMT/MEVD-101**

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

Examination, November 2019

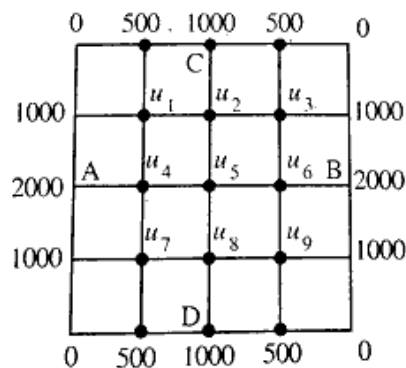
**Advanced Mathematics**

*Time : Three Hours*

*Maximum Marks : 70*

- Note:** i) Attempt any five questions.  
ii) All questions carry equal marks.

1. a) Solve  $\frac{\partial u}{\partial x} = 2\frac{\partial u}{\partial t} + u$  by the method of separation of variables, where  $u(x, 0) = 6e^{-3x}$ .
- b) Solve the elliptic equation  $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ , for the following square mesh with boundary values as shown below.



2. a) Find the Fourier cosine transform of the function  $f(x)$ , if

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

- b) Compute the 8-point DFT of the signal  $S(n) = \{1, 1, 1, 1, 1, 1, 0, 0\}$ . Also, sketch its magnitude and phase.
3. a) What is the chance that a leap year, selected at random will contain 53 Sunday?  
b) Find the mean and variance of the Poisson distribution.
4. a) Assuming that half the population are consumers of chocolate, so that the chance, of an individual being a consumer is  $\frac{1}{2}$  and assuming that 100 investigators each take 10 individuals to see whether they are consumers, how many investigators would you expect to report that three people or less were consumers.  
b) Assume the mean height of soldiers to be 68.22 inches with a variance of 10.8 (in)<sup>2</sup>. 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) Draw the transition graph for the following transition matrix:

$$\begin{bmatrix} 0 & 0.5 & 0.5 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 \\ 0.5 & 0 & 0 & 0.5 \end{bmatrix}$$

- b) Find the long-range trend for the Markov chain:

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

6. a) Write a note on Multi-server queuing model.  
b) In a service department manned by one server, on an average one customer arrives every 10 minutes. It has been found out that each customer requires 6 minutes to be served, find out
- i) Average queue length
  - ii) Average time spent in the system
  - iii) The probability that there would be two customers in the queue
7. a) Write a note on fuzzy logic and its applications.  
b) Write a note on MATLAB and its applications.
8. a) Write the derivation of reliability functions.  
b) Write a note on decision theory.

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