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Roll No :

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

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

Examination, November 2018

Advanced Mathematics

Time : Three Hours

Maximum Marks : 70

Note: *i)* Attempt any five questions.

ii) All questions carry equal marks.

1. a) Find the temperature in a rod (length l and conductivity k) which is at a uniform temperature of 50°C. Suddenly at $t = 0$, the end $x = 0$ is cooled to 0°C by an application of ice and the end $x = l$ is heated to 100°C by an application of steam, and these two temperatures are maintained at ends. Furthermore, the rod is insulated along its length so that no transfer of heat can occur from the sides.

b) Solve the boundary value problem $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ under the conditions $u(0,t) = u(1,t) = 0$ and

$u(x,0) = \sin \pi x,\ 0 \le x \le 1$ taking $h = 0.2$ and $k = 0.02$.

2. a) Write short notes on the following

i) Discrete Fourier transform

ii) Wavelet transform

iii) Haar transform

b) 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 $x = 0, x = 3 = y$ with $u(x,y) = 0$ on the boundary and mesh length = 1

3. a) In 1,000 extensive sets of trials for an event of small probability the frequencies f of the number x of successes are found to be

x	0	1	2	3	4	5	6	7
f	305	365	210	82	28	9	2	1

Assuming it to be a Poissonian distribution, calculate its mean, variance and expected frequencies for the poissonian distribution with same mean.

b) Solve the recurrence relation

$a_r = a_{r-1} + a_{r-2}$, given $a_0 = 1, a_1 = 1$

4. a) Explain the following with example

i) Testing of hypothesis

ii) Theory of estimation

iii) Errors of first and second kind

b) Suppose there are two market products of brands A and B respectively. Let each of these two brands have exactly 50% of the total market in same period and let the market be of a fixed size. The transition matrix is given below

From \ To	A	B
A	0.9	0.1
B	0.5	0.5

If the initial market share breakdown is 50% for each brand, then determine their market share in the steady state.

5. a) What is queueing problem? Explain some basic characteristics of a queueing system. What are some of the important assumptions of queueing 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.

6. a) Define the following term's giving example.

      i) Support of fuzzy set

      ii) Complement of a fuzzy set

      iii) Union of two fuzzy sets

      iv) Intersection of two fuzzy sets.

b) If $P = \begin{bmatrix} 0.1 & 0.5 \\ 0.6 & 0.9 \end{bmatrix}$, $Q = \begin{bmatrix} 0.3 & 0.6 & 0.8 \\ 0.7 & 0.5 & 0.4 \end{bmatrix}$

Then find the relation R = POQ

7. a) What is matlab programming? Explain different types of loop in MATLAB with their syntax.

   b) Write short notes on the following

      i) Decision theory

      ii) Goal programming

8. a) The time till failure of a part, T years has probability density function $f(t) = kt^{-4}(t > 1)$ and is zero elsewhere, where k is a constant.

      i) Find the value of k

      ii) Find the mean time till failure

      iii) Find the failure rate.

   b) Define Reliability. Explain the importance of reliability. What are the basic elements of reliability? Discuss in brief.

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