Roll No ....

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

M.E/M.Tech. I Semester

Examination, June 2017

Advanced Mathematics

Time : Three Hours

Maximum Marks : 70

Note: i) Attempt any five questions.

ii) All questions carry equal marks.

1. a) 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 $h = 1$.

b) Find the solution of one dimensional heat equation by variable separable method.

2. a) A die was thrown 9000 times and throw of 5 or 6 was obtained 3240 times. On assumption of random throwing, do the data indicate an unbiased die?

b) Show that the mean deviation from the mean of normal distribution is $\frac{4}{5}$ of standard deviation.

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3. a) Obtain the steady state difference equation for the queuing model

(M / M / 1) : (∞ / FCFS)

b) Consider the following Markov chain $P = \begin{pmatrix} 0.2 & 0.4 \\ 0.6 & 0.4 \end{pmatrix}$

Determine $\alpha^{(1)}$, $\alpha^{(4)}$ given that $\alpha^{(0)} = (0.7, 0.3)$

4. a) Let A, B be fuzzy sets defined on a universal set X. Prove that

$$|A| + |B| = |A \cup B| + |A \cap B|$$

b) Define fuzzy set. If :

A = {(1, 0.2), (2, 0.5), (3, 0.8), (4, 1), (5, 0.7), (6, 0.3)}

be a fuzzy set, then find the α cut for $\alpha = 0.2, 0.5, 0.8, 1$ and strong α cut for $\alpha = 0.8$

5. a) Define failure rate and failure rate distribution.

b) The density function of time to failure of an appliance is:

$$f(t) = \frac{4}{(t+2)^3}$$ t > 0 is in years find:

i) The reliability function R(t)

ii) The failure rate $\lambda(t)$

iii) The MTTF

6. a) Explain the following with properties:

i) Wavelet transform

ii) Haar transform

b) A component has the reliability function given by

$$R(t) = 1 - \frac{t^2}{a^2} \text{ for } 0 \le t \le a \text{ Where } a \text{ is a parameter of}$$

distribution representing the components maximum life. Then find:

i) Probability density function

ii) Mean time to failure

iii) Average failure rate

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

b) Arrivals at telephone booth are considered to be Poisson with an average time of 10 minutes between one arrival and the next. The length of the phone call is assumed to be distributed exponentially with mean 3 minutes:

i) What is the probability that a person arriving at the booth will have to wait in the queue?

ii) What is the average length of the queue that forms time to time?

8. Define each of the following:

a) Theory of testing hypothesis

b) Theory of estimators

c) Goal programming

d) Hazard rate

e) Matrix of transition Probabilities.

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