MEIC/MEDC/MEHP/MEMT/MEPS/ MEPE/MEVD–101

M. E./M. Tech. (First Semester)
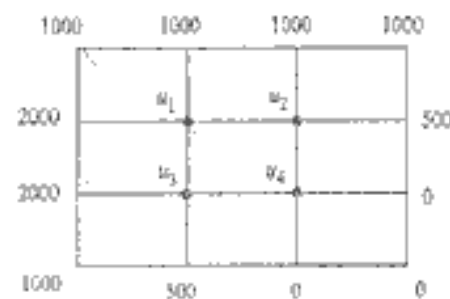### EXAMINATION, Dec., 2010
ADVANCED MATHEMATICS

Time : Three Hours

Maximum Marks : 100

Minimum Pass Marks : 40

Note : Attempt any *five* questions. All questions carry equal marks.

1. (a) Solve the elliptic equation $u_{xx} + u_{yy} = 0$ for the following square mesh with boundary values as shown :

(b) Solve the heat equation $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ subject to the initial condition $u = \sin \pi x$ at $t = 0$ for $0 \le x \le 1$ and $u = 0$ at $x = 0$ and $x = 1$ for $t > 0$ by Gauss-Seidel iterative method.

2. (a) Use the method of separation of variables to solve the equation :

$$\frac{\partial^2 u}{\partial x^2} = \frac{\partial u}{\partial t}$$

Given that $u = 0$ when $t \to \infty$ as well as $u = 0$ at $x = 0$ and $x = l$.

(b) A random variable X has the probability function :

X	$P(X = x) = p(x)$
0	a
1	$3a$
2	$5a$
3	$7a$
4	$9a$
5	$11a$
6	$13a$
7	$15a$
8	$17a$

(i) Determine the value of a.

(ii) Find $P(X > 2)$, $P(X \ge 6)$, $P(3 < X < 5)$.

3. (a) A person throws two dice, one the common cube and other a regular tetrahedron, the number on the lowest face being taken in the case of tetrahedron. Find the chances of throwing 6 and 10.

(b) A manufacturer of cotter pins knows that 5% of his product is defective. Pins are sold in boxes of 100. He guarantees that not more than 10 pins will be defective. Determine the probability that a box will fail to meet the guarantee.

4. (a) Define stochastic processes and explain classification of stochastic process.

(b) Derive the difference equations for the queuing model $(M/M/1):(\infty/FCFS)$.

(a) Let :

$$S = \begin{matrix} & & A & B & C \\ & A & \\ & B & \\ & C & \end{matrix} \begin{bmatrix} 0\cdot2 & 0\cdot3 & 0\cdot5 \\ 0\cdot4 & 0\cdot4 & 0\cdot2 \\ 0\cdot4 & 0\cdot6 & 0 \end{bmatrix}$$

is a transition matrix. Give the transition matrix for three steps and four steps.

(b) In a railway marshalling yard, goods trains arrive at a rate of 30 trains per day. Assuming that the inter-arrival time follows an exponential distribution and the service time distribution is also exponential with an average of 36 minutes, calculate :

(i) Expected queue size (line length).

(ii) Probability that the queue size exceeds 10.

6. (a) Define the following terms giving examples :

(i) α-cut of fuzzy set

(ii) Union of two fuzzy sets

(iii) Intersection of two fuzzy sets

(iv) Normal fuzzy set

(b) Describe fuzz if then rule and composition rule of inference for a fuzzy system.

7. (a) Differentiate between DFT and FFT MATLAB tools for wavelet transform.

(b) Variables a, b, c and d have been intialized to the following values : $a = 2, b = 3, c = 4, d = 3$. Evaluate the following MATLAB Assignments :

(i) $a*b+c*d$

(ii) $a*b*d$

(iii) $a*b+b*d$

(iv) $a*b+c*d*a$

8. (a) Write short notes on the following :

(i) Reliability

(ii) Failure rate

(iii) Decision theory

(iv) Goal programming

(b) The failure rate of a certain component is $h(t) = \lambda_0 t, \lambda_0 > 0$ is a given constant.

Determine the reliability $R(t)$ of the component. Repeat for $h(t) = \lambda_0 t^{1/2}$.

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