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MCSE/MSE - 101

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

Examination, June 2016

Advanced Computational Mathematics

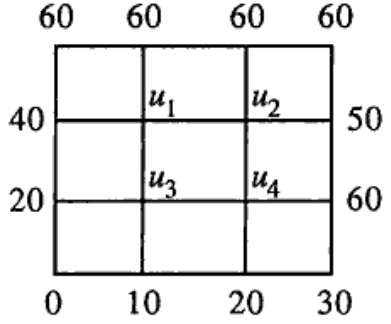
Time : Three Hours

Maximum Marks : 70

Note : i) Attempt any five questions out of Eight.
ii) All questions carry equal marks.

1. Show that the mapping $T : R^2 \to R^3$ defined by
$T(a, b) = (a - b, b - a, -a)\ \forall a, b \in R$
is a linear transformation from R^2 in to R^3. Find the range, rank, null space and nullity of T.

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



3. a) Show that the vectors (2, 1, 4), (1, –1, 2), (3, 1, –2) form a basis of R^3.

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b) Draw the graph for the marker chain with the following transition probability matrix.

$$\begin{bmatrix} 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 \\ y_2 & y_2 & 0 & 0 \\ 0 & 0 & 1 & 0 \end{bmatrix}_{4\times4}$$

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

5. a) In a sample of 600 men from a certain city, 450 are found to be smokers. In another sample of 900 men from another city, 450 are smokers. Do the data indicate that cities are significantly different with respect to the habit of smoking among men?

   b) Find the student's '*t*' for the following variable values in a sample of eight :

   –4, –2, –2, 0, 2, 2, 3, 3

6. a) Assume the mean height of soldiers to be 68.22 inches with a variance of 10.8cm^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 z = 0 and z = 0.35 is 0.1368, and between z = 0 and z = 1.15 is 0.3746].

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b) Find the probability that at most 5 defective fuses will be found in a box of 200 fuses, if experience shows that 2 percent of such fuses are defective.

7. a) What do you understand by a Marker chain. Give suitable examples.

   b) In a service department manned by one server, on an average one customer arrives every 10 minutes. It has been found 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.

8. a) What is MATLAB programming? Write its features. Also, discuss in detail, the applications of MATLAB.

   b) Define the following terms giving examples.

   i) Support of a fuzzy set

   ii) Complement of a fuzzy set

   iii) Union of two fuzzy sets

   iv) Intersection of two fuzzy sets

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