

ADVANCED COMPUTATIONAL MATHEMATICS

Time : Three Hours

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Maximum Marks : 100

Minimum Pass Marks : 40

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

1. (a) Define geometrical type curves from the second order partial differential equation in two independent variables x, y . Give their physical examples. Find the solution of the equation :

$$\nabla^2 u = -10(x^2 + y^2 + 10)$$

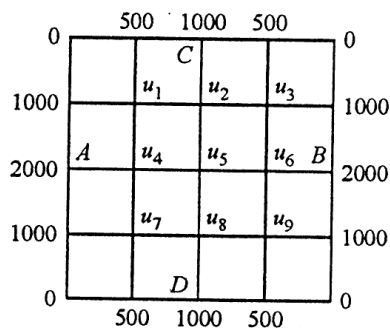
over the square mesh with sides $x = 0, y = 0, x = 3, y = 3$ with $u = 0$ on the boundary and mesh length = 1.

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

2. (a) Find Fourier sine transform of :

$$\frac{e^{-ax}}{x}$$

- (b) Solve the elliptic equation $u_{xx} + u_{yy} = 0$ for the ahead square mesh with boundary values as shown :



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3. (a) If the variance of the Poisson distribution is 2, find the probabilities for $r = 1, 2, 3, 4$ from the recurrence relation of the Poisson distribution. Also find $P(x \geq 4)$.
- (b) In a bombing action, there is 50% chance that any bomb will strike the target. Two direct hits are needed to destroy the target completely. How many bombs are required to be dropped to give a 99% chance or better of completely destroying the target ?
4. (a) Explain the Goal programming model formulation and state the difference between linear programming and Goal programming.

- (b) Obtain the steady state difference equation for the queuing model $((M/M/1) : (N/FCFS))$ and show that :

$$P_n = \frac{(1-\rho)}{1-\rho^{N+1}} \rho^n; 0 \leq n \leq N.$$

5. (a) 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 :
- expected queue size (line length)
 - probability that the queue size exceeds.
- (b) "The Markov chain method analyses the current behaviour of a process and relates the existing characters to the future." Describe this statement by taking an example from functional area of marketing.
6. (a) Show that the following operation on fuzzy sets satisfy De Morgan's laws :

$$U_{\max}, I_{\min}, C(a) = (1-a).$$

- (b) How Fuzzy tool box works ? Explain different functions which MATLAB provides in Fuzzy tool box.
7. (a) What are the three primary windows in MATLAB and write their purpose.
- (b) Write the MATLAB statements required to calculate $y(t)$ from the equation :

$$y(t) = \begin{cases} -3t^2 + 5 & , t \geq 0 \\ 5t + 2 & , t < 0 \end{cases}$$

for values of t between -9 and 9 in step of 0.5 .

8. Write short notes on any four of the following :

- Mother wavelet
- Discrete Fourier transform
- Reliability
- Fault tolerant analysis
- Decision theory
- Sampling distribution.

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