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

M. E./M. Tech. (First Semester)

EXAMINATION, June, 2011

(Grading/Non-Grading)

ADVANCED MATHEMATICS

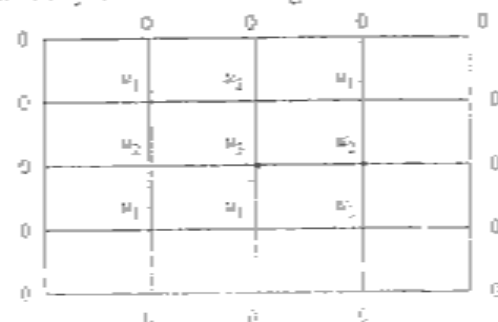
Time : Three Hours

Maximum Marks :  $\begin{cases} GS : 70 \\ NGS : 100 \end{cases}$ 

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

Q. (a) Solve the boundary value problem  $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$  under the condition  $u(0, t) = u(1, t) = 0$  and  $u(x, 0) = \sin \pi x$ ,  $0 \leq x \leq 1$ , taking  $h = 0.2$  and  $k = 0.02$  using Schmidt method.

(b) Discuss the solution of Poisson equation. Solve the partial differential equation  $u_{xx} + u_{yy} = 8x^2y^2$  for the square mesh of the following fig with  $u(x, y) = 0$  on the boundary and mesh length = 1



P. T. O.

2. (a) Find the solution of  $\frac{\partial^2 u}{\partial x^2} = h^2 \frac{\partial u}{\partial t}$  for which  $u(0, t) = u(1, t) = 0$ ,  $u(x, 0) = \frac{\sin \pi x}{1}$  by method of variable separation.

(b) Find the solution of two-dimensional heat equation.

3. (a) In a sample of 1000 cases the mean of certain test is 14 and  $\sigma = 2.5$ . Assuming the distribution to be normal. Then find :

(i) How many students score between 12 and 15 ?

(ii) How many score above 18 ?

(iii) How many score below 8 ?

(iv) How many score 16 ?

(b) If the probability of committing an error of magnitude  $x$  is given by :

$$y = \frac{h}{\sqrt{\pi}} e^{-h^2 x^2}$$

compute the probable error from the following data :

$$m_1 = 1.305, m_3 = 1.295, m_5 = 1.318$$

$$m_2 = 1.301, m_4 = 1.286, m_6 = 1.321$$

4. (a) Obtain the steady state solution of the queuing model (M/M/1) : (N/FCFS).

(b) Patients arrive at a clinic according to a Poisson distribution at the rate of 30 patients per hour. The waiting room does not accommodate more than 14 patients. Examination time per patient is exponential with mean rate 20 per hour :

(i) Find the effective arrival rate at the clinic.

(ii) What is the expected waiting time until a patient is discharged from a clinic ?

5. (a) Discuss the queuing model (M/M/S) : (N/FCFS).  
 (b) At a service centre customers arrive at the rate of 10 per hour and are served at the rate of 15 per hour. Their arrival follows Poisson distribution and service is exponentially distributed. Find the average length and average waiting time in the system.

6. (a) Define cardinality of a fuzzy set. And show that for any two fuzzy sets :

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

- (b) What are the three primary windows in MATLAB and write their purpose ?

7. (a) 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  $0.5$ .

- (b) Define the standard operations on fuzzy sets and show that for any two fuzzy sets A and B of X –

$$(A \cap B)' = A' \cup B'$$

8. (a) Define gamma model and find time to failure  $f(t)$ , probability of failure  $F(t)$ , probability of working reliability  $R(t)$  and mean time to failure MTTF.

- (b) The time to failure density function (PDF) for a system is :

$$f(t) = 0.01 ; 0 \leq t \leq 100 \text{ days}$$

Find :

- (i)  $R(t)$
- (ii) The hazard rate function
- (iii) The MTTF
- (iv) The standard deviation
- (v) The median time to failure