

3. a) Write a note on reliability and its failure rate. 7
- b) The mean time to failure of a particular type of component is 800 h. What is the probability that a similar component will fail in an operating time of 7
- i) 200 h,
 ii) 400 h,
 iii) 800 h and
 iv) 1000 h

Roll No

**MEDC/MEIC/MEHP/MEPS/MENT/
 MEPE/MEVD/MTPA/MTPS-101**

M.E/M.Tech., I Semester

Examination, July 2015

Advanced Mathematics

Time : Three Hours

Maximum Marks : 70

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

1. a) Using the method of separation of variables solve

$$\frac{\partial^2 u}{\partial x^2} = \frac{\partial u}{\partial t}, \text{ given that } u = 0, \text{ when } t \rightarrow \infty, \text{ as well as}$$

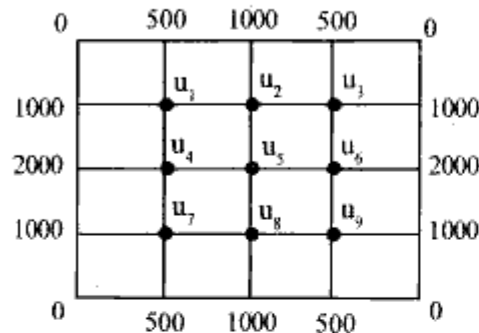
$$u(0, t) = 0 = u(l, t). \quad 7$$

- b) Express the function, $f(x) = \begin{cases} 1, & \text{when } |x| \leq 1 \\ 0, & \text{when } |x| > 1 \end{cases}$ as a

Fourier integral and hence evaluate $\int_0^\infty \frac{\sin \lambda \cos \lambda x}{\lambda} d\lambda.$

7

2. Solve $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$, for the domain of the given figure:



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3. a) Calculate the four-point DFT of the aperiodic sequence $x[n]$ of length $N = 4$, which is defined as follows: 7

$$x[n] = \begin{cases} 2, & n=0 \\ 3, & n=1 \\ -1, & n=2 \\ 1, & n=3 \end{cases}$$

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- b) Write a note on Haar Transform. 7
- a) From a pack of 52 cards, 6 cards are drawn at random. Find the probability of the following events: 7
- There are red and 3 are black cards.
 - There are kings and 3 are queens.
- b) In a precision bombing attack there is a 50% chance that any one bomb will strike the target. Two direct hits are required to destroy the target completely. How many bombs must be dropped to give a 99% chance or better of completely destroying the target? 7

5. a) Find the mean and variance of Poisson distribution. 7
- b) Assume the mean height of soldiers to be 68.22 inches with a variance of 10.8 (in)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 $t = 0$ and $t = 0.35$ is 0.1368, and between $t = 0$ and $t = 1.15$ is 0.3746. 7
6. a) Draw the graph for the Markov chain with the following transition probability matrix. 7

$$\begin{bmatrix} 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 \\ 1/2 & 1/2 & 0 & 0 \\ 0 & 0 & 1 & 0 \end{bmatrix}$$

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- 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 36 minutes. Calculate the followings:
- The mean queue size (line length) and
 - The probability that the queue size exceeds 10.
- If the input of trains increases to an average 33 per day, what will be change in (i) and (ii)? 7
7. a) Write a note on fuzzy logic and its applications. 7
- b) List the major components of the MATLAB environment. 7