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;

i) The mean queue size (line length) and

ii) The probability that the queue size exceeds 10. If the input of trains increases to an average 33 per day, what will be the change in (i) and (ii) ?

8. a) Write a note on Reliability and its applications.

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

i) 200 h

ii) 400 h

iii) 800 h and

iv) 1000 h.

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Roll No .....

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

M.E./M.Tech. I Semester

Examination, June 2016

Advanced Mathematics

Time : Three Hours

Maximum Marks: 70

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

1. a) Solve $\frac{\partial u}{\partial x}=2\frac{\partial u}{\partial t}+u$ by the method of separation of variables, where $u(x, 0)=6.e^{-3x}$.

b) Find the Fourier complex transform of

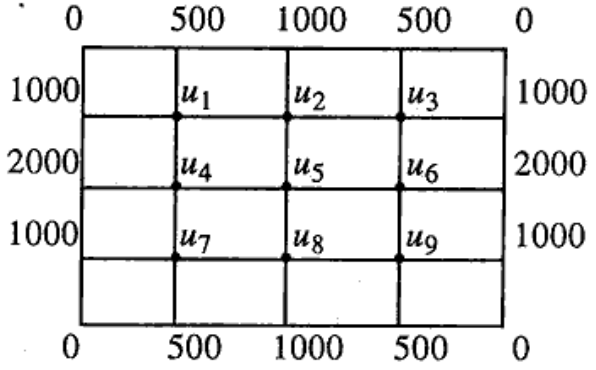
$$f(x)=\begin{cases}x^2, & |x|<a\\ 0, & |x|>a\end{cases}$$

2. a) Find the Fourier sine transform of $\frac{e^{-ax}}{x}$. Hence find Fourier sine transform of $\frac{1}{x}$.

b) Calculate the inverse DFT of

$$X(K)=\begin{cases}5, & K=0\\ 3-i2, & K=1\\ -3, & K=2\\ 3+i2, & K=3\end{cases}$$

3. Solve $u_{xx} + u_{yy} = 0$ for the domain of the given figure:



4. a) If A and B are two events, where $P(A) = \frac{1}{2}$, $P(B) = \frac{1}{3}$ and $P(A \cap B) = \frac{1}{4}$, then evaluate the following:

   i) $P(A/B)$

   ii) $P(B/A)$

   iii) $P(A \cup B)$

   b) Six dice are thrown 729 times. How many times do you expect, at least three dice to show a five or six?

5. a) Find the mean and variance of the Binomial distribution.

   b) In a book of 300 pages, a proof reader finds no error in 200 pages, in 75 pages one error on each page, in 20 pages two errors on each page and in 5 pages 3 errors on each page. Use Poisson's distribution to these data and calculate theoretical frequency. $[e^{-0.43} = 0.6505]$

6. a) Let $X = \{47, 48, 49, 50, 51\}$ and A and B be two fuzzy set given by

$$A = \left\{\frac{0.3}{47}, \frac{0.4}{48}, \frac{0.7}{49}, \frac{0.8}{50}, \frac{1}{51}\right\} \text{ and}$$

$$B = \left\{\frac{1}{47}, \frac{0}{48}, \frac{0.8}{49}, \frac{0.6}{50}, \frac{0.3}{51}\right\}$$

Find $A \cup B$ and $A \cap B$.

   b) Consider the two matrices:

$$A = \begin{bmatrix} 1 & 0 & 1 \\ 2 & 3 & 4 \\ -1 & 6 & 7 \end{bmatrix} \text{ and } B = \begin{bmatrix} 7 & 4 & 2 \\ 3 & 5 & 6 \\ -1 & 2 & 1 \end{bmatrix}$$

Using MATLAB, determine the following

i) $A+B$ ii) AB

iii) A^2 iv) A^T

v) B^{-1} vi) $B^T A^T$

vii) $A^2 + B^2 - AB$

7. a) Write the stochastic matrix for the following transition diagram: