Reg. No. : | | | | | | | | | | |

Question Paper Code : 97857

M.E. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2010

First Semester

Applied Electronics

MA 9217 — APPLIED MATHEMATICS FOR ELECTRONICS ENGINEERS

(Common to M.E. VLSI Design)

(Regulation 2009)

Time : Three hours Maximum : 100 Marks

(Use of statistical tables permitted)

Answer ALL questions

PART A — (10 × 2 = 20 Marks)

1. What are the types of fuzzy propositions?

2. Define universal and existential quantifiers.

3. List any two properties of pseudo inverse of a matrix.

4. Explain least square approximations.

5. State the memoryless property of the exponential distribution.

6. If X is a normal RV with mean zero and variance σ^2, find the pdf of $Y = e^X$.

7. Give an example of dynamic programming model.

8. State Bellman's principle of optimality.

9. State Little's formula for an (M/M/1) : (∞/FIFO) queueing model.

10. If $\lambda = 4$ per hour and $\mu = 12$ per hour in an $(\text{M/M/1}) : (4/\text{FIFO})$ queueing system, find the probability that there is no customer in the system. If $\lambda = \mu$, what is the value of this probability?

PART B — (5 × 16 = 80 Marks)

11. (a) Explain the unconditional and unqualified propositions with suitable examples.

Or

(b) Explain the fuzzy quantifiers with suitable examples.

12. (a) (i) Find the Q-R factorization of

$$A = \begin{bmatrix} 1 & -1 & +1 \\ 1 & 0 & 1 \\ -1 & 1 & 1 \end{bmatrix}. \quad (8)$$

(ii) Find the singular value decomposition of $\begin{pmatrix} 2 & 1 & -1 \\ -2 & -1 & 1 \end{pmatrix}$. (8)

Or

(b) (i) Find the pseudo inverse of $\begin{pmatrix} 1 & 1 \\ 0 & 1 \\ 1 & 0 \end{pmatrix}$. (8)

(ii) Solve the following equations in the least square method.

$$x_1 + x_2 = 1$$
$$x_1 + x_2 + x_3 + x_4 = 0. \quad (8)$$

13. (a) (i) Find the moment generating function of the Poisson distribution and hence find the values of the first four central moments. (8)

(ii) The mileage which car owners get with a certain kind of radial tire is a RV having an exponential distribution with mean 40,000 km. Find the probabilities that one of these tires will last

(1) atleast 20,000 km and

(2) atmost 30,000 km. (8)

Or

(b) (i) Fit a binomial distribution for the following data and hence find the theoretical frequencies :

x:	0	1	2	3	4	5	6
f:	5	18	28	12	7	6	4

(8)

(ii) State and prove reproductive property of Gamma distribution. (8)

14. (a) Use dynamic programming to solve

Minimize : $z = x_1^2 + x_2^2 + x_3^2$

Subject to

$$x_1 + x_2 + x_3 \geq 15$$
$$x_1, x_2, x_3 \geq 0.$$

Or

(b) Find the maximum value of $z = x_1^2 + 2x_2^2 + 4x_3$

Subject to constraints

$$x_1 + 2x_2 + x_3 \leq 8$$
$$x_1, x_2, x_3 \geq 0.$$

15. (a) At a port there are 6 unloading berths and 4 unloading crews. When all the berths are full, arriving ships are diverted to an overflow facility 20 kms down the river. Tankers arrive according to a Poisson process with a mean of 1 every 2 hour. It takes for an unloading crew, on the average, 10 hour to unload a tanker, the unloading time following an exponential distribution. Find :

(i) How many tankers are at the port on the average?

(ii) How long does a tanker spend at the port on the average?

(iii) What is the average arrival rate at the overflow facility?

Or

(b) Customers arrive at a one-man barber shop according to a Poisson process with a mean inter arrival time of 12 min. customers spend an average of 10 min. in the barber's chair

(i) What is the expected number of customers in the barber shop and in the queue?

(ii) Calculate the percentage of time an arrival can walk straight into the barber's chair without having to wait.

(iii) How much time can a customer expect to spend in the barber's shop?

(iv) What is the average time of customers spending in the queue?

(v) What is the probability that the waiting time in the system is greater than 30 min?

(vi) Calculate the percentage of customers who have to wait prior to getting into the barber's chair.

(vii) What is the probability that more than 3 customers are in the system?

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