Reg. No. :

Question Paper Code : 71435

M.E. DEGREE EXAMINATION, JUNE/JULY 2013.

First Semester

Power Systems Engineering

MA 9216/ MA 9314/ MA 902/ UMA 9111/ UMA 9122/ 10233 PS 101 – APPLIED MATHEMATICS FOR ELECTRICAL ENGINEERS

(Common to M.E. Power Electronics and Drives – M.E. Embedded System Technologies –M.E. Control and Instrumentation, M.E. Power Management M.E. Electrical Drives and Embedded Control, M.E. Embedded Systems and M.E. High Voltage Engineering)

(Regulation 2009/2010)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define Quasi-Diagonal matrix and given an example.

2. Define Orthogonal and unitary transformations.

3. Define Admissible variables.

4. Give the three possible cases that arise at the end of phase I, while solving an LPP under two-phase method.

5. Find the value of 'k' given $f(x)=kx^2, 0<x<4$ is a probability density function of a random variable X.

6. Find the moment generating function of a Binomial distribution.

7. State the basic elements of 'Queue'.

8. Write a short note on 'Service Discipline'.

9. State and classify, one-dimensional wave equation.

10. State the condition to get stable solution while solving parabolic equation under explicit method.

PART B — (5 × 16 = 80 marks)

11. (a) Determine the QR-decomposition of $A = \begin{pmatrix} 0 & 3 & 50 \\ 3 & 5 & 25 \\ 4 & 0 & 25 \end{pmatrix}$. (16)

Or

(b) Obtain the least square solution of $AX = b$ where

$$A = \begin{pmatrix} 0 & 1 \\ -3 & 0 \\ 0 & 2 \\ 4 & \frac{10}{3} \end{pmatrix}; \; X = \begin{pmatrix} x_1 \\ x_2 \end{pmatrix} \text{ and } b = \begin{pmatrix} 1 \\ 1 \\ 1 \\ 1 \end{pmatrix}.$$ (16)

12. (a) (i) Solve the following LPP by graphical method :

Maximize $Z = 8x_1 + 6x_2$ subject to $2x_1 + x_2 \le 1000$, $x_1 + x_2 \le 800$, $x_1 \le 400$, $x_2 \le 700$ and $x_1, x_2 \ge 0$. (8)

(ii) Determine the optimal assignment to maximize the profit. (8)

	A	B	C	D
I	21	15	19	16
II	19	16	20	20
III	10	20	18	17
IV	18	17	19	20

Or

(b) Solve the following LPP by Simplex Method :

Minimize $Z = 4x + 2y$ subject to $x + 2y \ge 2$, $3x + y \ge 3$, $4x + 3y \ge 6$ and $x, y \ge 0$.

(16)

13. (a) (i) A continuous random variable has the probability density function

$$f(x) = \begin{cases} 2e^{-2x}, & x \ge 0 \\ 0, & x < 0 \end{cases}$$

Find, the moment generating function and hence mean and variance. (6)

(ii) If the probability that a certain kind of measuring device will show excessive drift is 0.05, assuming geometric distribution find the probability that the sixth of these measuring devices tested will be the first to show excessive drift? (4)

(iii) If X is a uniformly distributed random variable with mean 1 and variance $\frac{4}{3}$, find $P(X > 0)$. (6)

Or

(b) (i) Suppose the life in hours of a certain kind of a radio tube has the probability density function

$$f(x) = \begin{cases} \frac{100}{x^2}, & x \geq 100 \\ 0, & x < 100 \end{cases}$$

What is the probability that none of three such tubes in a given ratio set will have to be replaced during the first 150 hours of operation? Also, what is the probability that all three of the original tubes lasts for the first 150 hours? (8)

(ii) If X is uniformly distributed in $(0,1)$ find the probability density function of $y = \frac{1}{2x+1}$. (8)

14. (a) A group of electricians has 2 computers. The average computing job requires 20 minutes of terminal time and each electrician requires some computation about once every half-an-hour. Assume that these are distributed according to an exponential distribution. If there are 6 electricians in the group find the expected number of electricians waiting to use one of the terminals. Also use Little's formula to find the expected number of electrician's waiting in the centre, the average time spent by the electrician in the centre and the total time lost per day. (16)

Or

(b) (i) Four counters are being run on the frontier of a country to check the passports and necessary papers of the tourists. The tourist chooses a counter at random. If the arrival at the frontier is Poisson at the rate of λ and the service time is exponential with parameter $\frac{\lambda}{2}$, what is the steady-state average queue at each counter? (8)

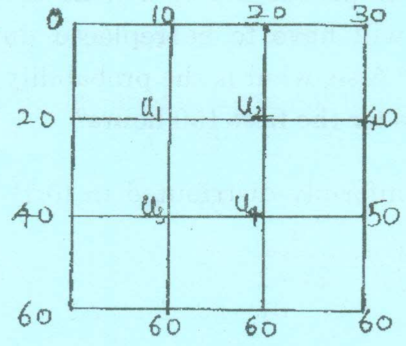
(ii) A self-service store employs one cashier at its counter. Nine customers arrive on an average of 5 minutes while the cashier can serve 10 customers in 5 minutes. Assuming Poisson distribution for arrival and exponential for service find the average number of customers in the system and in the queue. Also find the average waiting time of both a customer waits before being served and spends in the system. (8)

15. (a) (i) Solve $y'' = x + y$, given $y(0) = 0 = y(1)$ using finite differences by dividing the interval into 4 equal parts. (8)

(ii) Evaluate the pivotal values (taking h=1); given $16u_{xx} = u_{tt}$, $u(0,t) = 0 = u(5,t)$, $u_t(x,0) = 0$ and $u(x,0) = x^2(5-x)$ upto one-half of the period of the oscillation. (8)

Or

(b) (i) Solve $\nabla^2 u = 0$ in the given region : (8)



(ii) Using Crank-Nicholson method, solve $u_t = u_{xx}$ given $u(x,0) = 0 = u(0,t)$ and $u(1,t) = t$ taking $k = \frac{1}{8}$; $h = \frac{1}{4}$ for one-time step. (8)
