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

Question Paper Code: 12051

M.E. DEGREE EXAMINATION, DECEMBER 2013.

First Semester

Power Electronics and Drives

PMA126 - APPLIED MATHEMATICS FOR ELECTRICAL ENGINEERS

(Regulation 2013)

Duration: Three hours | Maximum: 100 Marks

Answer ALL Questions.

PART A - (10 x 2 = 20 Marks)

1. Find a generalized eigen vector of rank 3 corresponding to the eigenvalue $\lambda = 7$ for the matrix $\begin{bmatrix} 7 & 1 & 2 \\ 0 & 7 & 1 \\ 0 & 0 & 7 \end{bmatrix}$.

2. State any two properties of pseudo inverse.

3. Define degenerate basic feasible solution in transportation problem.

4. What do you mean by balanced and unbalanced transportation problem? Explain how would you convert the unbalanced problem into a balanced one?

5. Given the *p.d.f* of a continuous R.V *X* as follows

   $$f(x) = \begin{cases} 6x(1-x), & 0 < x < 1 \\ 0 & , otherwise \end{cases}.$$

   Find the *cdf* for *X*.

6. The *p.d.f* of a random variable *X* is $f(x) = 2x, 0 < x < 1,$ find the *p.d.f* of $Y = 3X + 1$.

7. State Little's Formula for the models with infinite capacity.

8. For (*M/M/C*) : (*N/FIFO*) Model, write down the formula for

(a) Average number of customers in the queue.

(b) Average number of customers in the system.

9. What is Bender Schmidt recurrence equation? For what purpose you use it.

10. Classify the *PDE* : $x^2 u_{xx} + (1 - y^2) u_{yy} = 0.$

PART -- B (5 x 16 = 80 Marks)

11. (a) Construct a *QR* decomposition for the matrix $\begin{bmatrix} -4 & 2 & 2 \\ 3 & -3 & 3 \\ 6 & 6 & 0 \end{bmatrix}$. (16)

Or

(b) Find the generalized inverse of the matrix $\begin{bmatrix} 2 & 2 & -2 \\ 2 & 2 & -2 \\ -2 & -2 & 6 \end{bmatrix}$. (16)

12. (a) Use Two- Phase simplex method to solve

Maximize $Z = 5x_1 + 8x_2,$

subject to the constraints

$3x_1 + 2x_2 \geq 3$,

$x_1 + 4x_2 \geq 4$,

$x_1 + x_2 \leq 5$ *and*

$x_1 , x_2 \geq 0$ (16)

Or

(b) Solve the transportation problem with unit transportation costs in rupees, demands and supplies as given below:

		Destination			
		D1	D2	D3	Supply (units)
	A	5	6	9	100
Origin	B	3	5	10	75
	C	6	7	6	50
	D	6	4	10	75
Demand (units)		70	80	120	

(16)

13. (a) (i) Find the *M.G.F* of Exponential distribution and hence find its mean and variance. (8)

(ii) State and prove the memory less property of geometric distribution (8)

Or

(b) (i) In a certain city, the daily consumption of electric power in millions of kilowatt hours can be treated as a RV having an Erlang distribution with parameters $\lambda = 1/2$ and $k = 3$. If the power plant of this city has a daily capacity of *12* million kilowatt-hours, what is the probability that this power supply will be inadequate on any given day. (8)

(ii) In an engineering examination, a student is considered to have failed, secured second class , first class and distinction, accordingly as he scores less than 45 %, between 45% and 60% , between 60% and 75% and above 75% respectively. In a particular year 10 % of the students failed in the examination and 5% of the students got distinction. Find the percentages of students who have got first class and second class. (8)

14. (a) In a single server queuing system with Poisson input and exponential service times, if the mean arrival rate is *3* calling units per hour the expected service time is *0.25 h* and the maximum possible number of calling units in the system is *2*, find P_n $(n \geq 0)$, average number of calling units in the system and in the queue and average waiting time in the system and in the queue. (16)

Or

(b) The local one-person barber shop can accommodate a maximum of *5* people at a time (*4* waiting and *1* getting hair - cut). Customers arrive according to a Poisson distribution with mean *5* per hour. The barber cuts hair at an average rate of *4* per hour (Exponential service time). Find

(a) What percentage of time is the barber idle?

(b) What fraction of the potential customers are turned away?

(c) What is the expected number of customers waiting for a hair-cut?

(d) How much time can a customer expect to spend in the barber shop? (16)

15. (a) Solve $u_{xx} + u_{yy} = 0$ over the square mesh of side 4 units: satisfying the following boundary conditions:

i) $u(0, y) = 0$ for $0 \le y \le 4$

ii) $u(4, y) = 12 + y$ for $0 \le y \le 4$

iii) $u(x, 0) = 3x$ for $0 \le x \le 4$

iv) $u(x, 4) = x^2$ for $0 \le x \le 4$ (16)

Or

(b) Solve $\frac{\partial^2 u}{\partial x^2} - 2\frac{\partial u}{\partial t} = 0$ given $u(0,t) = 0$, $u(4,t) = 0$ and $u(x, 0) = x(4 - x)$. Assume $h = 1$. Find the values of u up to $t = 5$. (16)