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

Question Paper Code: 52214

M.E. DEGREE EXAMINATION, NOV 2016

First Semester

Communication Systems

15PMA122 - APPLIED MATHEMATICS FOR COMMUNICATION ENGINEERS

(Regulation 2015)

Duration: Three hours | Maximum: 100 Marks

Answer ALL Questions

PART A - (5 x 1 = 5 Marks)

1. For the Bessel function $J_{\frac{1}{2}}(x)$ is equals to

   (a) $\sqrt{\frac{2}{\pi x}}\tan x$ (b) $\sqrt{\frac{2}{\pi x}}\sin x$ (c) $\sqrt{\frac{2}{\pi x}}\cos x$ (d) $\sqrt{\frac{2}{\pi x}}\cot x$

2. If A is orthogonal then

   (a) $A = A^2$ (b) $A = A^T$ (c) $AA^T = A^T A$ (d) $AA^T = I$

3. Find the value of $L^{-1}[\frac{1}{S^{n+1}}]$

   (a) $\frac{t^n}{n!}$ (b) $\frac{t^n}{(n-1)!}$ (c) $\frac{t^{n-1}}{n!}$ (d) $\frac{t^{n-1}}{(n-1)!}$

4. If all the variables in the basic feasible solution are positive then its called

   (a) maximum solution (b) minimum solution
   (c) degenerate solution (d) non-degenerate solution

5. In Kendall's notation (a/b/c): (d/e) , "b" refers to

   (a) service time distribution (b) waiting time distribution
   (c) queue length (d) none of these

PART - B (5 x 3 = 15 Marks)

6. State the orthogonal property of Bessel's functions.

7. Define Unitary matrix.

8. Find the Laplace transform of t^2.

9. Difference between the transportation problem and the assignment problem.

10. Define the terms queue discipline and system capacity.

PART - C (5 x 16 = 80 Marks)

11. (a) State and prove the orthogonal property of Legendre's Polynomial. (16)

Or

(b) Reduce the differential equation $x\frac{d^2y}{dx^2} + a\frac{dy}{dx} + k^2xy = 0$ by Bessel's form. (16)

12. (a) Find the Q.R decomposition of the matrix $\begin{pmatrix} 0 & -1 & 0 \\ -1 & 0 & -1 \\ 0 & -1 & 0 \end{pmatrix}$. (16)

Or

(b) Find the pseudo inverse of $\begin{pmatrix} 0 & 0 & 1 & 2 \\ 1 & 2 & 2 & 3 \end{pmatrix}$. (16)

13. (a) A string is stretched and fixed between two points (0, 0) and (l, 0) the motion is initiated by displacement the string in the form U = k sin $(\frac{\pi x}{l})$ and releasing from rest at time t =0. Find the displacement of any point on the string at any time t. (16)

Or

(b) An infinitely long string having one end at x =0 is initially at rest in the x - axis, the end x =0 under gone a periodic transverse displacement described by $A_o \sin \omega t$, t > o, find the displacement of any point on the string at any time. (16)

14. (a) Solve the following problem by simplex method:

Max Z = $x_1 - 2x_2 + 3x_3 - x_4$

Subject to $x_1 + 2x_2 + 3x_3 = 15$

$2x_1 + x_2 + 5x_3 = 20$

$$x_1 + 2x_2 + x_3 + x_4 = 10$$
$$x_1, x_2, x_3, x_4 \geq 0$$ (16)

Or

(b) Use the penalty (Big -M) method to solve the following LP problem:
Maximize $Z = 2x_1 + x_2 + 3x_3$ subject to the constraints,
(i)$x_1 + x_2 + 2x_3 \geq 5$ (ii) $2x_1 + 3x_2 + 4x_3 = 12$ and (iii) $x_1, x_2, x_3 \geq 0$. (16)

15. (a) A supermarket has two girls ringing up sales at the counters. If the service time for each customer is exponential with mean 4 minutes, and if the people arrive in a Poisson fashion at the rate of 10 per hour. (i) What is the probability of having to wait for service? (ii) What is the expected percentage of idle time for each girl? (iii) If a customer has to wait, what is the expected length of his waiting time? (16)

Or

(b) Let there be an automobile inspection situation with three inspection stalls. Assume that cars at the head of the line pulls up to it. The station can accommodate at most 4 cars waiting (seven in station) at one time. The arrival pattern is Poisson with a mean of one car every minute during peak hours. The service time is exponential mean 6 minutes. Find the average number of customers in the system during peak hours, the average waiting time and the average number per hour that cannot enter the station because of full capacity. (16)