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

Question Paper Code: 51022

M.E. DEGREE EXAMINATION, APRIL 2019

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 CO1- R

(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. For an $(M/M/1):(\infty/FIFO)$ queue, average number of customers in the queue is CO2 -R

(a) $\frac{\lambda}{\mu(\mu-\lambda)}$ (b) $\frac{\lambda^2}{\mu(\mu-\lambda)}$ (c) $\frac{\mu^2}{\lambda(\mu-\lambda)}$ (d) $\frac{\mu}{\lambda(\mu-\lambda)}$

3. The value of $L^{-1}\left[\frac{1}{s-2}+\frac{1}{s+2}\right]$ is CO3- R

(a) $2\sin 2t$ (b) $2\cos 2t$ (c) $2\sinh 2t$ (d) $2\cosh 2t$

4. If all the variables in the basic feasible solution are positive then its called CO4 -R

(a) Maximum solution (b) Minimum solution

(c) Degenerate solution (d) Non degenerate solution

5. If $X = (1, -3, -2)^T$ and $Y = (1, m, -4)^T$ are orthogonal then the value of *m* is CO5- R

(a) -1 (b) 0 (c) 3 (d) -3

PART – B (5 x 3= 15 Marks)

6. Show that CO1-E

$J_0''(x) = \frac{1}{2}[J_2(x) - J_0(x)]$.

7. Define Toeplitz matrix. CO2-U

8. Find the Laplace transform of Heaviside unit step function. CO3-E

9. Difference between the transportation problem and the assignment problem. CO4-U

10. Define the terms queue discipline and system capacity. CO5-U

PART – C (5 x 16= 80 Marks)

11. (a) State and prove the orthogonal property of Legendre's Polynomial. CO1- E (16)

Or

(b) State and prove the orthogonal property of Bessel's functions CO1- U (16)

12. (a) Solve the equations by least square method CO2- E (16)

$x_1 + 2x_2 + 3x_3 + x_5 = 1$

$-x_1 + 2x_3 - 2x_4 + 3x_5 = 1$

Or

(b) Solve the Equation using least square method CO2- App (16)

$X_3 + 2x_4 = 1$, $X_1 + 2X_2 + 2X_3 + 3X_4 = 2$

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. CO3-E (16)

Or

(b) Using Laplace transform, solve CO3-E (16)

PDE: $2u_t = u_{xx},\ 0 < x < l \qquad t > 0$

BCs: $u(0, t) = 0,\ u(l, t) = g(t) \qquad t > 0$

IC: $u(x, 0) = 0 \qquad 0 < x < l.$

14. (a) 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) $x_1, x_2, x_3 \geq 0$. CO4 -App (16)

Or

(b) Use simplex method to solve the LPP CO4 -App (16)

Maximize $Z = 4x_1 + 10x_2$

Subject to $2x_1 + x_2 \leq 50$
$2x_1 + 5x_2 \leq 100$
$2x_1 + 3x_2 \leq 90$ and $x_1, x_2 \geq 0$.

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. CO5-App (16)

(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?

(Or)

At a one - man barber shop, the customers arrive following poisson process at an average rate of 5 per hour and they are served according to exponential distribution with an average service rate of 10 minutes. Assuming that only 5 seats are available for waiting customers, find the average time a customers, find the average time a customer spends in the system, queue and number of customers in queue. CO5-App (16)