C **Reg. No. :** | | | | | | | | | | |

Question Paper Code: 51Z22

M.E. DEGREE EXAMINATION, NOV 2018

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. If A unitary then CO2 -R

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

3. Find the value of CO3- R

$L^{-1}[\frac{1}{S^{n+1}}]$

(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 CO4 -R

(a) Maximum solution (b) Minimum solution

(c) Degenerate solution (d) Non degenerate solution

5. In (M/M/S): (∞/FCFS) if $\frac{\lambda}{\mu} > 1$ then the state is CO5- R

(a) Steady state (b) Explosive (c) Identical (d) None of the above

PART – B (5 x 3= 15 Marks)

6. Find $J_0(x)$. CO1-E

7. Define Unitary 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. Explain Kendall's notation. CO5-U

PART – C (5 x 16= 80 Marks)

11. (a) (i) Prove that $\left[J_{-\frac{1}{2}}(x)\right]^2 + \left[J_{\frac{1}{2}}(x)\right]^2 = \frac{2}{\pi x}$. CO1- E (8)

(ii) Prove that $\frac{n}{x}J_n(x) - J_n'(x) = J_{n+1}(x)$ CO1 -E (8)

Or

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

12. (a) Find the Q.R decomposition of the matrix CO2- E (16)

$$\begin{pmatrix} 0 & -1 & 0 \\ -1 & 0 & -1 \\ 0 & -1 & 0 \end{pmatrix}$$

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) Solve the intial value problem by partial differential equation CO3-E (16)

$U_{tt} = U_{xx} 0 < x < 1$ boundary condition $U(0,t) = U(1,t) = 0$, $t > 0$

initial conduction $U(x,0) = \sin \pi x$. $U(x,0)$ initial displacement

$U_t(x,0) = -\sin \pi x$ $0 < x < 1$.

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. CO3-E (16)

14. (a) A company has a team of four salesmen and there are four districts where the company wants to start its business. After taking into accounts the capabilities of salesman and the nature of districts, the company estimates that the profit per day in rupees for each salesman in each district is as below : CO4 -App (16)

		Districts 1	2	3	4
Salesman	A	16	10	14	11
	B	14	11	15	15
	C	15	15	13	12
	D	13	12	14	15

Find the assignment of salesman to various districts which will yield maximum profit.

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) Customer arrive at the first class ticket counter of a Theatre at the rate of 12 per hour. There is one clerk serving the customers at the rate of 30 per hour. CO5-App (16)
(a) What is the probability that there is no customer in the counter (i.e., the system is idle)?
(b) What is the probability that there are more than 2 customers in the counter?
(c) What is the probability that there is no customer waiting to be server?
(d) What is the probability that a customer is being served and no body is waiting?

(Or)

(ii) 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)