Register No : ___________________

THE KAVERY ENGINEERING COLLEGE

(An Autonomous Institution)

M.E DEGREE END SEMESTER THEORY EXAMINATIONS, NOV /DEC 2024

First Semester

Power Systems Engineering

PAMPST2411/MA4107 - Applied Mathematics for Power Systems Engineers

Common to Regulations - 2021 & 2024

Duration : 3 Hrs *Maximum : 100 Marks*

*PART – A (ANSWER ALL QUESTIONS) (Marks 10*2=20)*

Q.No	Questions	BLT	CO	Marks
1.	Explain least square approximations.	UN	1	2
2.	Define the singular values of the matrix?	RE	1	2
3.	Find the Laplace transform of Dirac delta function.	RE	2	2
4.	State and Prove change of scale property of Laplace transform.	UN	2	2
5.	State the Dirichlet's conditions for the existence of Fourier series in $(c, c+2\pi)$.	UN	3	2
6.	Expand $f(x) = x$ as a Fourier series in $(-\pi, \pi)$.	UN	3	2
7.	What is mean by balanced and unbalanced transportation problem?	RE	4	2
8.	What are the slack and surplus variables?	RE	4	2
9.	What is Lagrangian multiplier with equality constraint?	RE	5	2
10.	Write the Kuhn- Tucker conditions for Non linear programming problem.	UN	5	2

*PART – B (ANSWER ALL QUESTIONS) (Marks 5*13 = 65)*

Q.No			Questions	BLT	CO	Marks
11.	a		Construct QR decomposition for the matrix $A = \begin{bmatrix} -4 & 4 & 2 \\ 4 & -4 & 1 \\ 2 & 1 & 0 \end{bmatrix}$	AP	1	13
			Or			
	b		Find a generalized Eigen vector of rank 2 corresponding to the Eigen value $\lambda = 4$ for the matrix $A = \begin{bmatrix} 4 & 0 & 0 & 0 \\ 1 & 5 & 1 & 0 \\ -1 & -1 & 3 & 0 \\ 0 & 0 & 0 & 3 \end{bmatrix}$	AP	1	13
12.	a		Solve the following one dimensional heat equation using Laplace transform techniques: $\frac{\partial u}{\partial t}(x,t) = \frac{\partial^2 u}{\partial t^2}(x,t), \quad 0 < x < 2, \quad t > 0$ $u(0,t) = 0, u(2,t) = 0, u(x,0) = 3\sin(2\pi x)$.	AP	2	13
			Or			
	b	i	Find the Laplace transform of $\frac{e^{-at} - e^{-bt}}{t}$.	AP	2	5
		ii	An infinitely long string having one end at x=o is initially at rest on the x-axis. The end x=o undergoes a periodic transverse displacement described by $A_0 \sin\omega t$, t > 0. Find the displacement of any point on the string at any time t.	AP	2	8

Q.No			Questions	BLT	CO	Marks
13.	a		Find the eigenvalues and eigenfunctions of the following Sturm-Liouville problem: $y'' + \lambda y = 0,\ 0 < x < 1, y(0) = 0$ and $y'(1) = 0$.	AP	3	13
			Or			
	b		Find the Fourier series for the function $f(x) = 2x - x^2$ in the interval $0 < x < 2$.	AP	3	13
14.	a		Solve the Transportation Problem and find the optimal solution	AP	4	13

	A	B	C	Supply
1	7	3	2	2
2	2	1	3	3
3	3	4	6	5
Demand	4	1	5	10

Or

b. Solve the following LPP by Simplex method (AP, 4, 13)

Maximize $Z = 3x_1 + 2x_2 + 5x_3$

Subject to ,

$x_1 + x_2 + x_3 \le 9$

$2x_1 + 3x_2 + 5x_3 \le 30$

$2x_1 - x_2 - x_3 \le 8$

and $x_1 \ge 0,\ x_2 \ge 0,\ x_3 \ge 0.$

15. a. Solve the following NLPP using the Kuhn- Tucker conditions: (AP, 5, 13)

Maximize $z = 2x_1^2 - 7x_2^2 + 12x_1x_2$

Subject to $2x_1 + 5x_2 \le 98$

$x_1, x_2 \ge 0.$

Or

b. Solve the following non-linear programming problem, using the Lagrangean multipliers: (AP, 5, 13)

Optimize $z = 4x_1^2 + 2x_2^2 + x_3^2 - 4x_1x_2$,

Subject to, $x_1 + x_2 + x_3 = 15,$

$2x_1 - x_2 + 2x_3 = 20,$

$x_1, x_2, x_3 \ge 0.$

*PART – C (Marks 1*15 = 15)*

Q.No			*Questions*	*BLT*	*CO*	*Marks*
16.	a	i	Obtain the Fourier series to represent the function $f(x) = \lvert x \rvert, -\pi < x < \pi$.	AP	3	8
		ii	Find $L^{-1}\left\{\frac{s}{(s^2+1)(s^2+4)}\right\}$ using convolution theorem.	AP	2	7
			Or			
	b		Construct the singular value decomposition for $A = \begin{bmatrix} 1 & 1 & 3 \\ 1 & 1 & 3 \end{bmatrix}$.	AP	1	15