Register No : ___________________

THE KAVERY ENGINEERING COLLEGE

(An Autonomous Institution)

B.E/B.TECH DEGREE END SEMESTER THEORY EXAMINATIONS, APRIL/MAY 2026

Third Semester

Agricultural Engineering

MA3301-Fourier Series and Linear Programming

Regulations – 2021

Duration : 3 Hrs | *Maximum : 100 Marks*

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

Q.No	Questions	BTL	CO	Marks
1.	Find the root mean square value of $f(x) = x(l-x)$ in $0 \leq x \leq l$.	L2	1	2
2.	If $f(x)=x^2+x$ is expressed as a Fourier series in the interval (-2,2) to which value this series converges at x=2.	L2	1	2
3.	State Fourier integral theorem	L1	2	2
4.	Find the Fourier Transform of $e^{-\|x\|}$.	L2	2	2
5.	Define unbounded solution.	L1	3	2
6.	Write down the formulation of Dual Problem.	L2	3	2
7.	Define Unbalanced Assignment problem.	L1	4	2
8.	Differentiate between transportation and Assignment problem.	L2	4	2
9.	Define Non-Linear Programming Problem.	L1	5	2
10.	Define Quadratic Programming Problem.	L1	5	2

*PART – B (ANSWER ALL QUESTIONS) (Marks 5*16 = 80)*

Q.No			Questions	BLT	CO	Marks
11.	a	i	Obtain the Fourier Half range Sine series for $f(x) = (x-2)^2$ in the interval $0 < x < 2$. Deduce that $\sum_{1}^{\infty} \frac{1}{(2n-1)^2} = \frac{\pi^2}{8}$.	L3	1	8
		ii	Fine the Cosine series of the function $f(x) = x^2$ in $(0, \pi)$.	L2	1	8
			Or			
	b	i	Determine the Fourier series expansion of $f(x) = x^2$ in $(-\pi, \pi)$ and hence show that $\frac{1}{1^4} + \frac{1}{2^4} + \frac{1}{3^4} + \ldots = \frac{\pi^4}{90}$.	L3	1	8
		ii	Determine the first two harmonics of Fourier series for the following data	L2	1	8

x:	0	$\pi/3$	$2\pi/3$	π	$4\pi/3$	$5\pi/3$
f(x):	1.98	1.30	1.05	1.30	-0.88	-0.25

12	a	i	Find the Fourier transform of the function $f(x) = \begin{cases} 1 - \lvert x\rvert, & \lvert x\rvert \le 1 \\ 0, & \lvert x\rvert > 1 \end{cases}$. Hence deduce that $\int_0^\infty \left(\frac{\sin t}{t}\right)^4 dt = \frac{\pi}{3}$.	L3	2	10
		ii	If F(s) is the Fourier Transform of $f(x)$, prove that $F\{f(ax)\} = \frac{1}{a} F\left(\frac{s}{a}\right), a \neq 0$.	L2	2	6
			Or			
	b	i	Find the F.T of f(x) is defined as f(x) = $e^{-a^2x^2}, a > 0$.	L3	2	8
		ii	State & Prove the convolution theorem on Fourier Transform.	L2	2	8
13.	a		Solve using Simplex Method Max z = $3x_1 + 2x_2$ Subject to $x_1 + x_2 \le 4$ $x_1 - x_2 \le 2$ $x_1, x_2 \ge 0$.	L3	3	16
			Or			
	b		Write the Dual of the LPP Max z = $2x_1 + 3x_2 + x_3$ Subject to $4x_1 + 3x_2 + x_3 = 6$ $x_1 + 2x_2 + 5x_3 = 4$ $x_1, x_2, x_3 \ge 0$.	L3	3	16
14.	a	i	Find the IBFS to the following transportation problem by VAM:	L3	4	8

	D	E	F	G	Available
A	11	13	17	14	250
B	16	18	14	10	300
C	21	24	13	10	400
Demand	200	225	275	250	

		ii	Solve the following travelling salesman problem so as to minimize the cost per cycle.	L3	4	8

From	To				
	A	B	C	D	E
A	-	3	6	2	3
B	3	-	5	2	3
C	6	5	-	6	4
D	2	2	6	-	6
E	3	3	4	6	-

Or

	b		Solve the assignment problem: $\begin{pmatrix} 8 & 4 & 2 & 6 & 1 \\ 0 & 9 & 5 & 5 & 4 \\ 3 & 8 & 9 & 2 & 6 \\ 4 & 3 & 1 & 0 & 2 \\ 9 & 5 & 8 & 9 & 5 \end{pmatrix}$	L3	4	16
15.	a	i	State and explain the Kuhn-Tucker conditions for solving a non-linear programming problem.	L2	5	8
		ii	Using Lagrange multiplier method, find the maximum and minimum values of f (x,y) = $x^2 + y^2$ subject to x + y = 1.	L3	5	8
			Or			
	b		Solve the following nonlinear programming problem using Kuhn-Tucker conditions: Minimize $Z = x^2 + 2y^2 + 3z^2$ Subject to $x - y - 2z \leq 12$, $x + 2y - 3z \leq 8$ $X, y, z \geq 0$	L3	5	16