

THE KAVERY ENGINEERING COLLEGE*(An Autonomous Institution)***B.E/B.TECH DEGREE END SEMESTER THEORY EXAMINATIONS, NOV/DEC 2025***Third Semester**Agricultural Engineering***MA3301 / UMAT24304 – Fourier Series and Linear Programming***Regulations – 2021 & 2024**Duration : 3 Hrs**Maximum : 100 Marks***PART – A (ANSWER ALL QUESTIONS) (Marks 10*2=20)**

<i>Q.No</i>	<i>Questions</i>	<i>BLT</i>	<i>CO</i>	<i>Marks</i>
1.	If the function $f(x) = x$ in $0 < x < 2\pi$ then find the constant term of the Fourier series expansion of the function f.	L2	1	2
2.	Find the root mean square value of $f(x) = x^2$ in $(0, l)$.	L3	1	2
3.	State Fourier Integral Theorem.	L1	2	2
4.	If $F(S) = F[f(x)]$ then find $F[xf(x)]$.	L2	2	2
5.	Define Artificial Variable.	L1	3	2
6.	State the limitations of LPP.	L1	3	2
7.	Define the basic feasible solution.	L1	4	2
8.	Write the difference between the Transportation problem and Assignment problem.	L2	4	2
9.	Write the sufficient condition for a function to have an extrema.	L2	5	2
10.	Write down the conditions for Khun – Tucker method.	L1	5	2

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

<i>Q.No</i>	<i>Questions</i>	<i>BLT</i>	<i>CO</i>	<i>Marks</i>
11.	a i Find the Fourier Series of $f(x) = x(2 - x)$ in $0 < x < 3$.	L3	1	8
	ii Find the half range cosine series of $f(x) = (\pi - x^2)$ in the interval $(0, \pi)$. Hence find the sum of the series $\frac{1}{1^4} + \frac{1}{2^4} + \frac{1}{3^4} + \dots$.	L3	1	8
	Or			
	b i Find the Fourier Series expansion of $f(x) = x^2 + x$ in $(-\pi, \pi)$ of periodicity 2π .	L3	1	8
	ii Find the Fourier Series up to second harmonic for the following data:	L2	1	8

x	0	$\pi/3$	$2\pi/3$	π	$4\pi/3$	$5\pi/3$	2π
$f(x)$	1.8	0.3	0.5	2.16	1.3	1.76	1.8

12. a Find the Fourier Transform of the function $f(x) = \begin{cases} 1 - |x|, & \text{if } |x| \leq 1 \\ 0, & \text{if } |x| > 1 \end{cases}$ and hence deduce that $\int_0^\infty \left(\frac{\sin t}{t}\right)^2 = \frac{\pi}{2}$ and $\int_0^\infty \left(\frac{\sin t}{t}\right)^4$
- Or

- b i Using Parseval's Identity for Fourier transform evaluate $\int_0^\infty \frac{ds}{(a^2+s^2)(b^2+s^2)}$. L3 2 8
- ii Find the Fourier sine transform of $f(x) = e^{-ax}, a > 0$ and hence find $F_c[xe^{-ax}]$. L2 2 8

13. a Solve the following linear programming problem using Graphical method:
 $Max Z = 100x_1 + 80x_2$, Subject to: $5x_1 + 10x_2 \leq 50$, $8x_1 + 2x_2 \geq 16$, $3x_1 - 2x_2 \geq 6$ & $x_1, x_2 \geq 0$. L3 3 16

Or

- b Solve the following LPP by Big - M method: $Min Z = 4x_1 + 2x_2$, Subject to:
 $3x_1 + x_2 \geq 27$, $x_1 + x_2 \geq 21$, $x_1 + 2x_2 \geq 0$ & $x_1, x_2 \geq 0$. L3 3 16

14. a Solve the transportation problem by using MODI method. L3 4 16

	1	2	3	4	Supply
I	21	16	25	13	11
II	17	18	14	23	13
III	32	27	18	41	19
Demand	6	10	12	15	

Or

- b Consider the problem of assigning four salespersons to four different sales regions as shown in the following table such that the total sales is maximized L3 4 16

Sales region					
Salesman		1	2	3	4
	1	10	22	12	14
	2	16	18	22	10
	3	24	20	12	18
	4	16	14	24	20

The cell entries represented annual sales figures in lakhs of rupees. Find the optimal allocations of the sales persons to different regions.

15. a Solve the non linear problem using the method of Lagrangian Multiplier:
 $Min Z = x_1^2 + 3x_2^2 + 5x_3^2$, Subject to: $x_1 + x_2 + 3x_3 = 2$, $5x_1 + 2x_2 + x_3 = 5$, $x_1, x_2, x_3 \geq 0$. L3 5 16

Or

- b Solve the non linear problem by Khun - Tucker Conditions: L2 5 16
 $Minimize f(x) = x_1^2 + x_2^2 + x_3^2$, Subject to:
 $g_1(x) = 2x_1 + x_2 - 5 \leq 0$
 $g_2(x) = x_1 + x_2 - 2 \leq 0$
 $g_3(x) = 1 - x_1 \leq 0$
 $g_4(x) = 2 - x_2 \leq 0$
 $g_5(x) = -x_3 \leq 0$