SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

S.R.M. Nagar, Kattankulathur - 603203

DEPARTMENT OF MATHEMATICS

QUESTION BANK

III SEMESTER

B.E- AGRI, CIVIL, EEE, EIE, ECE, MDE

MA3321–Transforms and Partial Differential Equations

Regulation – 2023

Academic Year – 2025 - 2026

Prepared by

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DEPARTMENT OF MATHEMATICS

S.No	QUESTIONS	BT Level	Competence	COs
UNIT I-Solutions Lagrange's linear equation - Linear partial differential equations of second and higher order with constant coefficients of homogeneous type.				
	Part - A (2 MARK QUESTIONS)			
1.	Define Lagrange's Linear Equation. What is its general form ?	BTL -1	Remembering	CO1
2.	What are the auxiliary (or subsidiary) equations associated with Lagrange's linear equation?.	BTL -1	Remembering	CO1
3.	Solve $p\,tanx + q\,tany = tanz$	BTL -2	Understanding	CO1
4.	Solve $px + qy = 3z$	BTL -2	Understanding	CO1
5.	Solve$p\sqrt{x} + q\sqrt{y} = \sqrt{z}$	BTL -2	Understanding	CO1
6.	Write the working rule for solving $Pp + Qq = R$ by Lagrange's method.	BTL -2	Understanding	CO1
7.	Find the particular integral of$(D^2 - 3DD' + 2D'^2)z = cos(4x - 2y)$	BTL -1	Remembering	CO1
8.	Solve $(D^3 - 4D^2D' + 4DD'^2)z = 0$	BTL -2	Understanding	CO1
9.	Solve $px^2 + qy^2 = z^2$	BTL -1	Remembering	CO1
10.	Find the complete solution of $(D^2 - DD' - 20D'^2)z = cos(x + 2y)$	BTL -1	Remembering	CO1
11.	Find the particular integral of$(D^2 - D'2)z = e^{x+2y}$	BTL -2	Understanding	CO1
12.	Solve p cot x + q cot y = cot z	BTL -2	Understanding	CO1
13.	Find the general integral of $p - q = \log(x + y)$	BTL -1	Remembering	CO1
14.	Find the general solution of $pzx + qzy = xy$	BTL -1	Remembering	CO1
15.	Define linear partial differential equations.	BTL -2	Understanding	CO1
16.	Write down the general solution of homogenous linear PDE.	BTL -1	Remembering	CO1
17.	Solve $(D^2 - 4DD' + 4D'^2)z = 0$	BTL -1	Remembering	CO1
18.	Find the particular integral of$\left(D^2 - 7DD' + 6D'^2\right)z = x + y$	BTL -2	Understanding	CO1
19.	Solve $(D^3 - D^2D' - 8DD'^2 + 12D'^3)z = 0$	BTL -2	Understanding	CO1
20.	Solve $(D^4 - D'^4)z = 0$	BTL -2	Understanding	CO1
21.	Solve $(D - D')^3z = 0$	BTL -2	Understanding	CO1
22.	Solve $\frac{\partial^2 z}{\partial x^2} - \frac{\partial^2 z}{\partial x \partial y} + \frac{\partial z}{\partial x} = 0$	BTL -1	Remembering	CO1
23.	Find the particular integral of Solve $\frac{\partial^2 z}{\partial x^2} - 2\frac{\partial^2 z}{\partial x \partial y} - 3\frac{\partial^2 z}{\partial y^2} = xy$	BTL -1	Remembering	CO1
24.	Find the particular integral of $(D^2 - 6DD' + 9D'^2)z = \sin(2x - y)$	BTL -2	Understanding	CO1
25.	Solve $\frac{\partial^2 z}{\partial x^2} - \frac{\partial^2 z}{\partial x \partial y} = 0$	BTL -2	Understanding	CO1
	PART – B (16 MARK QUESTIONS)			
1.	Solve $(z^2 - y^2 - 2yz)p + (xy + zx)q = (xy - zx)$	BTL -3	Applying	CO1
2.	Solve $x(y^2 + z)p + y(x^2 + z)q = z(x^2 - y^2)$	BTL -3	Applying	CO1
3.	Solve the Lagrange's equation $(x + 2z)p + (2xz - y)q = x^2 + y$	BTL -4	Analyzing	CO1

4.(a)	Find the general solution of $(3z - 4y)p + (4x - 2z)q = 2y – 3x$	BTL - 3	Applying	CO1
4.(b)	Solve $(x^2 - yz)p + (y^2 - xz)q = (z^2 - xy)$	BTL - 3	Applying	CO1
5.	Solve the partial differential equation (x -2z) p + (2z –y) q = x - y	BTL - 4	Analyzing	CO1
6.(a)	Solve $x(y^2 - z^2)p + y(z^2 - x^2)q = z(x^2 - y^2)$	BTL -3	Applying	CO1
6.(b)	Find the general solution of $(m z - ny)p + (nx - lz)q = ly – mx$	BTL - 4	Analyzing	CO1
7.	Solve $(x^2 - y^2 - z^2)p + 2xy\, q = 2xz$	BTL - 4	Analyzing	CO1
8.(a)	Solve the PDE $x^2(y - z)p + y^2(z - x)q = z^2(x - y)$	BTL - 3	Applying	CO1
8.(b)	Solve (y-z)p + (z-x)q = x- y	BTL - 3	Applying	CO1
9.(a)	Solve $(D^2 - 5DD' + 6D'^2)z = e^{2x+y}$	BTL - 3	Applying	CO1
9.(b)	Find the general solution of$\left(D^3 - 7DD'^2 - 6D'^3\right)z = cos(x + 2y)$	BTL - 3	Applying	CO1
10.	Solve $(D^3 + D^2D' - DD'^2 - D'^3)z = e^{2x+y} + cos\ (x + y)$	BTL -1	Remembering	CO1
11.	Solve$(D^2 - DD' - 2D'^2)z = 2x + 3y + e^{2x+4y}$	BTL -1	Remembering	CO1
12.a)	Solve $\left(D^2 + DD' - 6D'^2\right)z = x^2y$	BTL -4	Analyzing	CO1
12.(b)	Solve $(D^3 – 2 D^2 D’) z = 2 e^{2x}$	BTL -3	Applying	CO1
13.	Solve $(D^2 - DD’ - 20D’^2)\ z = e^{5x+y} + sin\ (4x - y).$	BTL - 4	Analyzing	CO1
14.(a)	Solve $[D^2 - 3DD' + 2D’^2]\ z = sinx\ cosy$	BTL -3	Applying	CO1
14.(b)	Find the general solution of $(D^2 + D'^2)z = x^2y^2$	BTL -3	Applying	CO1
15.	Solve $(D^2 + 3DD' + 2D'^2)z = xy + \cos(2x + y)$	BTL -3	Applying	CO1
16.	Solve $(D^2 + 2DD' + D'^2)z = x^2y + e^{x-y}$	BTL -4	Analyzing	CO1
17.	Solve $(D^3 - 7DD'^2 - 6D'^3)z = \sin\ (x + 2y) + x^3y^3$	BTL -3	Applying	CO1
18.	Solve $((D^2 - 4DD' + 4D'^2)z = e^{2x+y}$ + sin (x + y)	BTL -4	Analyzing	CO1
UNIT II FOURIER SERIES: Dirichlet’s conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series– Harmonic analysis.				
PART-A(2 MARK QUESTIONS)				
1.	State the Dirichlet’s conditions for Fourier series.	BTL -1	Remembering	CO2
2.	Does $f(x) = tanx$ possess a Fourier expansion?	BTL -1	Remembering	CO2
3.	If f(x) is an odd function defined in $(-l, l)$. What are the values of a_0 and a_n?	BTL -1	Remembering	CO2
4.	Write a_0, a_n in the expression $x + x^3$ as a Fourier series in $(-l, l)$	BTL -1	Remembering	CO2
5.	Determine the value of a_n in the Fourier series expansion of $f(x) = x^3$ in $(-\pi, \pi)$.	BTL -2	Understanding	CO2
6	Find b_n in the expansion of $f(x) = x^2$ as a Fourier series in $(-\pi, \pi)$	BTL -2	Understanding	CO2
7.	Find the Fourier constant b_n for xsinx in $(-\pi, \pi)$.	BTL -2	Understanding	CO2
8.	Find the constant term in the expansion of $f(x) = x^2 + x$ as a Fourier series in the interval $(-\pi, \pi)$.	BTL -2	Understanding	CO2
9.	Find the value of b_n for $f(x) = \|x\|$in $(-\pi, \pi)$	BTL -2	Understanding	CO2
10	Expand $f(x) = 1, in\ (0, \pi)$ as a half sine series.	BTL -2	Understanding	CO2
11.	Find the Fourier coefficient b_n for the function $f(x) = 2x - x^2$ defined in the interval $0 < x < 2$.	BTL -2	Understanding	CO2
12.	Find the constant a_0 of the Fourier series for the function $f(x) = e^x$in $(0,2\pi)$	BTL -1	Remembering	CO2
13.	State the convergence condition on Fourier series	BTL -2	Understanding	CO2
14.	If the function f(x) = x in the interval $0 < x < 2\pi$ then find the constant term of the Fourier series expansion of the function	BTL -2	Understanding	CO2
15.	If $(\pi - x)^2 = \frac{\pi^2}{3} + 4\sum_{n=1}^{\infty} \frac{cosnx}{n^2}\ in\ 0 < x < 2\pi$ then deduce	BTL -2	Understanding	CO2

	that value of $\sum_{n=1}^{\infty}\frac{1}{n^2}$.			
16.	If $x^2 = \frac{\pi^2}{3} + 4\sum_{n=1}^{\infty}\frac{(-1)^n}{n^2}\cos(nx)$, deduce that $\frac{1}{1^2}+\frac{1}{2^2}+\frac{1}{3^2}+\cdots=\frac{\pi^2}{6}$.	BTL -1	Remembering	CO2
17.	Write the Fourier series for a function $f(x)$ defined in $-l < x < l$	BTL -2	Understanding	CO2
18.	Write down the Half range Fourier Sine series formula.	BTL -2	Understanding	CO2
19.	Write down the Fourier Cosine series formula.	BTL -2	Understanding	CO2
20.	Find the root mean square value of f(x) = x^2 in (0,π)	BTL -2	Understanding	CO2
21.	Find the RMS value of f(x) = x (l -x) in 0$\leq x \leq l$	BTL -2	Understanding	CO2
22.	Find the RMS value of f(x) = $x - x^4$ in (0, l)	BTL -2	Understanding	CO2
23.	Define the RMS value of a function f(x) over the interval (a, b)	BTL -1	Remembering	CO2
24.	Find the R.M.S value of $f(x) = x$ in $0 < x < 1$.	BTL -2	Understanding	CO2
25.	What do you mean by Harmonic Analysis?	BTL -1	Remembering	CO2
	PART B (16 Mark Questions)			
1.	Find the Fourier series for the function $f(x) = \frac{1}{2}(\pi - x) in$ $0 < x < 2\pi$	BTL -2	Understanding	CO2
2.	Find the Fourier series of $f(x) = \lvert cosx \rvert$ in $-\pi \leq x \leq \pi$.	BTL -4	Analyzing	CO2
3.	Find the Fourier series of $f(x) = x + x^2$in (-π, π) with period 2π.	BTL -3	Applying	CO2
4.(a)	Find the Fourier series expansion of $f(x) = \begin{cases} x & for\ \ 0 \leq x \leq \pi \\ 2\pi - x & for\ \ \pi \leq x \leq 2\pi. \end{cases}$	BTL -4	Analyzing	CO2
4.(b)	Find the half range Fourier cosine series of $f(x) = (\pi - x)^2$ in the interval$(0, \pi)$.	BTL -4	Analyzing	CO2
5.(a)	Find the Fourier series of $f(x) = 2x - x^2$in 0 < x < 3.	BTL -3	Applying	CO2
5.(b)	Find the Sine seriesfor $f(x) = x\ \ in\ \ -l < x < l$	BTL -3	Applying	CO2
6.	Obtain the Fourier series for the function f(x) given by $f(x) = \begin{cases} 1 - x, & -\pi < x < 0 \\ 1 + x, & 0 < x < \pi \end{cases}$	BTL -3	Applying	CO2
7.	Find the half range sine series of $f(x) = 4x - x^2$in the interval 0 < x <4	BTL -1	Remembering	CO2
8.	Expand $f(x) = \begin{cases} 1 + \frac{2x}{\pi}, -\pi < x < 0 \\ 1 - \frac{2x}{\pi},\ \ 0 < x < \pi \end{cases}$ as a full range Fourier series in the interval $(-\pi, \pi)$.	BTL -4	Analyzing	CO2
9.	Find the Fourier expansion of the following periodic function of period 4 $\ f(x) = \begin{cases} 2 + x, & -2 \leq x \leq 0 \\ 2 - x, & 0 \leq x \leq 2 \end{cases}$ Hence deduce that $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \cdots\infty = \frac{\pi^2}{8}$.	BTL -4	Analyzing	CO2
10.	Find the Fourier series $f(x) = \begin{cases} l - \ x & 0 < x < l \\ 0 & l < x < 2l \end{cases}$ in $(0,2l)$	BTL -3	Applying	CO2
11.	Find the Half – range cosine series of $f(x) = x(\pi - x)$ in $0 < x < \pi$	BTL -4	Analyzing	CO2
12.	Compute the first two harmonics of the Fourier series of f(x) from the table given	BTL -3	Applying	CO2

x	0	$\pi/6$	$\pi/3$	$\pi/2$	$2\pi/3$	$5\pi/6$
f(x)	0	9.2	14.4	17.8	17.3	11.7

<table>
<tr><td>13.</td><td>Find the Fourier series up to second harmonic to represent the function given by the following data<table><tr><td>x</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr><tr><td>y</td><td>9</td><td>18</td><td>24</td><td>28</td><td>26</td><td>20</td></tr></table></td><td>BTL -3</td><td>Applying</td><td>CO2</td></tr>
<tr><td>14.</td><td><table><tr><td>t sec x:</td><td>0</td><td>T/6</td><td>T/3</td><td>T/2</td><td>2T/3</td><td>5T/6</td><td>T</td></tr><tr><td>A amps y:</td><td>1.98</td><td>1.30</td><td>1.05</td><td>1.30</td><td>-0.88</td><td>-0.25</td><td>1.98</td></tr></table>The table gives the time (t) in seconds as x and current (A) in amps as y, Obtain the first two harmonics from the given data.</td><td>BTL -3</td><td>Applying</td><td>CO2</td></tr>
<tr><td>15.</td><td>Find the Fourier cosine series up to second harmonic to represent the function given by the following data: $l = 6$<table><tr><td>x</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr><tr><td>y</td><td>4</td><td>8</td><td>15</td><td>7</td><td>6</td><td>2</td></tr></table></td><td>BTL -4</td><td>Analyzing</td><td>CO2</td></tr>
<tr><td>16.(a)</td><td>Express $f(x) = \begin{cases} K\ x & 0 < x < \frac{l}{2} \\ K(l - x) & \frac{l}{2} < x < l \end{cases}$ in a Half range Fourier cosine series.</td><td>BTL -2</td><td>Understanding</td><td>CO2</td></tr>
<tr><td>16.(b)</td><td>Find the Fourier series of $f(x) = |x|$ in $-\pi \leq x \leq \pi$.</td><td>BTL -4</td><td>Analyzing</td><td>CO2</td></tr>
<tr><td>17.</td><td>Express $f(x) = \begin{cases} x & 0 < x < \frac{\pi}{2} \\ (\pi - x) & \frac{\pi}{2} < x < \pi \end{cases}$ in a Half range Fourier sine series.Hence deduce the sum of the series that $\sum_{n=1}^{\infty} \frac{1}{(2n-1)^2}$</td><td>BTL -4</td><td>Analyzing</td><td>CO2</td></tr>
<tr><td>18.</td><td>Find the Fourier series for $f(x) = x^2$in $(-l, l)$.Hence show that $\frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \cdots .. = \frac{\pi^4}{6}$</td><td>BTL -3</td><td>Applying</td><td>CO2</td></tr>
<tr><td colspan="5">UNIT III - LAPLACE TRANSFORMS
Existence conditions – Transforms of elementary functions – Basic properties – Inverse transforms – Convolution theorem – Transform of periodic functions.</td></tr>
<tr><td colspan="4">PART-A(2 Mark Questions)</td><td></td></tr>
<tr><td>1.</td><td>State the sufficient conditions for the existence of Laplace transform.</td><td>BTL -1</td><td>Remembering</td><td>CO3</td></tr>
<tr><td>2.</td><td>State and prove change of scale property</td><td>BTL -1</td><td>Remembering</td><td>CO3</td></tr>
<tr><td>3.</td><td>Find $L(e^{-3t})$</td><td>BTL -1</td><td>Remembering</td><td>CO3</td></tr>
<tr><td>4.</td><td>Tell whether $L\left[\frac{\cos t}{t}\right]$ exist? Justify.</td><td>BTL -2</td><td>Understanding</td><td>CO3</td></tr>
<tr><td>5.</td><td>Give example of two functions for which Laplace Transform do not exist?</td><td>BTL -1</td><td>Remembering</td><td>CO3</td></tr>
<tr><td>6</td><td>Estimate L[t cost]</td><td>BTL -2</td><td>Understanding</td><td>CO3</td></tr>
<tr><td>7.</td><td>Estimate $L\left[\frac{\sin at}{t}\right]$</td><td>BTL -2</td><td>Understanding</td><td>CO3</td></tr>
<tr><td>8</td><td>Find $L((t-1)^2)$</td><td>BTL -1</td><td>Remembering</td><td>CO3</td></tr>
<tr><td>9.</td><td>Find $L(te^{-t})$</td><td>BTL -1</td><td>Remembering</td><td>CO3</td></tr>
<tr><td>10</td><td>Find L(t cosh3t)</td><td>BTL -2</td><td>Understanding</td><td>CO3</td></tr>
<tr><td>11.</td><td>Find L[t sinh2t]</td><td>BTL -2</td><td>Understanding</td><td>CO3</td></tr>
</table>

12.	Evaluate $L\left[\frac{e^t}{t}\right]$	BTL -1	Remembering	CO3
13.	Find $L\left[\frac{e^{at}-e^{-bt}}{t}\right]$	BTL -2	Understanding	CO3
14.	Find L[t cos at]	BTL -2	Understanding	CO3
15.	Define Inverse Laplace transforms	BTL -1	Remembering	CO3
16.	Define Laplace transform of periodic functions.	BTL -1	Remembering	CO3
17.	Find L(3e^{5t}+5cost)	BTL -2	Understanding	CO3
18.	Find L(sin2tcos4t)	BTL -2	Understanding	CO3
19.	Define convolution.	BTL -1	Remembering	CO3
20.	Evaluate $L^{-1}\left[\frac{1}{(s+2)^4}\right]$	BTL -1	Remembering	CO3
21.	Evaluate $L\left[\frac{e^t}{t}\right]$	BTL -2	Understanding	CO3
22.	Formulate$L^{-1}\left[\frac{1}{s(s-4)}\right]$	BTL -1	Remembering	CO3
23.	Find $L\left[\frac{1-e^t}{t}\right]$	BTL -2	Understanding	CO3
24.	Find $L^{-1}\left[\frac{s}{(s+4)(s+5)}\right]$	BTL -1	Remembering	CO3
25.	Find $L^{-1}\left[\log\frac{s+1}{s-1}\right]$	BTL -2	Understanding	CO3
	PART-B (16 Marks Questions)			
1.	Give L [f(t)], if f(t)=$\begin{cases} t, for 0 \le t \le 1 \\ 2-t, for 1 < t < 2 \end{cases}$and $f(t+2) = f(t)$), for all t.	BTL -3	Applying	CO3
2.	Find the Laplace transform of f(t) if $f(t) = e^t, 0 < t < 2\pi$ and $f(t+2\pi) = f(t)$	BTL -3	Applying	CO3
3.	Find the Laplace transform of the square- wave function of period a defined as f(t)=$\begin{cases} K, when 0 < t < a \\ -K, when a < t < 2a \end{cases}$and $f(t+2a) = f(t)$), for all t.	BTL -3	Applying	CO3
4.	Find the inverse Laplace Transform of log$\left(\frac{s^2+a^2}{s^2+b^2}\right)$	BTL -3	Applying	CO3
5.	Identify the Laplace transform of the square- wave function of period a defined as $f(t) = \begin{cases} 1, when 0 < t < a/2 \\ -1, when a/2 < t < a \end{cases}$	BTL -3	Applying	CO3
6.	Find f(t), if $L(f(t)) = \frac{s}{(s+5)^2}$	BTL -2	Understanding	CO3
7.(a)	Find the Laplace transform of the square- wave function of period 2 defined as f(t)=$\begin{cases} 1, when 0 < t < 1 \\ 0, when 1 < t < 2 \end{cases}$and $f(t+2) = f(t)$, for all t.	BTL -3	Applying	CO3
7.(b)	Evaluate $L\left[\frac{\cos at - coa\, bt}{t}\right]$	BTL -3	Applying	CO3
8.	Using Convolution theorem, Evaluate $L^{-1}\left[\frac{1}{s(s^2+1)}\right]$	BTL-5	Evaluating	CO3
9.	Estimate L[f(t)], if f(t)=$\begin{cases} \sin\omega t, for 0 < t < \frac{\pi}{\omega} \\ 0, for \frac{\pi}{\omega} < t < \frac{2\pi}{\omega} \end{cases}$ and $f\left(t+\frac{2\pi}{\omega}\right) = f(t)$, for all t.	BTL -4	Analyzing	CO3
10.	Using Convolution theorem calculate the inverse Laplace transform of $$L^{-1}\left[\frac{s^2}{(s^2+1)(s^2+4)}\right]$$	BTL- 6	Creating	CO3
11.(a)	Find the Laplace transform of f(t) if $f(t) = e^t, 0 < t < 2\pi$ and	BTL -4	Analyzing	CO3

	$f(t+2\pi)=f(t)$			
11.(b)	Identify the Laplace Transform of the function $\left[\frac{1-\cos t}{t}\right]$	BTL -4	Analyzing	CO3
12.	Using convolution theorem, find $L^{-1}\left[\frac{4}{(s^2+2s+5)^2}\right]$	BTL-4	Analyzing	CO3
13.	Estimate L[f(t)], if f(t)= $\begin{cases} \sin\omega t, for 0<t<\frac{\pi}{\omega} \\ 0, for \frac{\pi}{\omega}<t<\frac{2\pi}{\omega} \end{cases}$ and $f\left(t+\frac{2\pi}{\omega}\right)=f(t)$, for all t.	BTL -3	Applying	CO3
14.	Identify the Inverse Laplace transform of $\left[\tan^{-1}\left(\frac{2}{s}\right)+\cot^{-1}\left(\frac{s}{3}\right)\right]$	BTL-3	Applying	CO3
15.	Using Convolution theorem calculate the inverse Laplace transform of $L^{-1}\left[\frac{1}{(s+1)(s^2+1)}\right]$	BTL-4	Analyzing	CO3
16.	Give L [f(t)], if f(t)= $\begin{cases} t, for 0\le t\le c \\ 2c-t, for c<t<2c \end{cases}$ and $f(t+2c)=f(t)$, for all t.	BTL -3	Applying	CO3
17.	Using convolution theorem find (i) $L^{-1}\left[\frac{1}{(s+a)(s+b)}\right]$ (ii) $L^{-1}\left[\frac{2}{(s+1)(s^2+4)}\right]$	BTL-4	Analyzing	CO3
18.	Using Convolution theorem calculate the inverse Laplace transform of $L^{-1}\left[\frac{s^2}{(s^2+a^2)(s^2+b^2)}\right]$	BTL -3	Applying	CO3

UNIT –IV FOURIER TRANSFORM

Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity

PART-A(2 Mark Questions)

1.	State Fourier integral Theorem	BTL -1	Remembering	CO4
2.	Write Fourier transform pair.	BTL -1	Remembering	CO4
3.	If the Fourier transform of $f(x)$ is $F(s)=F[f(x)]$, then show that $F[f(x-a)]=e^{ias}F(s)$.	BTL -1	Remembering	CO4
4.	Find the Fourier Transform of $e^{-a\|x\|}$.	BTL -2	Understanding	CO4
5.	Find the Fourier Transform of $f(x)=\begin{cases} e^{ikx}, if a<x<b \\ 0, if x\le a \quad x>b \end{cases}$.	BTL -2	Understanding	CO4
6	State and Prove any one Modulation theorem on Fourier Transform	BTL -1	Remembering	CO4
7.	Define self-reciprocal with respect to Fourier Transform	BTL -1	Remembering	CO4
8	Prove that $F[f(ax)]=\frac{1}{a}F_s\left(\frac{s}{a}\right)$ if a>0.	BTL -1	Remembering	CO4
9.	If F(s) is the Fourier Transform of $f(x)$. Show that the Fourier Transform of $e^{iax}f(x) is F(s+a)$.	BTL -1	Remembering	CO4
10	Write Fourier Sine transform pair	BTL -1	Remembering	CO4
11.	Find the Fourier sine Transform of e^{-ax}.	BTL -2	Understanding	CO4
12.	Prove that $F_S[f(ax)]=\frac{1}{a}F_S\left(\frac{s}{a}\right)$	BTL -2	Understanding	CO4
13.	Find the Fourier sine transform of $\frac{1}{x}$.	BTL -2	Understanding	CO4

14.	Find the Fourier sine transform of f(x) = $\begin{cases} 1, & 0 \le x \le 1 \\ 0, & x > 1 \end{cases}$	BTL -2	Understanding	CO4
15.	Write Fourier Cosine transform pair	BTL -2	Understanding	CO4
16.	Find the Fourier cosine Transform of $e^{-2x} + 2e^{-x}$	BTL -1	Remembering	CO4
17.	Find the Fourier cosine transform of e^{-ax}.	BTL -2	Understanding	CO4
18.	Find the Fourier cosine Transform of f(x) = 2x in 0 < x < 4	BTL -2	Understanding	CO4
19.	Prove that $F_c[f(ax)] = \frac{1}{a} F_c\left(\frac{s}{a}\right)$	BTL -2	Understanding	CO4
20.	If $F(s) = F[f(x)]$, then find $F[xf(x)]$	BTL -3	Applying	CO4
21.	Find the Fourier cosine Transform of f(x) = $\begin{cases} x, & 0 \le x \le \pi \\ 0, & x > \pi \end{cases}$	BTL -2	Understanding	CO4
22.	Define Convolution of two functions f(x)*g(x).	BTL -2	Understanding	CO4
23.	State Convolution theorem for Fourier Transform	BTL -3	Applying	CO4
24.	State Parseval's Identity for Fourier Transform	BTL -2	Understanding	CO4
25.	State Parseval's Identity for Fourier sine and cosine transform.	BTL -2	Understanding	CO4
	PART-B (16 Mark Questions)			
1.	Find the Fourier Transform of $f(x) = \begin{cases} 1, \lvert x\rvert \le a \\ 0, \lvert x\rvert > a > 0 \end{cases}$ and hence evaluate $\int_0^\infty \left(\frac{\sin t}{t}\right) dt$. also using Parseval's Identity Prove that $\int_0^\infty \left(\frac{\sin t}{t}\right)^2 dt = \frac{\pi}{2}$	BTL -3	Applying	CO4
2.	Show that the Fourier Transform of $f(x) = \begin{cases} a - \lvert x\rvert, if \lvert x\rvert \le a \\ 0, if \lvert x\rvert > a > 0 \end{cases}$ is $\sqrt{\frac{2}{\pi}}\left(\frac{1-\cos as}{s^2}\right)$. Hence deduce that $(i) \int_0^\infty \left(\frac{\sin t}{t}\right)^2 dt = \frac{\pi}{2}, (ii) \int_0^\infty \left(\frac{\sin t}{t}\right)^4 dt = \frac{\pi}{3}$.	BTL -4	Analyzing	CO4
3.	Find the Fourier Transform of the function f(x) = $\begin{cases} 1 - \lvert x\rvert, if \lvert x\rvert \le 1 \\ 0, if \lvert x\rvert > 1 \end{cases}$ Hence deduce that (i) $\int_0^\infty \left(\frac{\sin t}{t}\right)^2 dt = \frac{\pi}{2} (ii) \int_0^\infty \left(\frac{\sin t}{t}\right)^4 dt = \frac{\pi}{3}$.	BTL -3	Applying	CO4
4.(a)	Show that the function $e^{\frac{-x^2}{2}}$ is self-reciprocal under the Fourier Transform.	BTL -3	Applying	CO4
4.(b)	Find the infinite Fourier sine transform of $\frac{1}{x}$.	BTL -3	Applying	CO4
5.	Find the Fourier Transform of $f(x) = \begin{cases} 1 - x^2, if \lvert x\rvert \le 1 \\ 0, if \lvert x\rvert > 1 \end{cases}$ Hence Show that $\int_0^\infty \left(\frac{\sin s - s\cos s}{s^3}\right) \cos\frac{s}{2} ds = \frac{3\pi}{16}$	BTL -3	Applying	CO4
6.(a)	Find $F_C\left[\frac{e^{-ax}}{x}\right]$ and hence find $F_C\left[\frac{e^{-ax} - e^{-bx}}{x}\right]$	BTL -3	Applying	CO4
6.(b)	Find the function whose Fourier Sine Transform is $\frac{e^{-as}}{s}, a > 0$	BTL -3	Applying	CO4

7.	Show that the Fourier transform of $f(x) = \begin{cases} a^2 - x^2, \lvert x\rvert < a \\ 0, \lvert x\rvert > a > 0 \end{cases}$ is $2\sqrt{\frac{2}{\pi}}\left(\frac{\sin as - as\cos as}{s^3}\right)$.Hence deduce that $(i) \int_0^\infty \left(\frac{\sin t - t\cos t}{t^3}\right) dt = \frac{\pi}{4}$ $(ii) \int_0^\infty \left(\frac{\sin t - t\cos t}{t^3}\right)^2 dt = \frac{\pi}{15}$.	BTL -4	Analyzing	CO4
8.(a)	Find the Fourier sine transform of e^{-ax} (a>0). Hence find $F_s[xe^{-ax}]$ and $F_s\left[\frac{e^{-ax}}{x}\right]$	BTL -4	Analyzing	CO4
8.(b)	Evaluate $\int_0^\infty \frac{dx}{(x^2+a^2)(x^2+b^2)}$ using Fourier Transform	BTL -3	Applying	CO4
9.	Find the Fourier Transform of $e^{-a\lvert x\rvert}$ and hence deduce that $(i) \int_0^\infty \frac{\cos xt}{a^2+t^2} dt = {}^{\pi}/_{2a}\, e^{-a\lvert x\rvert}$ $(ii) F\left[xe^{-a\lvert x\rvert}\right] = i\sqrt{\frac{2}{\pi}}\frac{2as}{(a^2+s^2)^2}$, here F stands for Fourier Transform.	BTL -4	Analyzing	CO4
10.(a)	Find the Fourier Transform of $e^{-\lvert x\rvert}$ and hence find the Fourier Transform of $f(x) = e^{-\lvert x\rvert} \cos 2x$.	BTL -4	Analyzing	CO4
10.(b)	Using Parseval's Identity evaluate $\int_0^\infty \frac{dx}{(x^2+25)(x^2+9)}$.	BTL -3	Applying	CO4
11.	Find the Fourier cosine & sine Transform of e^{-x}. Hence evaluate $$(i) \int_0^\infty \frac{1}{(x^2+1)^2} dx \;\; and \;\; (ii) \int_0^\infty \frac{x^2}{(x^2+1)^2} dx.$$	BTL -4	Analyzing	CO4
12.(a)	Prove that $F_c[xf(x)] = \frac{d}{ds}[F_s\{f(x)\}]$ and $F_s[xf(x)] = -\frac{d}{ds}[F_c\{f(x)\}]$	BTL -3	Applying	CO4
12.(b)	Find the Fourier Sine Transform of the function $$f(x) = \begin{cases} \sin x, 0 \le x < a \\ 0, x > a \end{cases}$$	BTL -3	Applying	CO4
13.	Using Fourier Sine transform prove that $\int_0^\infty \frac{x^2 dx}{(x^2+a^2)(x^2+b^2)} = \frac{\pi}{2(a+b)}$	BTL -4	Analyzing	CO4
14.(a)	Find the Fourier transform of $f(x) = \begin{cases} x, & \lvert x\rvert < a \\ 0, & \lvert x\rvert \ge a \end{cases}$	BTL -3	Applying	CO4
14.(b)	Find the Fourier cosine transform of f(x)= $\begin{cases} x, & 0 < x < 1 \\ 2 - x, & 1 < x < 2 \\ 0, & x > 2 \end{cases}$	BTL -3	Applying	CO4
15.	Find the Fourier transform of $f(x) = \begin{cases} 1, & \lvert x\rvert < 2 \\ 0, & \lvert x\rvert \ge 2 \end{cases}$ Hence deduce that $(i) \int_0^\infty \left(\frac{\sin t}{t}\right)^2 dt = \frac{\pi}{2}$, $(ii) \int_0^\infty \frac{\sin x}{x} dx$	BTL -4	Analyzing	CO4
16.(a)	Find the Fourier Transform of $f(x) = \begin{cases} e^{iax}, if 0 < x < 1 \\ 0, otherwise \end{cases}$.	BTL -4	Analyzing	CO4
16.(b)	Using transform methods evaluate $\int_0^\infty \frac{dx}{(x^2+1)(x^2+4)}$.	BTL -3	Applying	CO4
17.	Find the Fourier cosine transform of $e^{-a^2x^2}$ and hence find the Fourier cosine transform of $e^{\frac{-x^2}{2}}$	BTL -2	Understanding	CO4
18.	Using Parseval's Identity evaluate the following integrals. $(i) \int_0^\infty \frac{dx}{(a^2+x^2)^2}$, $(ii) \int_0^\infty \frac{x^2 dx}{(a^2+x^2)^2}$, $a > 0$.	BTL -3	Applying	CO4

UNIT –V: Z - TRANSFORMS AND DIFFERENCE EQUATIONS Z- transforms – Elementary properties – Inverse Z – transform (using partial fraction and residues) – Convolution theorem – Solution of difference equations using Z – transform.				
PART-A (2 Mark Questions)				
1.	Define Z – Transform of the sequence $\{f(n)\}$.	BTL -1	Remembering	CO5
2.	Find $Z(3^{n+2})$	BTL -2	Understanding	CO5
3.	Find $Z\left[\frac{a^n}{n!}\right]$	BTL -1	Remembering	CO5
4.	Find $Z\left[\frac{1}{n!}\right]$	BTL -2	Understanding	CO5
5.	Find $Z\left[\frac{1}{n(n+1)}\right]$	BTL -2	Understanding	CO5
6	Find $Z\left[\sin\frac{n\pi}{2}\right]$	BTL -2	Understanding	CO5
7.	Find the z – transform of n^2.	BTL -2	Understanding	CO5
8	Find $z(na^n)$	BTL -2	Understanding	CO5
9.	Find $z(a^n)$	BTL -2	Understanding	CO5
10	Find $z(n)$	BTL -2	Understanding	CO5
11.	Find Z transform of $\frac{1}{n}$	BTL -2	Understanding	CO5
12.	Find the Z ((n+1)(n+2))	BTL -2	Understanding	CO5
13.	Find $Z\left[\cos\frac{n\pi}{2}\right]$	BTL -2	Understanding	CO5
14.	Prove that $Z[a^n f(n)] = f(\frac{z}{a})$	BTL -1	Remembering	CO5
15.	Find$Z\left[\frac{1}{(n+1)!}\right]$	BTL -2	Understanding	CO5
16.	Find $Z[e^t \, sin\, 2\, t]$.	BTL -1	Remembering	CO5
17.	Find $z^{-1}[\frac{z}{(z+1)^2}]$	BTL -2	Understanding	CO5
18.	Find $z^{-1}[\frac{z}{(z-1)^2}]$	BTL -2	Understanding	CO5
19.	Find inverse Z transform of$\frac{z}{(z-1)(z-2)}$	BTL -1	Remembering	CO5
20.	Find $z^{-1}\left[\frac{z}{(z+4)(z+5)}\right]$	BTL -2	Understanding	CO5
21.	Prove that $Z[f(n+1)] = zF(z) - zf(0)$.	BTL -1	Remembering	CO5
22.	State Convolution theorem in Z – Transforms	BTL -1	Remembering	CO5
23.	Find the difference equation generated by $y_n = A2^{n+1}$.	BTL -2	Understanding	CO5
24.	Solve $y_{n+1} - 2y_n = 0$ given that $y_0 = 2$	BTL -2	Understanding	CO5
25.	Find the difference equation generated by $y_n = a + b3^n$.	BTL -2	Understanding	CO5
PART-B (16 Mark Questions)				
1.	Find the inverse Z – Transform of $\frac{z^2+z}{(z-1)(z^2+1)}$ by partial fraction method, and Cauchy Residue theorem.	BTL -3	Applying	CO5
2.(a)	Find the z transform of $f(n) = \frac{2n+3}{(n+1)(n+2)}$.	BTL -4	Analyzing	CO5
2.(b)	Find the inverse Z – Transform using partial fraction method of $\frac{z^2}{(z-3)(z-4)}$	BTL -4	Analyzing	CO5
3.	Using convolution theorem find the inverse Z – Transform of$\frac{\mathbf{12z^2}}{\mathbf{(3z-1)(4z+1)}}$	BTL -3	Applying	CO5

4.(a)	Using convolution theorem find inverse Z transform of $\left[\dfrac{z^2}{(z-a)(z-b)}\right]$	BTL -3	Applying	CO5
4.(b)	Using Z transform solve $y_{n+2} - 3y_{n+1} - 10y_n = 0$ with y(0) = 0,y(1) = 1.	BTL -3	Applying	CO5
5.	Form the difference equation, $y(k+3) - 3y(k+1) + 2y(k) = 0\ with\ y(0) = 4, y(1) = 0and\ y(2) = 8$	BTL -4	Analyzing	CO5
6.(a)	Using Residue theorem and Partial fraction method find the inverse Z transform of U(z)=$\left[\frac{z^2}{(z+2)(z+4)}\right]$	BTL -3	Applying	CO5
6.(b)	Solve $y_{n+2} + y_n = 2$ given that y(0) = 0, y(1) = 0	BTL -3	Applying	CO5
7.	Using Z transform solve $u_{n+2} + 6u_{n+1} + 9u_n = 2^n$ given that u(0) = 0,u(1) = 0	BTL -4	Analyzing	CO5
8.(a)	Using convolution theorem evaluate $Z^{-1}\left[\frac{z^2}{\left(z-\frac{1}{2}\right)\left(z-\frac{1}{4}\right)}\right]$	BTL -4	Analyzing	CO5
8.(b)	Find the z transform of $f(n) = \frac{4}{(n+2)(n+3)}$	BTL -3	Applying	CO5
9.	Solve the equation using Z – Transform $y_{n+2} - 5y_{n+1} + 6y_n =$ 36given that y(0) = y(1) = 0	BTL -4	Analyzing	CO5
10.(a)	Find the inverse Z-transform of $\left[\frac{z}{z^2+2z+2}\right]$ by residue theorem	BTL -4	Analyzing	CO5
10.(b)	Find inverse z-transform of $\frac{z^3}{(z-1)^2(z-2)}$ using partial fraction	BTL -3	Applying	CO5
11.	Solve $y_{n+2} - 4y_{n+1} + 4y_n = 0\ with\ y_0 = 1\ and\ y_1 = 0$, using Z-transform.	BTL -4	Analyzing	CO5
12.(a)	Find the z transform of $f(n) = \frac{1}{(n+1)(n+2)}$	BTL -3	Applying	CO5
12.(b)	Find the inverse Z-transform of $\left[\frac{z^2}{z^2+4}\right]$ by residue theorem	BTL -3	Applying	CO5
13.	Solve $y_{n+2} + 6y_{n+1} + 9y_n = 2^n\ with\ y_0 = 0\ and\ y_1 = 0$, using Z-transform.	BTL -4	Analyzing	CO5
14.(a)	Find $Z^{-1}\left(\frac{z^2}{z^2-7z+10}\right)$	BTL -3	Applying	CO5

14.(b)	Using Convolution theorem find $Z^{-1}\left[\frac{z^2}{(z+a)^2}\right]$.	BTL -3	Applying	CO5
15.	Solve$y_{n+2} - 7y_{n+1} + 12y_n = 2^n\ \ with\ y_0 = 0\ and\ y_1 = 0$, using Z-transform.	BTL -4	Analyzing	CO5
16.(a)	Find $Z^{-1}\left[\frac{z(z+1)}{(z-1)^3}\right]$ using residue theorem	BTL -4	Analyzing	CO5
16.(b)	Find z-transform of $\frac{1}{n(n+1)}$	BTL -3	Applying	CO5
17.	Solve$u_{n+2} - u_{n+1} + 6y_n = 4^n\ \ with\ u_0 = 0\ and\ u_1 = 1$, using Z-transform.	BTL -4	Analyzing	CO5
18.(a)	Find the inverse Z-transform of $\left[\frac{z^2-3z}{(z-5)(z+2)}\right]$ by residue theorem.	BTL -3	Applying	CO5
18.(b)	Using Z-transform solve $u_{n+2} - 3u_{n+1} + 2u_n = 0, given\ that\ u_0 = 0, u_1 = 1$	BTL -3	Applying	CO5

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