SRM VALLIAMMAI ENGINEERING COLLEGE
(An Autonomous Institution)

S.R.M. Nagar, Kattankulathur - 603203

DEPARTMENT OF MATHEMATICS

QUESTION BANK

III SEMESTER

AGRI, CIVIL, EEE, ECE, EIE, MDE, Mechanical

1918301 – Transforms and Partial Differential Equations

Regulation – 2019

Academic Year – 2022 - 2023

Prepared by

Dr. S.CHITRA, Assistant Professor / Mathematics
Dr. V. VIJAYALAKSHMI, Assistant Professor / Mathematics
Ms. S. RAMYA, Assistant Professor / Mathematics

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DEPARTMENT OF MATHEMATICS

SUBJECT : 1918301 – Transforms and Partial Differential Equation

SEM / YEAR: III / II year B.E. (COMMON TO AGRI, CIVIL, EEE, EIE, ECE, MDE)

UNIT I - Formation of partial differential equations - Solutions Lagrange's linear equation - Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

Q.No	Question	BT Level	Competence
	PART – A		
1.	Form a partial differential equation by eliminating the arbitrary constants 'a' and 'b' from $z = ax + by$	BTL -1	Remembering
2.	Form a partial differential equation by eliminating the arbitrary constants 'a' and 'b' from $z = ax^2 + by^2$.	BTL -1	Remembering
3.	Construct the partial differential equation of all spheres whose centers lie on the Z-axis.	BTL -1	Remembering
4.	Form a partial differential equation by eliminating the arbitrary constants 'a' and 'b' from $z = ax + by + ab$	BTL -2	Understanding
5.	Construct the partial differential equation of all spheres whose centers lie on the x – axis and radius 'b' units.	BTL -3	Applying
6	Form a partial differential equation by eliminating the arbitrary constants 'a' and 'b' from $z = ax^n + by^n$	BTL -3	Applying
7.	Find the PDE of all planes having equal intercepts on the x and y axis	BTL -2	Understanding
8	Form the partial differential equation by eliminating the arbitrary function f from $z = f(xy)$	BTL -2	Understanding
9.	Form the partial differential equation by eliminating the arbitrary function Φ from $\Phi(x^2 - y^2, z) = 0$	BTL -3	Applying
10	Form the partial differential equation by eliminating the arbitrary function f from $z = f(x/y)$	BTL -2	Understanding
11.	Form the partial differential equation by eliminating the arbitrary function f from $z = f(x + y)$	BTL -4	Analyzing
12.	Form the partial differential equation by eliminating the arbitrary function f from $z = f\left(\frac{xy}{z}\right)$	BTL -3	Applying
13.	Write the subsidiary equation for Lagrange's Linear Equation	BTL -4	Analyzing
14.	What is the general form of Lagrange's Linear Equation	BTL -2	Understanding
15.	Solve $(D^2 - 7DD' + 6D'^2)z = 0$	BTL -4	Analyzing
16.	Solve $(D^3 - D^2D' - 8DD'^2 + 12D'^3)z = 0$	BTL -1	Remembering
17.	Solve $(D^4 - D'^4)z = 0$	BTL -4	Analyzing
18.	Solve $(D - D')^3 z = 0$	BTL -2	Understanding
19.	Solve $(D^3 - 3DD'^2 + 2D'^3)z = 0$.	BTL -4	Analyzing

20.	Solve (. $D^2 - 2DD' - 3D'^2)z = 0$	BTL -3	Applying
21.	Solve $(D^2 - 6DD' + 9D'^2)z = 0$	BTL -2	Understanding
22.	Solve $\frac{\partial^2 z}{\partial x^2} - \frac{\partial^2 z}{\partial x \partial y} + \frac{\partial z}{\partial x} = 0$	BTL -4	Analyzing
23.	Solve $(D-1)(D-D'+1)z = 0$	BTL -3	Applying
24.	Solve $(D+D'-1)(D-2D'+3)z = 0$	BTL -2	Understanding
25.	Solve $((D+2D'$-5)($(D-3D'+2)z = 0$	BTL -4	Analyzing
	PART – B		
1.	Form the partial differential equation by eliminating arbitrary function Φ from$\Phi(x^2 + y^2 + z^2, ax + by + cz) = 0$	BTL -3	Applying
2.(a)	Find the partial differential equation by eliminating the arbitrary constants a, b, c from $\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$	BTL -5	Evaluating
2.(b)	Find the partial differential equation by eliminating the arbitrary functions from $z = f(x + 2y) + g(x - 2y)$	BTL -5	Evaluating
3.	Form the partial differential equation by eliminating arbitrary functions f and g from $z = xf(\frac{y}{x}) + yg(x)$	BTL -3	Applying
4.(a)	Form the partial differential equation by eliminating arbitrary function f and g from the relation $z = x f(x+t) + g(x + t)$	BTL -3	Applying
4.(b)	Solve $p \cot x + q \cot y = \cot z$	BTL -3	Applying
5(a)	Solve $x^2 p + y^2 q = z(x+y)$	BTL -3	Applying
5(b)	Solve $(y^2 + z^2)p - xyq + xz = 0$	BTL -3	Applying
6.(a)	Find the general solution of $(3z - 4y)p + (4x - 2z)q = 2y - 3x$	BTL -3	Applying
6.(b)	Solve $(D^2 - 5DD' + 6D'^2)z = y \sin x$	BTL -3	Applying
7.	Solve the partial differential equation $(x - 2z)p + (2z - y)q = x - y$	BTL -1	Remembering
8.(a)	Solve $(D^2 + DD' - 6D'^2)z = y \cos x$	BTL -4	Analyzing
8.(b)	Find the general solution of $(mz - ny)p + (nx - lz)q = ly - mx$	BTL -3	Applying
9.	Solve $(D^2 - DD' - 20D'^2)z = e^{5x+y} + \sin(4x - y)$.	BTL -5	Evaluating
10(a)	Solve $x(y^2 - z^2)p + y(z^2 - x^2)q = z(x^2 - y^2)$	BTL -6	Creating
10(b)	Solve $(D^3 - 2D^2D')z = 2e^{2x} + 3x^2y$	BTL -3	Applying
11.	Solve the Lagrange's equation $(x + 2z)p + (2xz - y)q = x^2 + y$	BTL -4	Analyzing
12(a)	Solve the PDE $x^2(y - z)p + y^2(z - x)q = z^2(x - y)$	BTL -3	Applying
12(b)	Solve $[D^3 + D^2D' - 4DD'^2 - 4D'^3]z = \cos(2x + y)$	BTL -3	Applying
13.	Solve $(D^2 + 2DD' + D'^2)z = x^2y + e^{x-y}$	BTL -4	Analyzing
14(a)	Solve $(y - z)p + (z - x)q = x - y$	BTL -3	Applying
14(b)	Find the general solution of $(D^2 + D'^2)z = x^2y^2$	BTL -3	Applying
15.	Solve $((D^2 - 4DD' + 4D'^2)z = e^{2x+y}$ + sin (x + y)	BTL -4	Analyzing
16(a)	Solve ptanx + qtany = tanz	BTL -4	Analyzing
16(b)	Solve $(D^3 - 7DD'^2 - 6D'^3)z = \sin(x + 2y)$	BTL -3	Applying
17.	Solve $(x^2 - y^2 - z^2)p + 2xy\, q = 2xz$	BTL -4	Analyzing
18(a)	Solve $px + qy = z$	BTL -3	Applying
18(b)	Solve $(D^2 + 3DD' + 2D'^2)z = xy + \cos(2x + y)$	BTL -3	Applying

PART – C			
1.	Solve $(x^2 - yz)p + (y^2 - xz)q = (z^2 - xy)$	BTL -4	Analyzing
2.	Solve $(D^2 - DD' - 2D'^2)z = 2x + 3y + e^{2x+4y}$	BTL -4	Analyzing
3.	Solve $(z^2 - y^2 - 2yz)p + (xy + zx)q = (xy - zx)$	BTL -2	Understanding
4.	Find the general solution of $(D^2 + 2DD' + D'^2)z = 2\cos y - x\sin y$	BTL -2	Understanding
5.	$Solve\ ((D^3 - D^2D' - DD'^2 - D'^3)z = e^{2x+y} + cos(x + y)$	BTL -3	Applying

UNIT II FOURIER SERIES:
Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Parseval's identity – Harmonic analysis.

Q.No.	Question	BT Level	Competence
	PART – A		
1.	State the Dirichlet's conditions for a function f(x) to be expanded as a Fourier series.	BTL -1	Remembering
2.	Does $f(x) = tanx$ possess a Fourier expansion?	BTL -1	Remembering
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
4.	Write a_0 , a_n in the expression $x + x^3$ as a Fourier series in (-l, l)	BTL -2	Understanding
5.	Determine the value of a_n in the Fourier series expansion of $f(x) = x^3$ in (-π, π).	BTL -3	Applying
6	Find b_n in the expansion of f$(x) = x^2$ as a Fourier series in $(-\pi, \pi)$	BTL -3	Applying
7.	Find the Fourier constant b_n for $xsinx$ in (-π, π).	BTL -2	Understanding
8	Find the constant term in the expansion of $f(x) = x^2 + x$ as a Fourier series in the interval (-π, π).	BTL -2	Understanding
9.	Find the value of b_n for f(x) = $\lvert x\rvert$in (-π, π)	BTL -3	Applying
10	Expand $f(x) = 1, in\ (0, \pi)$ as a half sine series.	BTL -2	Understanding
11.	Find the Fourier coefficient b_n for the function f (x) = $2x - x^2$ defined in the interval 0 < x < 2.	BTL -4	Analyzing
12.	Find the constant a_0 of the Fourier series for the function $f(x) = e^x$in $(0,2\pi)$	BTL -3	Applying
13.	Find the value of a_0 for f(x) = 1 + x + x^2 in (0, 2π)	BTL -4	Analyzing
14.	If the function $f(x) = x$ in the interval 0 < x < 2π then find the constant term of the Fourier series expansion of the function	BTL -2	Understanding
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 that value of $\sum_{n=1}^{\infty} \frac{1}{n^2}$.	BTL -4	Analyzing
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
17.	Write the fourier series for a function $f(x)$ defined in $-l < x < l$.	BTL -4	Analyzing
18.	Write down the Parseval's formula on Fourier coefficients	BTL -2	Understanding

19.	Find the root mean square value of f(x) = x^2 in (0,π)	BTL -4	Analyzing
20.	Find the RMS value of f(x) = x (l -x) in 0≤ $x \le l$	BTL -3	Applying
21.	Find the RMS value of f(x) = $x - x^4$ in (0, l)	BTL -2	Understanding
22.	Define the RMS value of a function f(x) over the interval (a, b)	BTL -4	Analyzing
23.	Find the R.M.S value of $f(x) = 1 - x$ in $0 < x < 1$.	BTL -3	Applying
24.	State Parseval's identity for the half-range cosine expansion of f(x) in (0,1).	BTL -2	Understanding
25.	What is meant by Harmonic Analysis?	BTL -4	Analyzing
	PART – B		
1.	Determine the Fourier series for the function $f(x) = xsinx \ in \ 0 < x < 2\pi.$	BTL -3	Applying
2.(a)	Expand $f(x) = \begin{cases} x, & 0 < x < 1 \\ 2 - x, & 1 < x < 2 \end{cases}$ as a series of cosines in the interval (0,2).	BTL -5	Evaluating
2.(b)	Find the half range sine series of $f(x) = 4x - x^2$ in the interval 0 < x < 4	BTL -5	Evaluating
3.	Find the Fourier series of $f(x) = x + x^2$ in (-π, π) with period 2 π. Hence deduce $\sum_{n=1}^{\infty} \frac{1}{n^2} = \frac{\pi^2}{6}$.	BTL -3	Applying
4.(a)	Find the Fourier series expansion of $f(x) = \begin{cases} x & for \ 0 \le x \le \pi \\ 2\pi - x & for \ \pi \le x \le 2\pi. \end{cases}$	BTL -3	Applying
4.(b)	Find the half range Fourier cosine series of $f(x) = (\pi - x)^2$ in the interval$(0, \pi)$. Hence Find the value of $\frac{1}{1^4} + \frac{1}{2^4} + \frac{1}{3^4} + \ldots$	BTL -3	Applying
5.	Obtain the Fourier series for $f(x) = \lvert sinx \rvert$ in the interval $(-\pi, \pi)$.	BTL -3	Applying
6.(a)	Obtain the Fourier series for the function f(x) given by $f(x) = \begin{cases} 1 - x, & -\pi < x < 0 \\ 1 + x, & 0 < x < \pi \end{cases}$ Hence deduce that $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \cdots = \frac{\pi^2}{8}$	BTL -3	Applying
6.(b)	Find the Fourier series of $f(x) = x(2 - x)$ in 0 < x < 3.	BTL -3	Applying
7.	By using Cosine series show that $\frac{\pi^4}{96} = 1 + \frac{1}{3^4} + \frac{1}{5^4} + \cdots$ for $f(x) = x \ in \ 0 < x < \pi$	BTL -1	Remembering
8.(a)	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
8.(b)	Find the half range cosine series for $f(x) = (x - 1)^2$ in the interval (0,1)	BTL -3	Applying
9.	Find the Fourier expansion of the following periodic function of period 4 $f(x) = \begin{cases} 2 + x, & -2 \le x \le 0 \\ 2 - x, & 0 \le x \le 2 \end{cases}$ Hence deduce that $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \cdots \infty = \frac{\pi^2}{8}$.	BTL -5	Evaluating
10.(a)	Find the Fourier series $f(x) = \begin{cases} l - x & 0 < x < l \\ 0 & l < x < 2l \end{cases}$ in $(0, 2l)$	BTL -6	Creating

<table>
<tr><td>10.(b)</td><td>Express $f(x) = \begin{cases} x & 0 < x < 1 \\ 2 - x & 1 < x < 2 \end{cases}$ in a Fourier cosine series.</td><td>BTL -3</td><td>Applying</td></tr>
<tr><td>11.</td><td>Find the Half – range cosine series of $f(x) = x(\pi - x)$ in $0 < x < \pi$ and Hence deduce that $\frac{1}{1^4} + \frac{1}{2^4} + \frac{1}{3^4} + = \frac{\pi^4}{90}$</td><td>BTL -4</td><td>Analyzing</td></tr>
<tr><td>12.(a)</td><td>Compute the first two harmonics of the Fourier series of f(x) from the table given
<table><tr><td>x</td><td>0</td><td>$\pi/3$</td><td>$2\pi/3$</td><td>π</td><td>$4\pi/3$</td><td>$5\pi/3$</td><td>2π</td></tr>
<tr><td>f(x)</td><td>1</td><td>1.4</td><td>1.9</td><td>1.7</td><td>1.5</td><td>1.2</td><td>1</td></tr></table></td><td>BTL -3</td><td>Applying</td></tr>
<tr><td>12.(b)</td><td>Express in a Fourier series for $f(x) = \begin{cases} 1 & 0 < x < \pi \\ 2 & \pi < x < 2\pi \end{cases}$</td><td>BTL -3</td><td>Applying</td></tr>
<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></tr>
<tr><td>14.(a)</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></tr>
<tr><td>14.(b)</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 -3</td><td>Applying</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></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 -4</td><td>Analyzing</td></tr>
<tr><td>16.(b)</td><td>Find the fourier series of $f(x) = x$ in $-\pi \le x \le \pi$.</td><td>BTL -3</td><td>Applying</td></tr>
<tr><td>17.</td><td>Find the Fourier series as far as the second harmonic to represent the function $f(x)$ With period 6 , $2l = 6$, $l = 3$.
<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 -4</td><td>Analyzing</td></tr>
<tr><td>18.(a)</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></tr>
<tr><td>18.(b)</td><td>Find the half range sine series of $f(x) = xcos\pi x$ in (0,1).</td><td>BTL -3</td><td>Applying</td></tr>
</table>

<table>
<tr><td colspan="4">PART – C</td></tr>
<tr><td>1.</td><td>Obtain the Fourier series for $f(x) = |cosx|$ in the interval $(-\pi, \pi)$.</td><td>BTL -4</td><td>Analyzing</td></tr>
<tr><td>2.</td><td>Calculate the first 3 harmonics of the Fourier of f(x) from the following data
<table>
<tr><td>X</td><td>0</td><td>30</td><td>60</td><td>90</td><td>120</td><td>150</td><td>180</td><td>210</td><td>240</td><td>270</td><td>300</td><td>330</td><td>360</td></tr>
<tr><td>f(x)</td><td>1.8</td><td>1.1</td><td>0.3</td><td>0.16</td><td>0.5</td><td>1.3</td><td>2.16</td><td>1.25</td><td>1.3</td><td>1.52</td><td>1.76</td><td>2</td><td>1.8</td></tr>
</table></td><td>BTL -4</td><td>Analyzing</td></tr>
<tr><td>3.</td><td>Find the Fourier series as far as the third harmonic to represent the function given in the following data:
<table>
<tr><td>x</td><td>0</td><td>π/3</td><td>2π/3</td><td>π</td><td>4 π /3</td><td>5π/3</td></tr>
<tr><td>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></tr>
</table></td><td>BTL -2</td><td>Understanding</td></tr>
<tr><td>4.</td><td>Find the half range cosine series for $f(x) = x$ in the interval$(0,4)$. Hence deduce the value of $\frac{1}{1^4} + \frac{1}{2^4} + \frac{1}{3^4} + \cdots$</td><td>BTL -2</td><td>Understanding</td></tr>
<tr><td>5.</td><td>Find the fourier series of $f(x) = x^2$ in $-\pi < x < \pi$ and Hence deduce that $\frac{1}{1^4} + \frac{1}{2^4} + \frac{1}{3^4} + = \frac{\pi^4}{90}$</td><td>BTL -3</td><td>Applying</td></tr>
<tr><td colspan="4">UNIT III -APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS
Classification of PDE – Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction in infinite plates(excluding insulated edges)</td></tr>
<tr><td>Q.No.</td><td>Question</td><td>BT Level</td><td>Competence</td></tr>
<tr><td colspan="4">PART – A</td></tr>
<tr><td>1.</td><td>Classify the PDE $u_{xx} + u_{xy} + u_{yy} = 0$</td><td>BTL -1</td><td>Remembering</td></tr>
<tr><td>2.</td><td>Classify the PDE $Z_{xx} + 2Z_{xy} + (1 - y^2)Z_{yy} + xZ_x + 3x^2yz - 2Z = 0$</td><td>BTL -1</td><td>Remembering</td></tr>
<tr><td>3.</td><td>Classify the pde $u_{xx} + u_{xy} = f(x, y)$.</td><td>BTL -1</td><td>Remembering</td></tr>
<tr><td>4.</td><td>Classify the pde $(1 - x^2)z_{xx} - 2xyz_{xy} + (1 - y^2)z_{yy} + xy^2z_y - 2z = 0$.</td><td>BTL -2</td><td>Understanding</td></tr>
<tr><td>5.</td><td>Classify the PDE $u_{xx} = u_{yy}$</td><td>BTL -3</td><td>Applying</td></tr>
<tr><td>6</td><td>Classify the PDE $u_{xy} = u_x u_y + xy$</td><td>BTL -3</td><td>Applying</td></tr>
<tr><td>7.</td><td>Classify the PDE $4u_{xx} + 4u_{xy} + u_{yy} - 6u_x - 8u_y = 0$</td><td>BTL -2</td><td>Understanding</td></tr>
<tr><td>8</td><td>What are the various solutions of one-dimensional wave equation</td><td>BTL -2</td><td>Understanding</td></tr>
<tr><td>9.</td><td>In the wave equation $\frac{\partial^2 y}{\partial t^2} = c^2 \frac{\partial^2 y}{\partial x^2}$ what does C^2 stand for?</td><td>BTL -3</td><td>Applying</td></tr>
<tr><td>10</td><td>What is the basic difference between the solutions of one-dimensional wave equation and one-dimensional heat equation with respect to the time?</td><td>BTL -2</td><td>Understanding</td></tr>
<tr><td>11.</td><td>Write down the initial conditions when a taut string of length $2l$ is fastened on both ends. The midpoint of the string is taken</td><td>BTL -4</td><td>Analyzing</td></tr>
</table>

	to a height b and released from the rest in that position		
12.	A slightly stretched string of length l has its ends fastened at x = 0 and x = l is initially in a position given by $y(x,0) = y_0 sin^3 \frac{\pi x}{l}$.If it is released from rest from this position, write the boundary conditions	BTL -3	Applying
13.	A tightly stretched string with end points $x = 0$ & $x = l$ is initially at rest in equilibrium position. If it is set vibrating giving each point velocity $\lambda x(l - x)$. Write the initial and boundary conditions	BTL -4	Analyzing
14.	If the ends of a string of length l are fixed at both sides. The midpoint of the string is displaced transversely through a height h and the string is released from rest, state the initial and boundary conditions	BTL -2	Understanding
15.	State the assumptions in deriving the one-dimensional heat equation	BTL -4	Analyzing
16.	What are the possible solutions of one-dimensional heat flow equation?	BTL -1	Remembering
17.	In the one-dimensional heat equation $\frac{\partial u}{\partial t} = C^2 \frac{\partial^2 u}{\partial x^2}$ what is C^2 ?	BTL -4	Analyzing
18.	The ends A and B of a rod of length 20 cm long have their temperature kept 30^0 C and 80^0 C until steady state prevails. Find the steady state temperature on the rod	BTL -2	Understanding
19.	An insulated rod of length 60 cm has its ends at A and B maintained at 20^0C and 80^0 C respectively. Find the steady state solution of the rod.	BTL -4	Analyzing
20.	An insulated rod of length l cm has its ends at A and B maintained at 0^0C and 80^0 C respectively. Find the steady state solution of the rod.	BTL -3	Applying
21.	Write down the three possible solutions of Laplace equation in two dimensions	BTL -2	Understanding
22.	Write down the governing equation of two-dimensional steady state heat equation.	BTL -4	Analyzing
23.	A rectangular plate with insulated surface is 10cm wide. The two long edges and one short edge are kept at0^0 C, while the temperature at short edge x =0 is given by $u = \begin{cases} 20y , & 0 \le y \le 5 \\ 20(10-y), & 5 \le y \le 10 \end{cases}$ Write the boundary conditions to solve two-dimensional heat flow equation.	BTL -3	Applying
24.	A plate is bounded by the lines x=0, y=0, x=l and y=l. Its faces are insulated. The edge coinciding with x-axis is kept at 100^0 C. The edge coinciding with y-axis at 50^0 C. The other 2 edges are kept at 0^0 C. write the boundary conditions that are needed for solving two-dimensional heat flow equation.	BTL -2	Understanding
25.	Define steady state condition heat flow.	BTL -4	Analyzing
PART – B			
1.	A tightly stretched string of length l is initially at rest in this equilibrium position and each of its points is given the	BTL -3	Applying

	velocity $v_0 \sin^3 \frac{\pi x}{l}$. Find the displacement $y(x,t)$.		
2.	A string is stretched and fastened to two points that are distinct string l apart. Motion is started by displacing the string into the form $y = k(lx - x^2)$ from which it is released at time t=0. Find the displacement of any point on the string at a distance of x from one end at time t.	BTL -5	Evaluating
3.	A tightly stretched string of length $2l$ is fastened at both ends. The Midpoint of the string is displaced by a distance b transversely and the string is released from rest in this position. Find an expression for the transverse displacement of the string at any time during the subsequent motion.	BTL -3	Applying
4.	A slightly stretched string of length l has its ends fastened at $x = 0$ and $x = l$ is initially in a position given by $y(x,0) = y_0 sin^3 \frac{\pi x}{l}$. If it is released from rest from this position, find the displacement y at any distance x from one end and at any time.	BTL -3	Applying
5.	A tightly stretched string with fixed end points $x = 0$ and $x = l$ is initially at rest in its equilibrium position. If it is set vibrating string giving each point a velocity $3x(l - x)$. Find the displacement of the string.	BTL -3	Applying
6.	A uniform string is stretched and fastened to two points l apart motion is started by displacing the string into the form of curve $y = asin\frac{\pi x}{l}$ at time t = 0 .Derive the expression for the displacement of any point of the string at a distance x from one end at time	BTL -3	Applying
7.	Solve $\frac{\partial u}{\partial t} = C^2 \frac{\partial^2 u}{\partial x^2}$ subject to the conditions (i)u(0, t)=0 for all $t \geq 0$ (ii) $u(l,t) = 0\ for\ all\ t \geq 0$ (iii)$u(x,0) = \begin{cases} x\ if\ 0 \leq x \leq \frac{l}{2} \\ l - x if \frac{l}{2} \leq x \leq l \end{cases}$	BTL -1	Remembering
8.	A rod 30 cm long has its ends A and B kept at 20^0 and 80^0 respectively until steady state conditions prevail. The temperature at each end is then suddenly reduced to 0^0C and kept so. Find the resulting temperature function u(x, t) taking x = 0 at A.	BTL -4	Analyzing
9.	A bar 10 cm long with insulated sides has its ends A and B maintained at temperature 50^0C and 100^0C respectively. Until steady state conditions prevail. The temperature at A is suddenly raised to 90^0C and at the same time lowered to 60^0C at B. Find the temperature distributed in the bar at time t.	BTL -5	Evaluating
10.	A rod 40 cm long has its ends A and B kept at 0^0 and 80^0 respectively until steady state conditions prevail. The temperature at each end B is then suddenly reduced to 40^0C and kept so, while at A the temperature is 0^o c. Find the resulting temperature function u(x, t) taking x = 0 at A	BTL -6	Creating

11.	A rod 20 cm long has its ends A and B kept at 20^0 and 80^0 respectively until steady state conditions prevail. The temperature at each end B is then suddenly reduced to 40^0C and kept so, while at A the temperature is raised to 60^o c. Find the resulting temperature distribution	BTL -4	Analyzing
12.	A rod of length 10 cm has its ends $A\ and\ B$ are kept at $0^0c\ and\ 100^0c$ respectively, until steady state condition prevails. The temperature of the end B is then suddenly reduced to 0^0 C and kept so, while that of the end A is kept at 0^0C. Find the subsequent temperature distribution u(x,t) in the rod.	BTL -3	Applying
13.	A square metal plate is bounded by the lines x = 0, x = a, y = 0, y = ∞. The edges x = a, y = 0, y = ∞ are kept at 0^0 temperature while the temperature at the edge y = a is 100^0 temperature. Find the steady state temperature distribution at in the plate.	BTL -4	Analyzing
14.	A rectangular plate with insulated surface is 10 cm wide and so long compared to its width that it may be considered infinite in length without introducing appreciable error. The temperature at short edge y=0 is given by $u = \begin{cases} 20x, & 0 \le x \le 5 \\ 20(10-x), & 5 \le x \le 10 \end{cases}$ and all the other three edges are kept at 0^0C. Find the steady state temperature at any point in the plate.	BTL -3	Applying
15.	An infinitely long rectangular plate with insulated surface is 10cm wide. The two long edges and one short edge are kept at 0^0C, while the other short edge x=0 is kept at temperature $u = \begin{cases} 20y, & 0 \le y \le 5 \\ 20(10-y), & 5 \le y \le 10 \end{cases}$. Find the steady state temperature distribution in the plate.	BTL -4	Analyzing
16.	A long rectangular plate with insulated surface is $l$cm . If the temperature along one short edge y=0 is u(x,0) =K(l x -x^2) degrees, for 0 < x < l , while the other 2 edges x=0 and x=l as well as the other short edge are kept at 0^0C, find the steady state temperature function $u(x,y)$.	BTL -4	Analyzing
17.	An infinitely long rectangular plate with insulated surfaces is 20 cm wide. The two long edges and one short edge are kept at 0^0C, while the other short edge x=0 is kept at temperature $u = \begin{cases} 10y & 0 \le y \le 10 \\ 10(20-y), & 10 \le y \le 20 \end{cases}$ Find the steady state temperature distribution in the plate.	BTL -4	Analyzing
18.	A rectangular plate with an insulated surface is 8cm wide and so long compared to its width that it may be considered as an infinite plate. If the temperature along the short edge y=0 is $u(x,0) = 100\,sin\left(\frac{\pi x}{8}\right), 0 \le x \le 8$, while two long edges x=0 and x=8 as well as the other short edge kept at 0^0. Find the steady state temperature at any point of the plate.	BTL -3	Applying
	PART – C		
1.	A tightly stretched string with fixed end points x=0 and x=l is initially at rest in its equilibrium position. If it is set vibrating	BTL -4	Analyzing

	giving each point a velocity $v = \begin{cases} \frac{2kx}{l} & in\ (0, l/2) \\ \frac{2k(l-x)}{l} & in\ (l/2, l) \end{cases}$, Find the displacement of a string at any distance x from one end at any time t.		
2.	A tightly stretched string of length l with fixed end points initially at rest in its equilibrium position. If it is set vibrating by giving each point a velocity $y_t(x,0) = v_0 sin\left(\frac{3\pi x}{l}\right) cos\left(\frac{\pi x}{l}\right)$ where 0 < x < l. Find the displacement of the string at a point at a distance x from one end at any instant " t".	BTL -4	Analyzing
3.	A string is tightly stretched between x = 0 and x = 20 is fastened at both ends. The midpoint of the string is taken to be a height and then released from rest in that position. Find the displacement of any point of the string x at any time t.	BTL -2	Understanding
4.	A bar 20 cm long with insulated sides has its ends A and B maintained at temperature 40^0C and 90^0C respectively, until steady state conditions prevail. The temperature at A is suddenly raised to 70^0C and at the same time lowered to 50^0C at B. Find the temperature distributed in the bar at time t.	BTL -2	Understanding
5.	A infinite rectangular plate with insulated surface is bounded by the lines x = 0, x = a, y = 0 and y= ∞. The temperature along the edge y = 0 kept at 100^o C, while the temperature along the other three edges are at 0^o C. Find the steady state temperature at any point in the plate.	BTL -3	Applying

UNIT –IV FOURIER TRANSFORM

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

Q.No.	**Question**	**BT Level**	**Competence**
	PART – A		
1.	State Fourier integral Theorem	BTL -1	Remembering
2.	Write Fourier transform pair.	BTL -1	Remembering
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
4.	Find the Fourier Transform of $e^{-a\|x\|}$.	BTL -2	Understanding
5.	Find the Fourier Transform of $f(x) = \begin{cases} e^{ikx}, & if\ \ a < x < b \\ 0, & if\ \ x \le a\ \&\ x > b \end{cases}$.	BTL -3	Applying
6	State and Prove any one Modulation theorem on Fourier Transform	BTL -3	Applying
7.	Define self-reciprocal with respect to Fourier Transform	BTL -2	Understanding
8	Prove that $F[f(ax)] = \frac{1}{a}F\left(\frac{s}{a}\right)$ if a>0.	BTL -2	Understanding
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 -3	Applying
10	Write Fourier Sine transform pair	BTL -2	Understanding

11.	Find the Fourier sine Transform of e^{-ax}.	BTL -4	Analyzing
12.	Prove that $F_S[f(ax)] = \frac{1}{a} F_S\left(\frac{s}{a}\right)$	BTL -3	Applying
13.	Find the Fourier sine transform of $\frac{1}{x}$.	BTL -4	Analyzing
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
15.	Write Fourier Cosine transform pair	BTL -4	Analyzing
16.	Find the Fourier cosine Transform of $e^{-2x} + 2e^{-x}$	BTL -1	Remembering
17.	Find the Fourier cosine transform of e^{-ax}.	BTL -4	Analyzing
18.	Find the Fourier cosine Transform of f(x) = 2x in 0 < x < 4	BTL -2	Understanding
19.	Prove that $F_c[f(ax)] = \frac{1}{a} F_c\left(\frac{s}{a}\right)$	BTL -4	Analyzing
20.	If $F(s) = F[f(x)]$, $then\ find\ F[xf(x)]$.	BTL -3	Applying
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
22.	Define Convolution of two functions f(x)*g(x).	BTL -4	Analyzing
23.	State Convolution theorem for Fourier Transform	BTL -3	Applying
24.	State Parseval's Identity for Fourier Transform	BTL -2	Understanding
25.	State Parseval's Identity for Fourier sine and cosine transform	BTL -4	Analyzing
	PART – B		
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
2.	Show that $x\, e^{-x^2/2}$ is self-reciprocal under the Fourier sine transform	BTL -5	Evaluating
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
4.(a)	Show that the function $e^{\frac{-x^2}{2}}$ is self-reciprocal under the Fourier Transform.	BTL -3	Applying
4.(b)	Find the infinite Fourier sine transform of $\frac{1}{x}$.	BTL -3	Applying
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
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
6.(b)	Find the function whose Fourier Sine Transform is $\frac{e^{-as}}{s}, a > 0$	BTL -3	Applying
7.	Find the Fourier sine and cosine transforms of x^{n-1}.Hence deduce that $\frac{1}{\sqrt{x}}$ is self reciprocal under both the transforms.	BTL -1	Remembering

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
8.(b)	Evaluate $\int_0^\infty \frac{dx}{(x^2+a^2)(x^2+b^2)}$ using Fourier Transform	BTL -3	Applying
9.	Find the Fourier Transform of $e^{-a\|x\|}$ and hence deduce that $(i)\int_0^\infty \frac{\cos xt}{a^2+t^2}dt = \pi/_{2a}\, e^{-a\|x\|}$ $(ii) F\left[xe^{-a\|x\|}\right]=i\sqrt{\frac{2}{\pi}}\frac{2as}{(a^2+s^2)^2}$, here F stands for Fourier Transform.	BTL -5	Evaluating
10.(a)	Find the Fourier Transform of $e^{-\|x\|}$ and hence find the Fourier Transform of $f(x)=e^{-\|x\|}\cos 2x$.	BTL -6	Creating
10.(b)	Using Parseval's Identity evaluate $\int_0^\infty \frac{dx}{(x^2+25)(x^2+9)}$.	BTL -3	Applying
11.	Find the Fourier cosine & sine Transform of e^{-x}. Hence evaluate $(i)\int_0^\infty \frac{1}{(x^2+1)^2}dx \text{ and } (ii)\int_0^\infty \frac{x^2}{(x^2+1)^2}dx.$	BTL -4	Analyzing
12.(a)	Provethat $F_c[xf(x)] = \frac{d}{ds}[F_s\{f(x)\}]$ and $F_s[xf(x)] = -\frac{d}{ds}[F_c\{f(x)\}]$	BTL -3	Applying
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
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
14.(a)	Find the Fourier transform of $f(x) = \begin{cases} x, & \|x\| < a \\ 0, & \|x\| \ge a \end{cases}$	BTL -3	Applying
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
15.	Find the Fourier transform of $f(x) = \begin{cases} 1, & \|x\| < 2 \\ 0, & \|x\| \ge 2 \end{cases}$ Hence deduce that $(i)\int_0^\infty \left(\frac{\sin t}{t}\right)^2 dt = \frac{\pi}{2}$, $(ii)\int_0^\infty \frac{\sin x}{x}dx = \frac{\pi}{2}$	BTL -4	Analyzing
16.(a)	Find the Fourier Transform of $f(x) = \begin{cases} e^{iax}, & if\ 0<x<1 \\ 0, & otherwise \end{cases}$.	BTL -4	Analyzing
16.(b)	Using transform methods evaluate $\int_0^\infty \frac{dx}{(x^2+1)(x^2+4)}$.	BTL -3	Applying
17.	Find the Fourier sine and cosine transform of f(x) = e^{-ax} and deduce the inversion formula	BTL -4	Analyzing
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
PART – C			
1.	Show that the Fourier Transform of $f(x) = \begin{cases} a-\|x\|, if\|x\| \le a \\ 0, if\|x\| > a > 0 \end{cases}$ is $\sqrt{\frac{2}{\pi}}\left(\frac{1-\cos as}{s^2}\right)$. Hence deduce that	BTL -4	Analyzing

	$(i)\int_0^\infty \left(\frac{\sin t}{t}\right)^2 dt = \frac{\pi}{2}, (ii)\int_0^\infty \left(\frac{\sin t}{t}\right)^4 dt = \frac{\pi}{3}.$		
2.	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
3.	State and Prove (i) Convolution Theorem (ii) Parseval's identity for Fourier Transform.	BTL -2	Understanding
4.	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
5.	Find the Fourier transform of $e^{-a^2x^2}$ and hence show that the function of $e^{\frac{-x^2}{2}}$ is self reciprocal	BTL -3	Applying

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.

Q.No.	**Question**	**BT Level**	**Competence**
	PART – A		
1.	Define Z – Transform of the sequence $\{f(n)\}$.	BTL -1	Remembering
2.	Find $Z(3^{n+2})$	BTL -1	Remembering
3.	Find $Z\left[\frac{a^n}{n!}\right]$	BTL -1	Remembering
4.	Find $Z\left[\frac{1}{n!}\right]$	BTL -2	Understanding
5.	Find $Z\left[\frac{1}{n(n+1)}\right]$	BTL -3	Applying
6	Find $Z\left[\sin\frac{n\pi}{2}\right]$	BTL -3	Applying
7.	Find the z – transform of n^2.	BTL -2	Understanding
8	Find $z(na^n)$	BTL -2	Understanding
9.	Find $z(a^n)$	BTL -3	Applying
10	Find $z(n)$	BTL -2	Understanding
11.	Find Z transform of $\frac{1}{n}$	BTL -4	Analyzing
12.	Find the Z ((n+1)(n+2))	BTL -3	Applying
13.	Find $Z\left[\cos\frac{n\pi}{2}\right]$	BTL -4	Analyzing
14.	Prove that $Z[a^n f(n)] = f(\frac{z}{a})$	BTL -2	Understanding
15.	Find$Z\left[\frac{1}{(n+1)!}\right]$	BTL -4	Analyzing
16.	Find $Z[e^t \sin 2t]$.	BTL -1	Remembering
17.	Find $z^{-1}[\frac{z}{(z+1)^2}]$	BTL -4	Analyzing

18.	Find $z^{-1}[\frac{z}{(z-1)^2}]$	BTL -2	Understanding
19.	Find inverse Z transform of $\frac{z}{(z-1)(z-2)}$	BTL -4	Analyzing
20.	Find $z^{-1}\left[\frac{z}{(z+4)(z+5)}\right]$	BTL -3	Applying
21.	Prove that $Z[f(n+1)] = zF(z) - zf(0)$.	BTL -2	Understanding
22.	State Convolution theorem in Z – Transforms	BTL -4	Analyzing
23.	Find the difference equation generated by $y_n = A2^{n+1}$.	BTL -3	Applying
24.	Solve $y_{n+1} - 2y_n = 0$ given that $y_0 = 2$	BTL -2	Understanding
25.	Find the difference equation generated by $y_n = a + b3^n$.	BTL -4	Analyzing
	PART – B		
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
2.(a)	Find the z transform of $f(n) = \frac{2n+3}{(n+1)(n+2)}$	BTL -5	Evaluating
2.(b)	Find the inverse Z – Transform using partial fraction method of $\frac{z^2}{(z-3)(z-4)}$	BTL -5	Evaluating
3.	Using convolution theorem find the inverse Z – Transform of $\frac{12z^2}{(3z-1)(4z+1)}$	BTL -3	Applying
4.(a)	Using convolution theorem find inverse Z transform of $\left[\frac{z^2}{(z-a)(z-b)}\right]$	BTL -3	Applying
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
5.	Form the difference equation, $y(k+3) - 3y(k+1) + 2y(k) = 0\ with$ $y(0) = 4, y(1) = 0 and\ y(2) = 8$	BTL -3	Applying
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
6.(b)	Solve $y_{n+2} + y_n = 2$ given that y(0) = 0, y(1) = 0	BTL -3	Applying
7.	Using Z transform solve $u_{n+2} + 6u_{n+1} + 9u_n = 2^n$ given that u(0) = 0,u(1) = 0	BTL -1	Remembering
8.(a)	Using convolution theorem evaluate $Z^{-1}\left[\frac{z^2}{(z-\frac{1}{2})(z-\frac{1}{4})}\right]$	BTL -4	Analyzing
8.(b)	Find the z transform of $f(n) = \frac{4}{(n+2)(n+3)}$	BTL -3	Applying
9.	Solve the equation using Z – Transform $y_{n+2} - 5y_{n+1} + 6y_n = 36$ given that y(0) = y(1) = 0	BTL -5	Evaluating
10.(a)	Find the inverse Z-transform of $\left[\frac{z}{z^2+2z+2}\right]$ by residue theorem	BTL -6	Creating
10.(b)	Find inverse z-transform of $\frac{z^3}{(z-1)^2(z-2)}$ using partial fraction	BTL -3	Applying
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
12.(a)	Find the z transform of $f(n) = \frac{1}{(n+1)(n+2)}$	BTL -3	Applying

12.(b)	Find the inverse Z-transform of $\left[\frac{z^2}{z^2+4}\right]$ by residue theorem	BTL -3	Applying
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
14.(a)	Find $Z^{-1}\left(\frac{z^2}{z^2-7z+10}\right)$	BTL -3	Applying
14.(b)	Using Convolution theorem find $Z^{-1}\left[\frac{z^2}{(z+a)^2}\right]$.	BTL -3	Applying
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
16.(a)	Find $Z^{-1}\left[\frac{z(z+1)}{(z-1)^3}\right]$ using residue theorem	BTL -4	Analyzing
16.(b)	Find z-transform of $\frac{1}{n(n+1)}$	BTL -3	Applying
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
18.(a)	Find the inverse Z-transform of $\left[\frac{z^2-3z}{(z-5)(z+2)}\right]$ by residue theorem.	BTL -3	Applying
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
	PART – C		
1.	Find$(i)Z[r^n \cos n\,\theta], (ii)Z[r^n \sin n\,\theta], (iii)Z(e^{-at} \cos b\,t)$	BTL -4	Analyzing
2(a)	Find inverse Z -Transform of $\frac{z^3}{(z-1)^2(z-2)}$ by the method of Partial fraction	BTL -4	Analyzing
2(b).	Find the $Z^{-1}\left(\frac{10z}{z^2-3z+2}\right)$	BTL -2	Understanding
3(a)	Using convolution theorem find $Z^{-1}\left[\frac{z^2}{(z-4)(z-5)}\right]$	BTL -2	Understanding
3(b)	Using Residue method find $Z^{-1}\left(\frac{z}{z^2-2z+2}\right)$	BTL -2	Understanding
4.	Solve $u_{n+2} + 4u_{n+1} + 3u_n = 3^n$, given that $u_0 = 0$ and $u_1 = 1$.	BTL -3	Applying
5.	Using the inversion intergral method (Residue theorem), find the inverse Z-transform of $U(z) = \frac{z^2}{(z+2)(z^2+4)}$.	BTL -6	Creating