MOHAMED SATHAK A.J. COLLEGE OF ENGINEERING

Third Semester Department of MECH and Civil

MA3351-Transforms and Partial Differential Equation

(Regulation 2021)

SUB CODE: MA3351

Time: *Unit-I-Question Bank* Maximum Marks:100

$PARTA(10X2 = 20marks)$

Attend All Question

1. From the partial differential equation $(x-a)^2 + (x-b)^2 + Z^2 = 1$
2. solve the PDE $pq = x$.
3. $(D^2 - 3DD' + D'^2)Z = 0$
4. Find particular integral of the equation $(D^2 - 3DD'^2 + 2D'^2) = e^{x-y}$
5. solve: $(D - D')^2$=o.
6. Eliminating a and b from $Z = (2x^2 + a)(3y - b)$ from the PDE
7. Solve $\frac{\partial^2 z}{\partial x^2} = siny$
8. Find the complete integral P(1+q)=qz
9. Solve $p + q = x - y$.
10.solve $p + q = sinx + siny$.
11. solve $pq = xy$
12.find the complete integral $\frac{z}{pq} = \frac{x}{q} + \frac{y}{pq} + \sqrt{pq}$

$PARTB(5X16 = 80)$

13. From the PDE by eliminating the arbitrary function from $Z = f(y + x) + xg(y + x)$
14. Form the PDE by eliminating the arbitrary function f and g from $z = xf(\frac{y}{x}) + yg(x)$.
14. Solve $Z = px + qy + p^2q^2$
16.(i) Solve $Z = px + qy + \sqrt{1 + q^2 + p^2}$
(ii). solve $Z = px + qy + p^2q^2$
17. (i). solve $pz - qz = z^2 + (x + y)^2$
(ii). solve $y^2p - qxy = x(z - 2y)^2$
18. solve: $(x^2 - yz)p + (y^2 - xy)q$
19. (i). Solve $(D^2 + 3DD' - 4D')z = cos(2x + y) + xy$
(ii). Solve $(D^2 + 3DD' - 4D')z = cos(x + 2y) + e^{2x+y}$

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Time: *UNIT-II-Question Bank* Maximum Marks:100

$PART A$–$(10X2 = 20marks)$

Attend All Question

1. Discuss the converges of the Fourier series .
2. write down the Dirichlet condition for Fourier series .
3. I f f(x) is an odd function of x in $(0, \ell)$ what are the a_0 and a_n .
4. Find the b_n of $f(x) = \int xsinxdx$.
5. If $f(x) = \frac{1}{2(\pi - x)}$, find the Fourier series of a_0 in the interval $(0, 2\pi)$.
6. Find the Complex of Fourier series for $f(x)$ in $(c, c + x)$.
7. If $f(x) = e^{ax}$, find the Fourier series of b_n in the interval $(0, \pi)$.
8. Find the R.M.S values of $f(x) = x^2$ in $-1 < x < 1$.
9. what is known as harmonic analysis.
10. state parseval's theorem on Fourier series.
11. Find the value of $a_0$for $f(x) = x^2 + 1$ the $0 < x < 1$
12. Find the Fourier sine series $f(x) = x$ in $(0, \pi)$

$PART B(5X16 = 80)$

13. Find the Fourier series for $f(x) = |x|$ when $\pi < x < \pi$ hence deduced the sum of the series $1 + \frac{1}{3^2} + \frac{1}{5^2} + ...$
14. Find the Fourier series of $f(x) = x^2 + x$ in the interval (π, π)
15. find the cosine series of $f(x) = xsinx$ x in $(0, \pi)$ and hence the find the value of $1 + \frac{2}{1.3} - \frac{2}{3.5} + \frac{2}{3.5} + ...$
16. Compute first two harmonic of Fourier series for f(x) from the table

X	0	$\frac{\pi}{3}$	$2\frac{\pi}{3}$	π	$\frac{4\pi}{3}$	$\frac{5\pi}{3}$	2π
y	0.8	0.6	o.4	0.7	0.9	1.1	0.8

17. The constant term and the first three harmonic of Fourier series for $y = f(x)$ using the following table

X	0	$\frac{\pi}{6}$	$\frac{\pi}{3}$	$\frac{\pi}{2}$	$\frac{2\pi}{3}$	$\frac{\pi}{6}$
y	10	12	15	20	17	11

18. The following gives the vibration of periodic current over a period

X	0	$\frac{T}{6}$	$\frac{T}{3}$	$\frac{T}{2}$	$\frac{2T}{3}$	$\frac{5T}{6}$	T
y	1.98	1.30	1.O6	1.30	-0.88	-0.5	1.98

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Time: *unit-III-Question Bank* Maximum Marks:100

$PARTA$–$(10X2 = 20marks)$

Attend All Question

1. List of all possible solution of one dimensional wave equation.
2. Find the steady steady state temperature distributions a rod of length $10cm$ whose ends $x = 0$ and $x = 10$ are kept at $20^{\cdot}C$ and $50^{\cdot}C$ respectively.
3.A road 30 cm long has its end A and B kept at $20^{\cdot}C$ and $80^{\cdot}C$ until steady conditions prevail. Determine at steady state
4. Write all possible solution of one dimensional Heat equation..
5. Classification the following $u_{xx} + (1 - x)u_{xy} - 2u_{yy} = 0$.
6. Classification the following $4u_{xx} + 4u_{xy} + 2u_x - u_y = 0$.
7. write the most suitable solution of one-dimensional wave equation state reason .
8. In the diffusion equation $\frac{\partial u}{\partial t} = \alpha^2 \frac{\partial^2 u}{\partial x^2}$ what is α^2 for.
9. Write all solution of Laplace's equation in Cartesian form.
10. write the boundary condition and initial condition for solving the vibration of string , if the string is subjected to initial displacement $f(x)$ and initial velocity $g(x)$.
11. Classify the following$3u_{xx} + 2u_{xy} + 5u_{yy} + xu_y = 0$
12. Classify the following$3u_{xx} + 4u_{xy} + 3u_{yy} - 2u_x = 0$

$PARTB(5X16 = 80)$

11. A string stretched and fastened to two points at a distance ℓ apart Motion is started by displacement the string in the form $y = 50(\ell x - x^2)$ from which it released at time $t = 0$. Fin the displacement at any point on the string at a distance x from one end at time t
12. A tightly stretched string with end point $x = 0$ and $x = \ell$ is initially in a position given by $y(x, 0) = y_0 sin^3(\frac{\pi x}{\ell})$. If it is released from rest from this position, find the displacement y at any time and at time any distance from the end $x = 0$ 13.A tightly stretched string of length Lhas its end its fixed at $x = 0$ and $x = L$ is initially in the the position given by $y(x, 0) = Asin^3(\frac{\pi x}{\ell})+Bsin^3(\frac{\pi x}{\ell})$. It is released from rest from this position to vibrate transversely. Find the displacement function $y(x, t)$
14. A string of length 2ℓ is tightly stretched and fixed at its ends at the point (0,0) and (2ℓ, 0) of the xy-plane. its made to vibrate transversely in the xy plane by giving to each of its point a transverse velocity v in the xy-plane where V is given by $v = kx0 \leq x < \ell : K(2\ell - x), \ell < x < 2l$. Find the expression for the transverse displacement of the string at any time t 15. A tightly stretched with fixed and end point $x = 0$ and $x = \ell$ is initially at rest in its equilibrium position. If it is set vibrating by giving each of its points $y = \lambda(\ell x - x^2)$ find $y(x, t)$
16. An uniformly long plate is bounded by two parallel edges $x = 0$ and $x = \ell$ and an end at right angles to them. the breath of edge $y = 0$ is ℓ and is maintained at temperature $f(x)$. Find the

steady state temperature at any point of the plate
15 (i)Discuss the solution of one dimensional heat equation
(i)Discuss the solution of the Laplace equation in two dimensional heat equation

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MA3351-Transforms and Partial Differential Equation

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Time: *unit-IV- Question Bank* Maximum Marks:100

1. State Inversion theorem for complex Fourier Transformation .
2. Write the Fourier transform of $f(x-a)$. .
3. Find the Fourier cosine transformation of e^{-2x} , $x > 0$.
4. Define Fourier sine and cosine Transform of f(x) .
5. Write down the parseval's identity For Fourier Transform.
6. Sate modulation theorem for Fourier Transform.
7.State the Fourier Transform of derivatives of function .
8. State Convolution theorem on Fourier Transform .
9. Prove that $F[e^{iax}] = F(s+a)$, where F[f(x)]=F(s).
10. state parseval's theorem on Fourier series.
11. State Fourier integral theorem
12. write the Parseval's identity for Fourier transform.

PARTB

13.Derived the parsevals identity for Fourier Transforms.
14 State and prove Convolution theorem in Fourier transform.
15. Show that $e^{\frac{-x^2}{2}}$ is self-reciprocal under Fourier transform.
16.Find the function if its sine transform is $\frac{e^{-ax}}{s}$. hence deduce $F_s^{-1}\left(\frac{1}{s}\right)$
17.Using Parsval's identity evaluate $\int_0^\infty \frac{x^2}{(x^2+a^2)}dx$
18. Find the Fourier cosine transform of $e^{a^2x^2}$. Hence show that the function is $e^{\frac{x^2}{2}}$ self reciprocal
19. Find the Fourier Cosine transform of e^{-ax}. Hence evaluate $\int_0^\infty \frac{x^2}{(x^2+a^2)(x^2+b^2)}dx$
18. Evaluate $\int_0^\infty \frac{dx}{(x^2+a^2)^2}$ using parseval's identity 19. Find the Fourier sine and cosine transforms of $f(x) = e^{-ax}$. Hence deduce the inverse formula.
Find the Fourier sine and cosine transforms of x^n. Hence deduce prove $\frac{1}{\sqrt{x}}$ is self reciprocal under Fourier sine and cosine,

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Time: *Unit-V- Question Bank* Maximum Marks:100

1. State the initial value theorem on Z transform.
2. Fine the Z transform of $Cos^2 t$.
3.Derive the difference equation from $y_n = (A + Bn)(2)^n$.
4. Solve $y_{n+1} - 2y_n = 0$ given y(0)=3.
5. State shifting theorem on Z transforms.
6. Find the Z transform of n^2.
7. State convolution theorem on Z transforms.
8. State final value theorem on Z transform.
9. Find Z transform of $\left(\frac{1}{n(n-1)}\right)^2$.
10. Find the Z transform of $\left(\frac{1}{n!}\right)$.
11. Find the Z transform of $Z[\frac{a^n}{n}]$
12. State the initial value theorem on Z transform.

PARTB

13. State and prove the second shifting theorem on Z transform.
14. State and the final value theorem on Z transform
15. Find the Z transformation of i. $\frac{1}{n(n+1)}$ (ii). $e^{-t}t^2$
16. Using partial fraction method. Find $Z^{-1}\left[\frac{Z^2}{(Z+2)(Z^2+4)}\right]$,
(ii) Find$Z^{-1}\left[\frac{z^2-3z}{(Z+2)(Z-5)}\right]$ by residue method
17. Using convolution theorem, find the inverse Z transform of $\frac{8z^2}{(2z-1)(4z+1)}$
18. Using convolution theorem, find the inverse Z transform of $\frac{z^2}{(z-2)(z-3)}$
19. solve using Z transform $y_{n+2} - 4y_{n+1} - 10y_n$, given $y_0 = 2$ and $y_1 = 4$
20. solve using Z transform $y_{n+2} - 6y_{n+1} - 9y_n$, given $y_0 = 2$ and $y_1 = 0$