Q. Code:575700

Reg. No. | | | | | | | | | | | | | |

B.E. / B.TECH. DEGREE EXAMINATIONS, MAY 2024

Third Semester

MA22357 – TRANSFORMS AND DIFFERENTIAL EQUATIONS

(Mechanical Engineering)

(Regulation 2022)

TIME: 3 HOURS **MAX. MARKS: 100**

COURSE OUTCOMES	STATEMENT	RBT LEVEL
CO 1	Model any periodic signal with a combination of sines and cosines.	3
CO 2	Mathematically formulate, and thus aid the solution of physical and other problems involving functions of several variables.	3
CO 3	Understanding the theory of ordinary differential equations through applications.	3
CO 4	Learning analytical method for solving boundary value problems.	3
CO 5	Use the Z-transform as a mathematical tool which is used to convert the difference equations in time domain into the algebraic equations in Z- domain.	3

PART- A (20 x 2 = 40 Marks)

(Answer all Questions)

		CO	RBT LEVEL
1.	Find the Fourier constant b_n for $f(x)=x\sin x \ \ in\ (-\pi,\pi)$.	1	2
2.	Does $f(x)=\tan x$ possess a Fourier series? Justify.	1	2
3.	If $f(x)=2x$ in the interval (0,4), find the value of a_2 in the Fourier Series expansion.	1	2
4.	Find the root mean square value of $f(x)=\pi-x \ \ in\ \ 0<x<2\pi$.	1	2
5.	Find the PDE of all planes passing through the origin.	2	2
6.	Form the PDE by eliminating arbitrary function from $z=f(x^2+y^2)$	2	2
7.	Solve p+q=pq	2	2
8.	Solve $\frac{\partial^2 z}{\partial y^2}=0$	2	2

9.	What are orthogonal trajectories?	**3**	**2**
10.	Explain neutral axis.	**3**	**2**
11.	A particle is executing simple harmonic motion with amplitude 20 cm and time 4 seconds. Find the time required by the particle in passing between points which are at distances 15 cm and 5 cm from the centre of force and are on the same side of it.	**3**	**2**
12.	Write any two applications of linear differential equations.	**3**	**2**
13.	What is the constant a^2 in the wave equation $u_{tt}=a^2 u_{xx}$?	**4**	**2**
14.	What are the possible solutions of one dimensional wave equation?	**4**	**2**
15.	Find the nature of the PDE $u_{xy}=u_x+u_y+xy$.	**4**	**2**
16.	The bar of length 50 cm has its ends at $20^\circ C$ and $100^\circ C$ until steady state condition prevails. Find the steady state temperature of the rod.	**4**	**2**
17.	Find $Z(a^n)$	**5**	**2**
18.	Find $Z\left(\frac{1}{n!}\right)$	**5**	**2**
19.	$Z^{-1}\left(\frac{z}{(z-1)(z-2)}\right)$.	**5**	**2**
20.	Form the difference equation whose solution is $y_n=(A+Bn)2^n$.	**5**	**2**

PART- B (5 x 10 = 50 Marks)

		Marks	CO	RBT LEVEL
21. (a)	Find the half range Fourier Sine Series of $f(x)=x \ \ in \ (0,l)$	**(10)**	**1**	**3**
	(OR)			
(b)	Find the first two harmonics of the Fourier Series from the table	**(10)**	**1**	**3**

x	0	1	2	3	4	5
y	9	18	24	28	26	20

			Marks	CO	RBT Level
22.	**(a)**	Solve $x(y-z)p+y(z-x)q=z(x-y)$	**(10)**	**2**	**3**
		(OR)			
	(b)	Solve $\frac{\partial^3 z}{\partial x^3}-2\frac{\partial^3 z}{\partial x^2 \partial y}=2e^{2x}+3x^2 y$	**(10)**	**2**	**3**
23.	**(a)**	Find the orthogonal trajectories of the family of curves $\frac{x^2}{a^2}+\frac{y^2}{b^2+\lambda}=1$ where λ is a parameter.	**(10)**	**3**	**3**
		(OR)			
	(b)	A moving body opposed by a force per unit mass of value Cx and resistance per unit mass of value bv^2, where x and v are the displacement and velocity of the particle, if it starts from rest is given by $v^2=\frac{C}{2b^2}\left(1-e^{-2bx}\right)-\frac{Cx}{b}$	**(10)**	**3**	**3**
24.	**(a)**	A tightly stretched string with fixed end points x=0 and x=l is initially at rest in equilibrium position. If it is set vibrating giving each point a velocity $\lambda x(l-x)$, find the displacement of any point on the string at a distance from one end at any time t.	**(10)**	**4**	**3**
		(OR)			
	(b)	An infinitely long plate in the form of an area enclosed between the lines y=0 and y=π for the positive values of x. The temperature is zero along the edges y=0 and y=π and the edge at infinity. If the edge x=0 is kept at the temperature f(y) = ky, 0 < y < π, Find the steady state temperature distribution in the plate.	**(10)**	**4**	**3**
25.	**(a)**	Find $Z(\cos n\theta)$ *and* $Z\left(\cos\frac{n\pi}{2}\right)$	**(10)**	**5**	**3**
		(OR)			
	(b)	Find $Z^{-1}\left(\frac{z^3}{(z-1)^2(z-2)}\right)$.	**(10)**	**5**	**3**

<u>PART- C (1 x 10 = 10 Marks)</u>

(Q.No.26 is compulsory)

Marks **CO** **RBT LEVEL**

26. Find Fourier Series of $f(x)=\begin{cases} 1\ , & 0<x<\pi \\ 2\ , & \pi<x<2\pi \end{cases}$ **(10)** **1** 3

****