Q. Code:471505

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

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

Third Semester

MA22351 – APPLIED MATHEMATICS III

(Chemical Engineering)

(Regulation 2022)

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

COURSE OUTCOMES	STATEMENT	RBT LEVEL
CO 1	Develop skills in dealing with problems on ordinary differential equations and apply knowledge of LDE to solve the problems in Chemical engineering.	3
CO 2	Classify, formulate and solve the first order and second order linear, non-linear partial differential equations and apply the knowledge of partial differential equations to solve the engineering problems.	3
CO 3	Achieve an understanding of the basic concepts of periodic function and method of solving problems in Fourier series.	3
CO 4	Analyze and evaluate various partial differential equations such as wave equation, one- and two-dimensional heat flow equations.	3
CO 5	Develops the skill of conversion between time domain to frequency domain using the concept of Fourier Transforms and Z-transform.	3

PART- A (20 x 2 = 40 Marks)

(Answer all Questions)

		CO	RBT LEVEL
1.	How do you find the neutral axis of the beam?	1	2
2.	State any two applications of linear differential equation.	1	2
3.	Write a brief note on deflection curve.	1	2
4.	Show that the curve in which the portion of the tangent included between the co-ordinate axes is bisected at the point of contact is a rectangular hyperbola.	1	2
5.	Form the PDE by eliminating the arbitrary constants from $z=(x^2+a^2)(y^2+b^2)$.	2	2
6.	Find the PDE of all planes passing through the origin.	2	2
7.	Form the PDE by eliminating the arbitrary functions from $z=f(xy/z)$.	2	2
8.	Solve $\frac{\partial^2 z}{\partial y^2}=0$.	2	2

9.	Find the root mean square value of $f(x)=x^2$ in the interval $(0,\pi)$.	**3**	**2**
10.	Find the constant term in the Fourier series expansion of $f(x)=x^2-2$ in $(-2,2)$.	**3**	**2**
11.	Determine the value of a_n in the Fourier series expansion of $f(x)=x^3$ in $-\pi<x<\pi$.	**3**	**2**
12.	What do you mean by Harmonic Analysis?	**3**	**2**
13.	In the diffusion equation $\frac{\partial u}{\partial t}=\alpha^2\frac{\partial^2 u}{\partial x^2}$ what does α^2 stand for?	**4**	**2**
14.	What are the possible solutions of one dimensional wave equation?	**4**	**2**
15.	Find the nature of the PDE $4u_{xx}+4u_{xy}+u_{yy}+2u_x-u_y=0$.	**4**	**2**
16.	The ends A and B of a rod of length 10cm long have their temperature kept at $20^\circ c$ and $70^\circ c$. Find the steady state temperature distribution on the rod.	**4**	**2**
17.	Find the Fourier sine transform of $e^{-ax}, a>0$. Hence find $F_s[xe^{-ax}]$.	**5**	**2**
18.	Prove that $F_c(f(ax))=\frac{1}{a}F_c\left(\frac{s}{a}\right), a\neq 0$	**5**	**2**
19.	Find $Z[n]$.	**5**	**2**
20.	Form the difference equation by eliminating arbitrary constant from $y_n=A.2^n+B.3^n$.	**5**	**2**

PART- B (5 x 10 = 50 Marks)

		Marks	CO	RBT LEVEL
21. (a)	Find the orthogonal trajectories of the cardioids $r=a(1-cos\theta)$.	**(10)**	**1**	**3**
	(OR)			
(b)	The deflection of a strut of length l with one end $(x=0)$ built in and the other supported and subjected to end thrust P, satisfies the equation $\frac{d^2y}{dx^2}+a^2y=\frac{a^2R}{P}(1-x)$. Prove that the deflection curve is $y=\frac{R}{P}\left[\frac{\sin ax}{a}-l\cos ax+l-x\right]$ where $al=\tan al$.	**(10)**	**1**	**3**
22.(a) (i)	Solve $p\tan x+q\tan y=\tan z$.	**(5)**	**2**	**3**
(ii)	Solve .	**(5)**	**2**	**3**
	(OR)			

(b) Solve $\frac{\partial^3 z}{\partial x^3}-2\frac{\partial^3 z}{\partial x^2 \partial y}=2e^{2x}+3x^2y$. **(10)** **2** **3**

23. (a) Expand $f(x)=x(\pi-x)$ in $0<x<\pi$ as half range Fourier Sine Series. Deduce that $\frac{1}{1^4}+\frac{1}{2^4}+\frac{1}{3^4}+\ldots=\frac{\pi^4}{90}$. **(10)** **3** **3**

(OR)

(b) Find a Fourier series up to the second harmonic to represent $f(x)$ in terms of x for the following table values. **(10)** **3** **3**

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

24. (a) A tightly stretched flexible string has its ends fixed at $x=0$ and $x=l$. At time $t=0$, the string is given a shape defined by $f(x)=kx^2(l-x)$, where k is a constant, and then released from rest. Find the displacement of any point x of the string at anytime $t>0$. **(10)** **4** **3**

(OR)

(b) An infinitely long rectangular plate with insulated surfaces is 10 cm wide. The two long edges and one short edge are kept at zero temperature while the other short edge x = 0 is kept at temperature $u(0,y)=¿20y \quad for\ 0\leq y\leq 5¿¿¿¿$. Find the steady state temperature distribution in the plate. **(10)** **4** **3**

25. (a) Find the Fourier cosine transform of e^{-4x}. Deduce that $\int_0^\infty \frac{\cos 2x\,dx}{x^2+16}=\frac{\pi e^{-8}}{8}$ and $\int_0^\infty \frac{x\sin 2x\,dx}{x^2+16}=\frac{\pi e^{-8}}{2}$. **(10)** **5** **3**

(OR)

(b) Solve using Z-transforms technique the difference equation $y_{n+2}-7y_{n+1}+12y_n=2^n$ with $y_0=0=y_1$ **(10)** **5** **3**

PART- C (1 x 10 = 10 Marks)

(Q.No.26 is compulsory)

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

26.	Find the Fourier cosine transform of $e^{-a^2x^2}$ and hence show that $e^{\frac{-x^2}{2}}$ is self-reciprocal with respect to the Fourier cosine Transform.	**(10)**	**5**	**3**

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