Q. Code:990564

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

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

Third Semester

MA18351 – ENGINEERING MATHEMATICS-III

(Common to All Branches except MR)

(Regulation 2018 & 2018A)

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

CO 1 Express proficiency in handling higher order Partial differential equations.
CO 2 Acquire the skill in examining a signal in another domain rather in the original domain by handling Full and Half Range Fourier Series.
CO 3 Develop skills in classification, formulation, solution, and interpretation of PDE models.
CO 4 Develops the skill of conversion between time domain to frequency domain using the concept of Fourier Transforms.
CO 5 Apply the systematic method for finding the impulse response of LTI systems described by difference equations: partial fraction expansion.

PART- A (10 x 2 = 20 Marks)

(Answer all Questions)

		CO	RBT LEVEL
1	Form the PDE of the following by eliminating arbitrary constants from $(x-a)^2+(y-b)^2=z^2\cot^2\alpha$	**1**	**2**
2	Solve $\sqrt{p}+\sqrt{q}=1$	**1**	**2**
3	Determine the value of a_n in the Fourier series expansion of $f(x)=x^3$ in $-\pi<x<\pi$.	**2**	**2**
4	Find the root mean square value of $f(x)=x^2$ in the interval $(0,\pi)$.	**2**	**2**
5	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.	**3**	**2**
6	How many conditions are required to solve $u_t=\alpha^2 u_{xx}$.	**3**	**1**
7	If $F[f(x)]=F(s)$, prove that $F[f(ax)]=\frac{1}{\lvert a\rvert}F\left(\frac{s}{a}\right)$.	**4**	**1**
8	Find the Fourier sine transform of $3e^{-2x}$.	**4**	**2**
9	Evaluate $Z^{-1}\left[\frac{z}{z^2+7z+10}\right]$.	**5**	**2**
10	Form difference equation from $U_n=a2^{n+1}$.	**5**	**2**

PART- B (5 x 14 = 70 Marks)
(Restrict to a maximum of TWO subdivisions)

			Marks	CO	RBT LEVEL
11(a)	**(i)**	Find the singular integral of $z=px+qy+\sqrt{1+p^2+q^2}$	**(7)**	**1**	**3**
	(ii)	Solve $x(y-z)p+y(z-x)q=z(x-y)$	**(7)**	**1**	**3**
		(OR)			
11(b)	**(i)**	Solve $\frac{\partial^2 z}{\partial x^2}+\frac{\partial^2 z}{\partial xy}-6\frac{\partial^2 z}{\partial y^2}=\cos(2x+y)+e^{x-y}$	**(7)**	**1**	**3**
	(ii)	Form the PDE of the following by eliminating arbitrary functions from $\varphi\left[z^2-xy,\ \frac{x}{z}\right]=0$	**(7)**	**1**	**3**
12(a)	**(i)**	Find the Fourier series expansion of $f(x)=\pi x \quad \text{in } 0\le x\le 1$ in the interval (0, 1).	**(7)**	**2**	**3**
	(ii)	Find the Fourier series expansion of $f(x)=x^2$ in $-\pi<x<\pi$. Hence prove $\frac{\pi^4}{90}=1+\frac{1}{2^4}+\frac{1}{3^4}+\ldots$	**(7)**	**2**	**3**
		(OR)			
12(b)	**(i)**	Find the half range cosine series of $f(x)=(x-2)^2$ in $0<x<2$.	**(7)**	**2**	**3**
	(ii)	Find the Fourier series up to second harmonic from the following data.	**(7)**	**2**	**3**

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

13(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.	**(14)**	**3**	**3**
	(OR)			
13(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.	**(14)**	**3**	**3**

$$u(x,t)=\begin{cases}20y & \text{for } 0\le y\le 5\end{cases}$$

Find the steady state temperature distribution in the plate.

14(a)	Find the Fourier transform of f (x) defined as $f(x)=\begin{cases}a-\lvert x\rvert, & \text{for } \lvert x\rvert<a\end{cases}$ Hence show that $\int_0^\infty \left(\frac{\sin t}{t}\right)^2 dt=\frac{\pi}{2}$ and $\int_0^\infty \left(\frac{\sin t}{t}\right)^4 dt=\frac{\pi}{3}$.	**(14)**	**4**	**3**
	(OR)			
14(b)	**(i)** Find the Fourier sine transforms of $f(x)=\begin{cases}x, & \text{for } 0<x<1\\ 2-x, & \text{for } 1<x<2\end{cases}$	**(7)**	**4**	**3**
	(ii) Using Fourier Transform technique evaluate $\int_0^\infty \frac{dx}{(a^2+x^2)(b^2+x^2)}$.	**(7)**	**4**	**3**
15(a)	**(i)** Find the Z-transform of $\frac{1}{(n+1)(n+2)}$	**(7)**	**5**	**3**
	(ii) Using Convolution theorem find inverse Z-transforms of $\frac{z^2}{(z-a)(z-b)}$	**(7)**	**5**	**3**
	(OR)			
15(b)	Solve the following difference equations using z-transforms $u_{n+2}+4u_{n+1}+3u_n=3^n$ With $u_0=0,\ u_1=1.$	**(14)**	**5**	**3**

PART- C (1 x 10 = 10 Marks)

(Q.No.16 is compulsory)

		Marks	CO	RBT LEVEL
16	Using partial fractions find inverse Z-transforms of $\frac{z^3+3z}{(z-1)^2(z^2+1)}$	**(10)**	**5**	**3**

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