Reg. No.															

4 3

B.Tech. DEGREE EXAMINATION, DECEMBER 2022

Three Semester

18MAB201T – TRANSFORMS AND BOUNDARY VALUE PROBLEMS

(For the candidates admitted from the academic year 2018-2019 to 2021-2022)

Note:

(i) **Part - A** should be answered in OMR sheet within first 40 minutes and OMR sheet should be handed over to hall invigilator at the end of 40th minute.

(ii) **Part - B** should be answered in answer booklet.

Time: 2½ Hours | Max. Marks: 75

PART – A (25 × 1 = 25 Marks)

Answer **ALL** Questions

		Marks	BL	CO	PO
1.	The complete integral of $q = 2py$ is ________ (A) $z = ax + ay^2 + b$ (B) $z = ax^2 - ay^2 + b$ (C) $z = ax + by$ (D) $z = 2xy$	1	2	1	2
2.	The solution to $pq = x$ is (A) $z = \frac{x^2}{2a} + ay + c$ (B) $z = \frac{y^2}{2a} + ax + c$ (C) $z = x + y + 1$ (D) $z = x - ay$	1	2	1	1
3.	The partial differential equation formed by eliminating arbitrary function in $z = f\left(x^2 + y^2\right)$ is (A) $xy = pq$ (B) $xp = yq$ (C) $xq = yp$ (D) $x + p = y + q$	1	2	1	2
4.	Solve $\left(D^3 - 3D^2D'\right)z = 0$ (A) $z = f_1(y - x) + f_2(y - 2x) + f_3(y + 2x)$ (B) $z = f_1(y) + f_2(y) + f_3(y + 3x)$ (C) $z = f_1(y) + x\, f_2(y) + f_3(y + 3x)$ (D) $z = f_1(y) + f_2(y) + f_3(y - 3x)$	1	2	1	2
5.	The particular integral $D^2 z = x^3 y$ is (A) $x^3 y$ (B) $x^4 y^2$ (C) $x^2 y^2$ (D) $\frac{x^5 y}{20}$	1	2	1	2
6.	The constant a_0 for the Fourier series for the function $f(x) = k, 0 \le x \le 2\pi$ is (A) k (B) 2k (C) 0 (D) k/2	1	1	2	1
7.	Which one of the following function is an even function? (A) $Sin\, x$ (B) x (C) e^x (D) x^2	1	1	2	1
8.	The Root Mean Square value of $f(x) = x \text{ in } -1 \le x \le 1$ is (A) 1 (B) 0 (C) $1/\sqrt{3}$ (D) –1	1	2	2	2

9. Half range cosine series for $f(x)$ in $(0,\pi)$ is 1 1 2 1

(A) $\sum_{n=1}^{\infty} b_n \sin nx$

(B) $\frac{a_0}{2}+\sum_{n=1}^{\infty} a_n \cos nx$

(C) $\frac{a_0^2}{2}+\frac{1}{2}\sum_{n=1}^{\infty} a_n^2$

(D) $\frac{a_0}{2}+\sum_{n=1}^{\infty} a_n \cos nx+\sin nx$

10. An example for a function which is neither even nor odd. 1 1 2 1

(A) $x\sin x$

(B) $x^2 \sin x$

(C) e^{ax}

(D) $x\cos x$

11. The wave equation $\frac{\partial^2 y}{\partial t^2}=a^2\frac{\partial^2 y}{\partial x^2}$, a^2 stands for 1 1 3 1

(A) $\frac{T}{m}$

(B) $\frac{k}{c}$

(C) $\frac{m}{T}$

(D) $\frac{k}{m}$

12. In heat equation $u_t=\alpha^2 u_{xx}$, α^2 stands for 1 1 3 1

(A) $\frac{k}{\rho}$

(B) $\frac{T}{m}$

(C) $\frac{k}{\rho c}$

(D) $\frac{k}{c}$

13. One dimensional heat equation is used to find 1 1 3 1

(A) Density

(B) Temperature distribution

(C) Time

(D) Displacement

14. Heat flows from ______ temperature. 1 1 3

(A) Higher to lower

(B) Uniform

(C) Lower to higher

(D) Stable

15. The steady state temperature of a rod of length l whose ends are kept at 30° and 40° is 1 2 3

(A) $u=\frac{10x}{l}+30$

(B) $u=\frac{20x}{l}+30$

(C) $u=\frac{10x}{l}+20$

(D) $u=\frac{10x}{l}$

16. The Fourier transform of $f(x)=e^{\frac{-x^2}{2}}$ is 1 1 4

(A) e^{-z^2}

(B) $e^{-\frac{s^2}{2}}$

(C) $\frac{1}{e^{x^2}}$

(D) $\frac{1}{e^{-s^2/2}}$

17. $F(f(x)\cos ax)=$______ 1 2 4

(A) $[F(a)+F(s-a)]/2$

(B) $[F(sa)+F(s+a)]/2$

(C) $[F(s+a)+F(s-a)]/2$

(D) $F(s/a)$

18. $F(f(x)*g(x)) =$ ________ 1 1 4 1

(A) $F(s)+G(s)$
(B) $F(s)-G(s)$
(C) $F(s)G(s)$
(D) $F(s)/G(s)$

19. If $F(f(x)) = F(s)$, then $F(f(ax)) =$ ________ 1 1 4 1

(A) $\frac{1}{z}F(s/a)$
(B) $\frac{1}{a}F(a/s)$
(C) $\frac{1}{a}F(s/a)$
(D) $\frac{1}{s}F(s/a)$

20. The Fourier cosine transform of e^{-4x} is 1 2 4 1

(A) $\sqrt{\frac{2}{\pi}}\frac{2}{4+s^2}$
(B) $\sqrt{\frac{2}{\pi}}\frac{4}{16-s^2}$
(C) $\sqrt{\frac{2}{\pi}}\frac{4}{16+t^2}$
(D) $\sqrt{\frac{2}{\pi}}\frac{4}{s^2+16}$

21. Find $Z\{(-1)^n\}$ is 1 1 5 1

(A) $\frac{z+1}{z}$
(B) $\frac{z}{z-1}$
(C) $\frac{z}{z+1}$
(D) $\frac{-z}{z+1}$

22. Find $Z\left\{\cos\frac{n\pi}{2}\right\}$ 1 2 5 2

(A) $\frac{z}{z^2+1}$
(B) $\frac{z^2}{z^2+1}$
(C) $\frac{z}{z^2-1}$
(D) $\frac{z^2}{z^2-4}$

23. What is the value of $Z^{-1}\left\{\frac{z}{(z-1)^2}\right\}$ 1 1 5 1

(A) n+1
(B) n
(C) n–1
(D) 1/n

24. The solution of $u_n = 5\ u_{n-1}, n \geq 1\ and\ u_0 = 2$ is 1 2 5 2

(A) 5^n
(B) 2×5^n
(C) 2^n
(D) 5×2^n

25. Find the pole of $F(z) = \left[\frac{z^n(z+1)}{(z-1)^3}\right]$ 1 2 5 2

(A) *z=1*
(B) *z=–1*
(C) *z=0*
(D) *z=3*

		Marks	BL	CO	PO

PART – B (5 × 10 = 50 Marks)
Answer ALL Questions

26. a. Find the general solution of $x\left(z^2-y^2\right)p+y\left(x^2-z^2\right)q=z\left(y^2-x^2\right)$. — 10 3 1 1

(OR)

b. Solve $\left(D^3-7DD'^2-6D'^3\right)z=x^2y+\sin(x+2y)$. — 10 3 1 1

27. a. Find the half-range cosine series of $f(x)=(\pi-x)^2$ *in* $(0,\pi)$. Hence find the sum of series $\frac{1}{1^4}+\frac{1}{2^4}+\frac{1}{3^4}+\ldots\infty$. — 10 4 2 2

(OR)

b. Find the first two harmonics of the Fourier series from the following table. — 10 3 2 2

x:	0	$\pi/3$	$2\pi/3$	π	$4\pi/3$	$5\pi/3$	2π
y:	1	1.4	1.9	1.7	1.5	1.2	1.0

28. a. A string is stretched and fastened to two points 'l' apart. Motion is started by displacing the string in the form $y=\lambda\left(lx-x^2\right)$ from which it is released at time $t=0$. Find the displacement $y(x,t)$. — 10 4 3 2

(OR)

b. A rod of length 'l' has its ends A and B kept at 0°C and 120°C respectively until steady state condition prevails. If the temperature at B is reduced to 0°C and kept so while that of 'A' is maintained, find the temperature distribution in the rod. — 10 4 3 2

29. a. Find the Fourier transform of $f(x)=\begin{cases}1-x^2, if & |x|<1\\ 0 \quad ,if & |x|>1\end{cases}$ hence evaluate $\int_0^{\infty}\frac{x\cos x-\sin x}{x^3}dx$. — 10 3 4 2

(OR)

b. Evaluate $\int_0^{\infty}\frac{dx}{\left(x^2+a^2\right)\left(x^2+b^2\right)}$ using transform method. — 10 3 4

30. a. Using partial fraction method, evaluate $Z^{-1}\left[\frac{z^2}{(z-1)(z-3)^2}\right]$. — 10 3 5

(OR)

b. Solve the difference equation $y_{n+2}-5y_{n+1}+6y_n=1$, $y_0=0$ and $y_1=1$ using Z-transform method. — 10 3 5

* * * * *