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

Marks BL CO PO

26. a.i. Find the complete integral of $pq=1$. 5 3 1 2

ii. Solve $p.\tan x+q.\tan y=\tan z$. 5 3 1 2

(OR)

b. Solve $\left(D^3-5D^2D'+6D'^3\right)z=e^{4x+y}$. 10 4 1 2

27. a. Find the Fourier series for $f(x)=x^2$ in $-\pi\le x\le\pi$ and hence deduce that 10 3 2 2

(i) $\frac{1}{1^2}+\frac{1}{2^2}+\frac{1}{3^2}+.......=\frac{\pi^2}{6}$

(ii) $\frac{1}{1^2}-\frac{1}{2^2}+\frac{1}{3^2}+.......=\frac{\pi^2}{12}$

(iii) $\frac{1}{1^2}+\frac{1}{3^2}+\frac{1}{5^2}+.......=\frac{\pi^2}{8}$

(OR)

b. Compute the first two harmonics of the Fourier series for f(x) from the following. 10 4 2 2

x	0	$\pi/3$	$2\pi/3$	π	$4\pi/3$	$5\pi/3$	2π
$f(x)$	10	12	15	20	17	11	10

28. a. A string is stretched and fastened to two points 'l' apart. Motion is started by displacing the string into the form $50\left(lx-x^2\right)$ from which it is released at time t = 0. Find the displacement at any point on the string at a distance 'x' from one end at time 't'. 10 4 3 2

(OR)

b. The ends A and B of a rod 30 cm long have their temperature kept at 20°C and 80°C until steady state prevails. The temperature at the end B is then suddenly reduced to 60°C and that of A is raised to 40°C and maintained the same. Find the temperature distribution. 10 4 3 2

29. a. Find the Fourier transform of $f(x)=\begin{cases}1 & \text{for } |x|<a\\ 0 & \text{for } |x|>a>0\end{cases}$ and hence evaluate 10 4 4 2

$(i)\ \int_0^\infty\left(\frac{\sin t}{t}\right)dt\quad (ii)\int_0^\infty\left(\frac{\sin x}{x}\right)^2dx.$

(OR)

b. Find the Fourier cosine transform of $e^{-ax}, a>0$. Hence deduce the value of $\int_0^\infty\frac{dx}{\left(x^2+1\right)\left(x^2+4\right)}$. 10 3 4 2

30. a. Find the Z-transform of $(i)\ \frac{1}{n(n-1)}\quad (ii)\ \frac{3n+4}{(n+1)(n+2)}$ 10 3 5 2

(OR)

b. Solve the difference equation using Z-transform: 10 3 5 2

$y_{n+2}-3y_{n+1}-10y_n=0, y_0=1, y_1=0$

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Reg. No.															

B.Tech. DEGREE EXAMINATION, MAY 2022
Third Semester

18MAB201T – TRANSFORMS AND BOUNDARY VALUE PROBLEMS
(For the candidates admitted from the academic year 2018-2019 to 2019-2020)

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 partial differential equation formed by eliminating arbitrary constants in $z=ax+by+ab$ is 1 1 1 2
(A) $z=px+qy+ab$ (B) $z=ax+by+pq$
(C) $z=ax+by+ab$ (D) $z=px+qy+pq$

2. The complete integral of $q=2py$ is 1 2 1 2
(A) $z=ax+ay^2+b$ (B) $z=a(x+y)+b$
(C) $z=ax+by+c$ (D) $z=ax-by+a$

3. The general integral of $p+q=1$ is 1 1 1 2
(A) $x-y=f(y-z)$ (B) $\phi(x+y,y-z)=0$
(C) $f(x-y,y-z)=0$ (D) $x=y+f(y+z)$

4. The solution of $\left(D^3-7DD'^2-6D'^3\right)z=0$ 1 2 1 2
(A) $z=f_1(y-x)+f_2(y-2x)+f_3(y+3x)$
(B) $z=f_1(y-x)+f_2(y+2x)+f_3(y-3x)$
(C) $z=f_1(y+x)+f_2(y-2x)+f_3(y+3x)$
(D) $z=f_1(y+x)+f_2(y-2x)+f_3(y-3x)$

5. The particular integral of $\left(D^2\right)z=x^3y$ is 1 1 1 2
(A) $\frac{x^5y}{20}$ (B) x^3y
(C) x^4y^2 (D) x^2y

6. If $\int_{-a}^{a}f(x)dx=0$ then the function is 1 2 2 2
(A) Odd (B) Even
(C) Neither even nor odd (D) Periodic

7. If x=a is a point of continuity of f(x) then the sum of the Fourier series is 1 2 2 2
(A) f(a) (B) f(0)
(C) $\frac{f(a^-)+f\left(a^+\right)}{2}$ (D) 0

8. The half range sine series for $f(x)$ in $(0, \pi)$ is 1 1 2 2

(A) $\frac{a_0^2}{4}+\frac{1}{2}\sum\left(a_n^2+b_n^2\right)$ (B) $\frac{a_0}{2}+\frac{1}{2}\sum_{n=1} a_n \cos nx$

(C) $\sum_{n=1}^{\infty} a_n \cos nx$ (D) $\sum_{n=1}^{\infty} b_n \sin nx$

9. Find a_0, if $f(x)=x^2$ in $0<x<2$ 1 1 2 2

(A) 0 (B) 1/3

(C) 2 (D) 8/3

10. Sinx is a periodic function with period ________ 1 2 2 2

(A) π (B) $\frac{\pi}{2}$

(C) 2π (D) 4π

11. If the wave equation is $\frac{\partial^2 y}{\partial t^2}=\alpha^2\frac{\partial^2 y}{\partial x^2}$ then α^2 stands for 1 2 3 2

(A) T/m (B) k/c

(C) m/T (D) k/m

12. The one dimensional heat equation in steady state is 1 1 3 2

(A) $\frac{\partial u}{\partial t}=0$ (B) $\partial^2 u/\partial t^2=0$

(C) $\partial^2 u/\partial t^2-\partial u/\partial t=0$ (D) $\partial^2 u/\partial x^2=0$

13. How many initial and boundary conditions are required to solve $\frac{\partial^2 y}{\partial t^2}=\alpha^2\frac{\partial^2 y}{\partial x^2}$ 1 1 3 2

(A) Two (B) Three

(C) Five (D) Four

14. The one dimensional wave equation is used to find 1 2 3 2

(A) Temperature (B) Displacement

(C) Time (D) Mass

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

(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 value of $F\left[a\,f(x)+b\,g(x)\right]$ is 1 1 4 2

(A) $F\left[f(x)\right]+b\,F\left[g(x)\right]$ (B) $a\,F\left[f(x)\right]+F\left[g(x)\right]$

(C) $a\,F\left[f(x)\right]+b\,F\left[g(x)\right]$ (D) $F\left[f(x)\right]+F\left[g(x)\right]$

17. If $F\left[f(x)\right]=F(s)$ and a > 0 then $F\left[f(ax)\right]$ is 1 1 4 2

(A) $\frac{1}{a}F\left(a/s\right)$ (B) $\frac{1}{a}F\left(s/a\right)$

(C) $\frac{1}{s}F\left(s/a\right)$ (D) $\frac{1}{s}F\left(a/s\right)$

18. Find $F\left[e^{iax}f(x)\right]$ 1 2 4 2

(A) $F(s-a)$ (B) $F(s+a)$

(C) $F(sa)$ (D) $F\left(s/a\right)$

19. The Fourier cosine transform of e^{-ax}, $a>0$ is 1 2 4 2

(A) $\sqrt{\frac{1}{\pi}}\left(\frac{a}{a^2+s^2}\right)$ (B) $\sqrt{\frac{2}{\pi}}\left(\frac{a}{a^2+s^2}\right)$

(C) $\sqrt{\frac{1}{\pi}}\left(\frac{s}{a^2+s^2}\right)$ (D) $\sqrt{\frac{2}{\pi}}\left(\frac{s}{a^2+s^2}\right)$

20. The value of $F_c\left[xf(x)\right]$ is

(A) $\frac{d}{ds}F_s(s)$ (B) $-\frac{d}{ds}F_s(s)$

(C) $\frac{d}{ds}F_c(s)$ (D) $-\frac{d}{ds}F_c(s)$

21. The value of $z(5)$ is 1 1 5 2

(A) $\frac{z}{z-1}$ (B) $5\left[\frac{z}{z-1}\right]$

(C) $\frac{1}{5}\left[\frac{z}{z-1}\right]$ (D) $\frac{z-1}{z}$

22. The value of $z\left[\sin\frac{n\pi}{2}\right]$ is 1 2 5 2

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

(C) $\frac{z}{z^2+1}$ (D) $\frac{z^2}{z^2+1}$

23. The value of $z^{-1}\left[\frac{z}{z-a}\right]$ is 1 1 5 2

(A) a^{n+1} (B) a

(C) a^n (D) a^{n-1}

24. Poles of $\phi(z)=\frac{z^n}{(z-1)(z-2)}$ are 1 2 5 2

(A) $z=0$ (B) $z=1, 2$

(C) $z=0, 1$ (D) $z=0, 2$

25. If $z\left[f(k)\right]=F(z)$ then $z\left[f(-k)\right]$ is 1 1 5 2

(A) $F(z)$ (B) $F\left(\frac{1}{z}\right)$

(C) $F(k)$ (D) $F\left(\frac{1}{k}\right)$