ii. Solve $9pqz^4 = 4\left(1+z^3\right)$.

(OR)

b. Solve the equation $\left(D^2+2DD'+D'^2\right)z = x^2y+e^{x-y}$.

29. a. Obtain the Fourier series of period $2l$ for the function

$$f(x) = l-x, \; in \; 0<x\le l$$
$$= 0, \quad in \; l\le x<2l$$

Deduce that $\frac{1}{1^2}+\frac{1}{3^2}+\frac{1}{5^2}+....+\infty = \frac{\pi^2}{8}$.

(OR)

b. Find the Fourier series of $y=f(x)$ in $(0,2\pi)$ upto the third harmonic using the definition of y given by the following table.

x	0	$\pi/3$	$2\pi/3$	π	$4\pi/3$	$5\pi/3$	2π
y	1.98	1.30	1.05	1.30	– 0.88	– 0.25	1.98

30. a. A tightly stretched string of length π is fastened at both ends. The midpoint of the string is displaced by a distance d transversely and the string is released from rest in this position. Find the displacement of any point of the string at any subsequent time.

(OR)

b. A uniform bar of length l through which heat flows is insulted at its sides. The ends are kept at zero temperature. If the initial temperature at the interior points of the bar is given by $k\left(lx-x^2\right)$ for $0<x<l$, find the temperature distribution in the bar after time t.

31. a. Find the Fourier transform of $f(x) = \begin{cases} 1-|x|, & for \; |x|\le 1 \\ 0 & for |x|>1 \end{cases}$ hence deduce $\int_0^\infty \left(\frac{\sin x}{x}\right)^4 dx = \frac{\pi}{3}$.

(OR)

b. Find Fourier sine and cosine transforms of e^{-x}. Hence evaluate $\int_0^\infty \frac{x^2}{\left(x^2+1\right)^2}dx$.

32. a.i. Find the Z transform of $(n+1)^2$ and $\sin(3n+5)$.

ii. Find the inverse Z-transform of $\frac{z^2}{(z-4)(z-3)}$.

(OR)

b. Solve the equation $y(k+2)+y(k)=1, \; y(0)=y(1)=0$, using Z-transform.

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Reg. No.														

B.Tech. DEGREE EXAMINATION, MAY 2019

3rd to 8th Semester

15MA201 – TRANSFORMS AND BOUNDARY VALUE PROBLEMS

(For the candidates admitted during the academic year 2015 – 2016 to 2017-2018)

Note:

(i) **Part - A** should be answered in OMR sheet within first 45 minutes and OMR sheet should be handed over to hall invigilator at the end of 45th minute.

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

Time: Three Hours — Max. Marks: 100

PART – A (20 × 1 = 20 Marks)

Answer **ALL** Questions

1. The complete integral of $pq=1$ is
   (A) $az = a^2x+y+ac$ (B) $z=ax+ay+c$
   (C) $az = x+y+c$ (D) $z=x+y+c$

2. The partial differential equation formed by eliminating the arbitrary function from $z=f\left(x^2+y^2\right)$ is
   (A) $xp=yq$ (B) $xy=pq$
   (C) $py=qx$ (D) $x+p=y+q$

3. solve $\left(D^3-7DD'^2-6D'^3\right)z=0$
   (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) $z=f_1(y-x)+f_2(y-2x)+f_3(y-3x)$

4. The particular integral of $\left(D^3-2D^2D'\right)z=e^{x+2y}$ is
   (A) $\frac{e^{x+2y}}{3}$ (B) $\frac{e^x}{3}$
   (C) e^{x+2y} (D) $\frac{-e^{x+2y}}{3}$

5. The constant a_0 of the Fourier series for the function $f(x)=x^2$ in (0, 2l)
   (A) $\frac{l^2}{3}$ (B) $\frac{4l^2}{3}$
   (C) $\frac{8l^2}{3}$ (D) l^2

6. The sum of the Fourier series of $f(x)=x+x^2$, in $-\pi<x<\pi$ at $x=\pi$ is
   (A) π (B) π^2
   (C) $\pi/2$ (D) $\pi^2/2$

7. If $f(x)=x$ in $-l\le x\le l$, then a_n
   (A) $\frac{-2l(-1)^n}{n\pi}$ (B) 0
   (C) l (D) $2l^2/3$

8. The RMS value of $f(x)=x$ in $-1\le x\le 1$ is
(A) 1 (B) 0
(C) $\frac{1}{\sqrt{3}}$ (D) -1

9. Classify the partial differential equation $4u_{xx}+4u_{xy}+u_{yy}=0$
(A) Elliptic (B) Parabolic
(C) Hyperbolic (D) Circular

10. The string is stretched between two fixed points $x=0$ and $x=l$, the boundary conditions are (t being positive)
(A) $y(0,t)=0,\ y(x,t)=0$ (B) $y(x,0)=0,\ \left(\frac{\partial y}{\partial t}\right)(x,0)=0$
(C) $y(0,t)=0,\ y(l,t)=0$ (D) $\left(\frac{\partial y}{\partial t}\right)(0,t)=0,\ \left(\frac{\partial y}{\partial t}\right)(l,t)=0$

11. The steady state temperature of a rod of length l whose ends are kept at 30°C and 40°C is
(A) $u=\frac{10x}{l}+30$ (B) $u=\frac{20x}{l}+30$
(C) $u=\frac{10x}{l}+20$ (D) $u=\frac{10x}{l}$

12. One dimensional wave equation is used to find
(A) Temperature (B) Displacement
(C) Time (D) Mass

13. If $F\{f(x)\}=F(s)$, then $F\left(e^{-iax}f(x)\right)$ is
(A) $F(s+a)$ (B) $F(s-a)$
(C) $F(as)$ (D) $F(a/s)$

14. $F_c(x.f(x))$ is
(A) $i\frac{dFs(s)}{ds}$ (B) $\frac{-dF_s(s)}{ds}$
(C) $i\frac{dFs(s)}{ds}$ (D) $\frac{dFs(s)}{ds}$

15. The Fourier cosine transform of e^{-ax} is
(A) $\sqrt{\frac{2}{\pi}}\frac{a}{a^2+x^2}$ (B) $\sqrt{\frac{1}{\pi}}\frac{s}{s^2+a^2}$
(C) $\sqrt{\frac{1}{\pi}}\frac{a}{s^2+a^2}$ (D) $\sqrt{\frac{2}{\pi}}\frac{a}{s^2+a^2}$

16. $F(f(ax))$ is
(A) $\frac{1}{s}F(s/a)$ (B) $\frac{1}{a}F(a/s)$
(C) $\frac{1}{s}F(as/a+1)$ (D) $\frac{1}{|a|}F(s/a)$

17. Z-transform of $\frac{1}{n!}$
(A) $\frac{1}{e^z}$ (B) e^{z^2}
(C) $e^{2/z}$ (D) e^{z^3}

18. $Z\left(n^2\right)$ is
(A) $\frac{z}{(z-1)^3}$ (B) $\frac{z(z+1)}{(z)^3}$
(C) $\frac{z(z+1)}{(z-1)^3}$ (D) $\frac{z+1}{(z-1)^3}$

19. $z\left(\sin\frac{n\pi}{2}\right)$ is
(A) $\frac{z^2}{z-1}$ (B) $\frac{z}{z^2+4}$
(C) $\frac{z}{z^2+1}$ (D) $\frac{z^2}{z^2+1}$

20. Poles of $\phi(z)=\frac{z^n}{(z-1)(z-2)}$ are
(A) $z=1,\ z=0$ (B) $z=1, z=2$
(C) $z=0, z=2$ (D) $z=0$

PART – B (5 × 4 = 20 Marks)
Answer **ANY FIVE** Questions

21. Solve $p-q=\log(x+y)$

22. Find the Fourier series of $f(x)=x^2$ in $-\pi\le x\le\pi$.

23. Classify the PDE $(x+1)f_{xx}+2(x+2)f_{xy}+(x+3)f_{yy}=0$.

24. Find the Fourier transform of $f(x)$ given by $f(x)=\begin{cases} x & for\ |x|\le a \\ 0 & for\ |x|>a\end{cases}$.

25. Find $z\left(na^n\right)$.

26. Solve $\left(D^2-DD'\right)z=\cos x\cos 2y$.

27. Find $Z(f(n))$ where $f(n)=an^2+bn+c$.

PART – C (5 × 12 = 60 Marks)
Answer **ALL** Questions

28. a.i. Find the partial differential equation of all planes which are at a constant distance k from the origin.

PART – C (5 × 12 = 60 Marks)
Answer **ALL** Questions

28. a. Solve (i) $z = px + qy + \sqrt{1+p^2+q^2}$ (ii) $x(z^2-y^2)p + y(x^2-z^2)q = z(y^2-x^2)$. Find also singular integral.

(OR)

b. Solve (i) $(D^2 - 2DD' + D'^2)z = \cos(x-3y)$ (ii) $(D^2 - DD'^2)z = e^{x+2y}$.

29. a. Find the Fourier series of $f(x) = x + x^2$ in $(-\pi, \pi)$ of periodicity 2π. Hence deduce $\Sigma \frac{1}{n^2} = \frac{\pi^2}{6}$.

(OR)

b. Compute the first two harmonics of the fourier series f(x) given by the following table.

x	0	π/3	2π/3	π	4π/3	5π/3	2π
f(x)	1.0	1.4	1.9	1.7	1.5	1.2	1

30. a. A tightly stretched string with fixed end point $x = 0$ and $x = l$ is initially at rest in its equilibrium position. If it is set vibrating giving each point a velocity $3x(l-x)$. Find the displacement.

(OR)

b. A rod of length l has its ends A and B kept at 0°C and 100°C respectively unit steady state conditions prevail. If the temperature at B is reduced suddenly to 0°C and kept so, while that of A is maintained. Find the temperature u(x, t).

31. a. Find the Fourier transform of f(x) if $f(x) = \begin{cases} 1-|x| & for\ |x|<1 \\ 0 & for |x|>1 \end{cases}$ hence prove that $\int_0^\infty \frac{\sin^4 x}{x^4} dx = \frac{\pi}{3}$.

(OR)

b. Use transform method to evaluate $\int_0^\infty \frac{x^2}{(x^2+a^2)(x^2+b^2)} dx$

32. a.i. Find $Z(a^n)$ and $Z(n^2)$.

ii. Using residues find the inverse Z-transform of $\frac{z}{(z-1)(z-2)}$.

(OR)

b. Solve the equation $y_{n+2} + 6y_{n+1} + 9y_n = 2^n$, given $y_0 = y_1 = 0$ by using Z-transform.

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Reg. No.														

B.Tech. DEGREE EXAMINATION, NOVEMBER 2018
3rd to 7th Semester

15MA201 – TRANSFORMS AND BOUNDARY VALUE PROBLEMS
(For the candidates admitted during the academic year 2015 – 2016 to 2017-2018)

Note:
(i) **Part - A** should be answered in OMR sheet within first 45 minutes and OMR sheet should be handed over to hall invigilator at the end of 45th minute.
(ii) **Part - B** and **Part - C** should be answered in answer booklet.

Time: Three Hours Max. Marks: 100

PART – A (20 × 1 = 20 Marks)
Answer **ALL** Questions

1. The partial differential equation formed by eliminating arbitrary constant a, b is $z = (x+a)(y+b)$
   (A) $z = p+q$ (B) $z = p-q$
   (C) $z = p/q$ (D) $z = pq$

2. The complementary function of $(D^2 + 2DD' + D'^2)z = 0$ is
   (A) $\phi_1(y-x) + \phi_2(y-x)$ (B) $\phi_1(y-x) + x\phi_2(y-x)$
   (C) $\phi_1(y-x) + \phi_2(y+x)$ (D) $\phi_1(y-x) + x\phi_2(y+x)$

3. The particular integral of $(D^2 - 2DD')z = e^{2x}$
   (A) $e^{2x}/4$ (B) $e^{2x+y}/4$
   (C) e^{2x} (D) $e^{2x}/2$

4. The complete solution of $z = px + qy + p^2q^2$ is
   (A) $z = ax + by^2 + ab^2$ (B) $z = ax^2 + by + ab^2$
   (C) $z = ax + by + a^2b^2$ (D) $z = ax + by + c$

5. sin$x$ is a periodic function with period
   (A) π (B) π/2
   (C) 2π (D) 4π

6. The constant a_0 of 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

7. The RMS value of $f(x) = x$ in $-1 \le x \le 1$ is
   (A) 1 (B) 0
   (C) $1/\sqrt{3}$ (D) –1

8. Half range cosine series for f(x) is (0, π) is

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

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

9. The proper solution of the problems of vibration of string is

(A) $y(x,t) = (Ae^{\lambda x} + Be^{-\lambda x})(ce^{\lambda at} + De^{\lambda at}$ (B) $y(x,t) = (Ax+B)(ct+1)$

(C) $y(x,t) = (A\cos\lambda x + B\sin\lambda x)(C\cos\lambda at + D\sin\lambda at)$ (D) $y(x,t) = Ax+B$

10. The one dimensional wave equation is

(A) $\frac{\partial u}{\partial t} = a^2 \frac{\partial^2 u}{\partial x^2}$ (B) $\frac{\partial^2 y}{\partial t^2} = a^2 \frac{\partial^2 y}{\partial x^2}$

(C) $\frac{\partial y}{\partial t} = a\frac{\partial^2 y}{\partial x^2}$ (D) $\frac{\partial^2 y}{\partial x^2} = a\frac{\partial^2 y}{\partial t^2}$

11. One dimensional heat equation is used to find

(A) Density (B) Temperature distribution

(C) Time (D) Displacement

12. A rod of length l has its ends A and B kept at 0° and 100° respectively, until steady state conditions prevail. Then the initial condition is given by

(A) $u(x,0) = ax+b+100l$ (B) $u(x,0) = \frac{100x}{l}$

(C) $u(x,0) = 100xl$ (D) $u(x,0) = (x+l)100$

13. $F\left[e^{iax} f(x)\right]$

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

(C) $F(sa)$ (D) $F(s/a)$

14. $F\left[xf'(x)\right] =$

(A) $\frac{dF(s)}{ds}$ (B) $i\frac{dF(s)}{ds}$

(C) $-i\frac{dF(s)}{ds}$ (D) $-\frac{dF(s)}{ds}$

15. The fourier cosine transform of $Fc\left[e^{-4x}\right]$

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

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

16. $F\left[f(x) * g(x)\right] =$

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

(C) $F(s)G(s)$ (D) $F(s)/G(s)$

17. What is Z(7)

(A) $\frac{z}{z-1}$ (B) $7\frac{z}{z-1}$

(C) $\frac{1}{7}\frac{z}{z-1}$ (D) $\frac{z-1}{z}$

18. What is $Z\left[na^n\right]$

(A) $\frac{az}{(z-a)^2}$ (B) $\frac{z}{(z-a)^2}$

(C) $\frac{a}{(z-a)^2}$ (D) $\frac{z}{(z-a)^3}$

19. If $z\left[f(t)\right] = F(z)$ then $\lim_{z\to\infty} F(z) =$

(A) $f(0)$ (B) $f(1)$

(C) $\lim_{x\to\infty} f(t)$ (D) $f(\infty)$

20. $\phi(z) = \frac{z^n(2z+4)}{(z-2)^3}$ has a pole of order

(A) 2 (B) 1

(C) 3 (D) 4

PART – B (5 × 4 = 20 Marks)
Answer **ANY FIVE** Questions

21. Form the Partial differential equation by eliminating f from $z = xy + f(x^2+y^2+z^2)$.

22. Find the half range Fourier sine series for $f(x) = x$ in $0 < x < \pi$.

23. Write the one dimensional heat flow equation and all the possible solutions.

24. Find the Fourier sine transform of e^{-ax} $a > 0$.

25. Find Z-transform of r^ncosn0.

26. Find $z^{-1}\left(\frac{1}{(z-1)(z-2)}\right)$ by convolution.

27. Solve $p^2 + q^2 = x + y$.

29. a. Express $f(x)=(\pi-x)^2$ as a Fourier series of periodicity 2π in $0<x<2\pi$ and hence deduce the sum $\sum_{n=1}^{\infty}\frac{1}{n^2}$.

(OR)

b. Compute the first three harmonics of the Fourier series of $f(x)$ given by the following table.

x	0	$\pi/3$	$2\pi/3$	π	$4\pi/3$	$5\pi/3$	2π
$f(x)$	1.0	1.4	1.9	1.7	1.5	1.2	1.0

30. a. If a string of length l is initially at rest in equilibrium position and each point of it is given the velocity $\left(\frac{\partial y}{\partial t}\right)_{t=0}=v_0\sin^3\frac{\pi x}{l},\ 0<x<l$, determine the transverse displacement $y(x,t)$.

(OR)

b. Solve $\frac{\partial u}{\partial t}=\alpha^2\frac{\partial^2 u}{\partial x^2}$ subject to (i) $u(0,t)=0$ for $t\geq 0$ (ii) $u(l,t)=0$ for $t\geq 0$ (iii) $u(x,0)=\begin{cases} x & for\ 0\leq x\leq l/2 \\ l-x & for\ l/2\leq x\leq l \end{cases}$

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

(OR)

b. Find Fourier cosine and sine transforms of $e^{-ax}, a>0$ and evaluate $\int_0^{\infty}\frac{dx}{(a^2+x^2)^2}$ and $\int_0^{\infty}\frac{x^2}{(a^2+x^2)^2}dx$ if $a>0$.

32.a.i. Find the Z-transform of $\left\{\frac{1}{n(n+1)}\right\}, n\geq 1$.

ii. Find the inverse Z-transform of $x(z)=\frac{z^2}{(z-1/2)(z-1/4)}$ using Convolution theorem.

(OR)

b. Solve $y_{n+2}-7y_{n+1}+12y_n=2^n$ given that $y_0=0,\ y_1=0$ using Z-transforms.

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Reg. No.														

B.Tech. DEGREE EXAMINATION, NOVEMBER 2019
Third to Seventh Semester

15MA201 – TRANSFORMS AND BOUNDARY VALUE PROBLEMS
(For the candidates admitted during the academic year 2015 – 2016 to 2017-2018)

Note:
(i) **Part - A** should be answered in OMR sheet within first 45 minutes and OMR sheet should be handed over to hall invigilator at the end of 45th minute.
(ii) **Part - B** and **Part - C** should be answered in answer booklet.

Time: Three Hours Max. Marks: 100

PART – A (20 × 1 = 20 Marks)
Answer **ALL** Questions

1. The complete integral of $p=2qx$
   (A) $z=ax^2+ay+c$ (B) $z=ax+ay^2+c$
   (C) $z=ax^2-ay+c$ (D) $z=ax+by+c$

2. The partial differential equation formed by eliminating arbitrary function in $z=f\left(x^2+y^2\right)$ is
   (A) $xp=yq$ (B) $xy=pq$
   (C) $xq=yp$ (D) $x+p=y+q$

3. Solve $\left(D^3-7DD'^2-6D'^2\right)z=0$
   (A) $z=\phi_1(y-x)+\phi_2(y-2x)+\phi_3(y+3x)$ (B) $z=\phi_1(y-x)+\phi_2(y+2x)+\phi_3(y-3x)$
   (C) $z=\phi_1(y+x)+\phi_2(y-2x)+\phi_3(y+3x)$ (D) $z=\phi_1(y+x)+\phi_2(y+2x)+\phi_3(y+3x)$

4. The general integral of $z=xp+yq$ is
   (A) $\phi\left(\frac{x}{y},\frac{y}{z}\right)=0$ (B) $\phi(x+y,\ y+z)=0$
   (C) $\phi\left(x-y,\frac{x}{2}\right)=0$ (D) $\phi\left(\frac{x}{y},y+z\right)=0$

5. The constant a_0 of the Fourier series for the function $f(x)=k, 0\leq x\leq 2\pi$
   (A) k (B) 2k
   (C) 0 (D) k/2

6. The RMS value of $f(x)=x$ in $-1\leq x\leq 1$ is
   (A) 1 (B) 0
   (C) $1/\sqrt{3}$ (D) -1

7. Find half-range cosine series of $f(x)=\cos x$ in $(0,\pi)$ the value of a_0 is
   (A) 4 (B) $2/\pi$
   (C) $4/\pi$ (D) 0

8. $\int_{-\pi}^{\pi} |x|dx$ is equal to

(A) $2\int_0^{\pi} x\,dx$
(B) 0
(C) $2\int_0^{\pi} (-x)\,dx$
(D) $4\int_0^{\pi} x\,dx$

9. In wave equation $\frac{\partial^2 y}{\partial t^2} = a^2 \frac{\partial^2 y}{\partial x^2}$, a^2 stands for

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

10. One dimensional heat equation is used to find

(A) Temperature
(B) Displacement
(C) Time
(D) Mass

11. How many initial and boundary conditions are required to solve $\frac{\partial u}{\partial t} = \alpha^2 \frac{\partial^2 u}{\partial x^2}$

(A) Two
(B) Three
(C) Four
(D) Five

12. A rod of length l has its ends A and B are kept at 0°C and 100°C respectively, until steady state conditions prevail. Then the initial condition is given by

(A) $u(x,0) = ax + b + 100l$
(B) $u(x,0) = \frac{100x}{l}$
(C) $u(x,0) = 100lx$
(D) $u(x,0) = (x+l)100$

13. If $F\{f(x)\} = F(s)$, then $F\{f(x-a)\}$

(A) $e^{ias}F(s)$
(B) $e^{ias}F(a)$
(C) $e^{iax}F(a)$
(D) $e^{ias}F(x)$

14. The Fourier transform of $f(x) = e^{-x^2/2}$ is

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

15. $F\{f(x) * g(x)\} =$

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

16. Under Fourier cosine transform of $f(x) = 1/\sqrt{x}$ is

(A) Self-reciprocal function
(B) Cosine function
(C) Inverse function
(D) Complex function

17. $Z\left[(-1)^n\right]$

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

18. If $Z[f(t)] = F(z)$, then $\lim_{z\to\infty} F(z)$

(A) $f(0)$
(B) $f(1)$
(C) $\lim_{t\to\infty} f(t)$
(D) $f(\infty)$

19. Find $Z^{-1}\left(\frac{z}{(z-1)^2}\right)$ is

(A) $n+1$
(B) n
(C) $n-1$
(D) $1/n$

20. The poles of $\phi(z) = \frac{z^n}{(z-1)(z-2)}$ are

(A) $z=1, z=2$
(B) $z=-1, z=-2$
(C) $z=1, z=-2$
(D) $z=0, z=2$

PART – B (5 × 4 = 20 Marks)
Answer **ANY FIVE** Questions

21. Form the partial differential equation by eliminating the arbitrary constants a and b from $z = (x^2+a)(y^2+b)$.

22. Solve $(D^2 - 2DD' + D'^2)z = e^{x+2y}$.

23. Express $f(x) = x$ in half range sine series of periodicity $2l$ in the range $0 < x < l$

24. Write the possible solutions and correct solution of one dimensional heat equation.

25. Classify the equation $(1+x^2)f_{xx} + (5+2x^2)f_{xy} + (4+x^2)f_{yy} = 2\sin(x+y)$.

26. If $F\{f(x)\} = F(s)$ then $F\{f(x)coax\} = \frac{1}{2}[F(s-a)+(s+a)]$.

27. Find $Z\{\sin n\theta\}$.

PART – C (5 × 12 = 60 Marks)
Answer **ALL** Questions

28. a. Solve (i) $9(p^2z+q^2) = 4$ (ii) $x(y-z)p + y(z-x)q = z(x-y)$.

(OR)

b. Solve $(D^3 - 2D^2D')z = \sin(x+2y) + 3x^2y$.

29.a. Find the half-range cosine series for $f(x)=x, 0\le x\le \pi$. Hence show that $\frac{1}{1^2}+\frac{1}{3^2}+\frac{1}{5^2}+....=\frac{\pi^2}{8}$.

(OR)

b. Find the Fourier sine series upto third harmonic for the function $y=f(x)$ in $(0,\pi)$ from the table.

x	0	$\pi/6$	$2\pi/6$	$3\pi/6$	$4\pi/6$	$5\pi/6$	π
y	2.34	2.2	1.6	0.83	0.51	0.88	2.34

30.a. A tightly stretched string of length l has its end fastened at $x=0$, $x=l$. At $t=0$, the string is in the form $f(x)=\lambda x(l-x)$ and then released. Find the displacement y at any time and at any distance from the end x=0.

(OR)

b. Find the solution of the equation $\frac{\partial u}{\partial t}=\alpha^2\frac{\partial^2 u}{\partial x^2}$ that satisfies the conditions.

(i) $u(0,t)=0$ (ii)

(ii) $u(l,t)=0$ for $t>0$

(iii) $u(x,0)=\begin{cases} x, 0\le x\le l/2 \\ l-x, l/2\le x\le l\end{cases}$

31.a. Find the Fourier transform of $f(x)$ given by $f(x)=\begin{cases} a^2-x^2; & if\ |x|<a \\ 0 & ; if\ |x|>a>0\end{cases}$ hence prove that $\int_0^{\alpha}\left(\frac{\sin x-x\cos x}{x^3}\right)dx=\frac{\pi}{4}$.

(OR)

b.i. Find the Fourier transform of $e^{-a|x|}$ and hence evaluate $\int_0^{\infty}\frac{1}{\left(x^2+a^2\right)^2}dx, a>0$. (8 Marks)

ii. If $F[f(x)]=F(s)$, then $F(f(x)\cos ax)=\frac{1}{2}[F(s+a)+F(s-a)]$. (4 Marks)

32.a.i. Find $Z^{-1}\left[\frac{z^2}{(z-a)(z-b)}\right]$ using convolution theorem.

ii. Find $Z^{-1}\left[\frac{z^2}{(z+2)\left(z^2+4\right)}\right]$ by method of partial fraction.

(OR)

b. Using Z-transform solve $u_{n+2}+4u_{n+1}+3u_n=3^n$ with $u_0=0, u_1=1$.

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Reg. No.														

B.Tech. DEGREE EXAMINATION, NOVEMBER 2019
First to Eighth Semester

15MA201 – TRANSFORMS AND BOUNDARY VALUE PROBLEMS
(For the candidates admitted during the academic year 2015-2016 to 2017-2018)

Note:
(i) **Part - A** should be answered in OMR sheet within first 45 minutes and OMR sheet should be handed over to hall invigilator at the end of 45th minute.
(ii) **Part - B** and **Part - C** should be answered in answer booklet.

Time: Three Hours Max. Marks: 100

PART – A (20 × 1 = 20 Marks)
Answer **ALL** Questions

1. Find the complete integral of $p^2+q^2=1$
(A) $z=ax+by+c$ (B) $z=ax+by$
(C) $z=a(x+y)+b$ (D) $z=ax-by+a$

2. Solve $pq=xy$
(A) $z=k\frac{x}{2}+\frac{1}{k}y/2+c$ (B) $z=k\frac{x^2}{2}+\frac{1}{k}\frac{y^2}{2}+c$
(C) $z=k(x+y/2)+c$ (D) $z=k(x/2-y)+c$

3. Solve $\left(D^3-3DD'^2+2D'^3\right)z=0$
(A) $z=\phi_1(y+2x)+\phi_2(y-x)+\phi_3(y+x)$ (B) $z=\phi_1(y+6x)+\phi_2(y-x)+x\phi_3(y-2x)$
(C) $z=\phi_1(y-2x)+\phi_2(y+x)+x\phi_3(y+x)$ (D) $z=\phi_1(y+3x)+\phi_2(y-2x)+\phi_3(y+4x)$

4. Find the particular integral of $\left(D^2+3DD'+4D'^2\right)z=e^{x-y}$
(A) $\frac{e^{x+y}}{2}$ (B) $\frac{e^{2x+y}}{2}$
(C) $\frac{e^{x-2y}}{2}$ (D) $\frac{e^{x-y}}{2}$

5. $\int_{-1}^{1}|x|\,dx$ is equal to
(A) $\int_0^1 x\ dx$ (B) $2\int_0^1 x\ dx$
(C) $2\int_0^1(-x)dx$ (D) $4\int_0^{\pi/2}(-x)dx$

6. The constant a_0 of the Fourier series for the function $f(x)=x$ is $0\le x\le 2\pi$
(A) π (B) 3π
(C) 2π (D) 0

7. The RMS value of $f(x)=x$ in $-1 \le x \le 1$ is
(A) 1 (B) 0
(C) -1 (D) $1/\sqrt{3}$

8. For half range cosine series of $f(x)=cosx$ in $(0,\pi)$ the value of a_0 is
(A) 0 (B) 4
(C) $2/\pi$ (D) $4/\pi$

9. The partial differential equation $u_{xx}+2u_{xy}+u_{yy}=0$ of the form.
(A) Elliptic (B) Parabolic
(C) Hyperbolic (D) None of these

10. The proper solution of $u_t=\alpha^2 u_{xx}$ is
(A) $u=(Ax+B)C$ (B) $u=(A\cos\lambda x+B\sin\lambda x)e^{-\alpha^2\lambda^2 t}$
(C) $u=\left(Ae^{\lambda x}+Be^{-\lambda x}\right)e^{\alpha^2\lambda^2 t}$ (D) $u=At+B$

11. One dimensional wave equation is used to find
(A) Temperature (B) Time
(C) Displacement (D) Mass

12. The amount of heat required to produce a given temperature change in a body is proportional to
(A) Weight of the body (B) Mass of the body
(C) Density of the body (D) Tension of the body

13. The steady state temperature of a rod of length l whose ends are kept at 30 and 40 is
(A) $u=\frac{10x}{l}+30$ (B) $u=\frac{20x}{l}+30$
(C) $u=\frac{10x}{l}+20$ (D) $u=\frac{10x}{l}$

14. The Fourier cosine transform of e^{-ax} is
(A) $\sqrt{\frac{2}{\pi}}\frac{a}{a^2+x^2}$ (B) $\sqrt{\frac{1}{\pi}}\frac{s}{s^2+a^2}$
(C) $\sqrt{\frac{1}{\pi}}\frac{a}{s^2-a^2}$ (D) $\sqrt{\frac{2}{\pi}}\frac{a}{\left(s^2+a^2\right)}$

15. $F[xf'(x)]=$
(A) $\frac{dF(s)}{ds}$ (B) $i\frac{dF(s)}{ds}$
(C) $-i\frac{dF(s)}{ds}$ (D) $-\frac{dF(s)}{ds}$

16. $F[f(x)*g(x)]=$
(A) F(s) + G(s) (B) F(s)– G(s)
(C) F(s)G(s) (D) F(s) / G(s)

17. What is Z-transform of na^n ?
(A) $\frac{az}{(z-a)^2}$ (B) $\frac{z}{(z-a)^2}$
(C) $\frac{a}{(z-a)^2}$ (D) $\frac{z}{(z-a)^3}$

18. Region of convergence of a $Z\left[a^n\right]$ is
(A) $|z|<a$ (B) $|z|>a$
(C) $|z|>|a|$ (D) $|z|<|a|$

19. Find $Z^{-1}\left[\frac{z}{z-a}\right]$
(A) a^{n+1} (B) a
(C) a^n (D) a^{n-1}

20. The difference equation formed by eliminating 'a' in $u_n=a\,2^{n+1}$ is
(A) $u_{n+1}-2u_n=0$ (B) $u_{n+1}=0$
(C) $u_{n+1}-u_n=0$ (D) $u_n=0$

PART – B (5 × 4 = 20 Marks)
Answer **ANY FIVE** Questions

21. Form a partial differential equation by eliminating arbitrary constants 'a' and 'b' from $z=(x+a)^2 \cdot (y+b)^2$.

22. Find the general solution of $\left(5D^2-12DD'-9D'^2\right)z=0$.

23. Find a Fourier sine series for the function $f(x)=1, 0<x<\pi$.

24. Find the RMS value of $f(x)=1-x$ in $0<x<1$.

25. What are all the solutions of one dimensional wave equation?

26. Prove that $F\left(e^{iax}f(x)\right)=F(s+a)$, where $F(f(x)=F(s))$.

27. Find the Z-transform of $(n+1)(n+2)$.

PART – C (5 × 12 = 60 Marks)
Answer **ALL** Questions

28.a.i. Form the partial differential equation by eliminating f from $xyz=f\left(x^2+y^2-z^2\right)$.

ii. Solve $(3z-4y)p+(4x-2z)q=2y-3x$.

(OR)

b. Solve $\left(D^2-6DD'+5D'^2\right)z=e^x\sinh y+xy$.

PART – C (5 × 12 = 60 Marks)
Answer **ALL** Questions

28. a. Solve (i) $z = px+qy+\sqrt{1+p^2+q^2}$ (ii) $x(z^2-y^2)p+y(x^2-z^2)q = z(y^2-x^2)$. Find also singular integral.

(OR)

b. Solve (i) $(D^2-2DD'+D'^2)z=\cos(x-3y)$ (ii) $(D^2-DD'^2)z=e^{x+2y}$.

29. a. Find the Fourier series of $f(x)=x+x^2 \text{in}(-\pi,\pi)$ of periodicity 2π. Hence deduce $\Sigma\frac{1}{n^2}=\frac{\pi^2}{6}$.

(OR)

b. Compute the first two harmonics of the fourier series f(x) given by the following table.

x	0	π/3	2π/3	π	4π/3	5π/3	2π
f(x)	1.0	1.4	1.9	1.7	1.5	1.2	1

30. a. A tightly stretched string with fixed end point $x = 0$ and $x = l$ is initially at rest in its equilibrium position. If it is set vibrating giving each point a velocity $3x(l-x)$. Find the displacement.

(OR)

b. A rod of length l has its ends A and B kept at 0°C and 100°C respectively unit steady state conditions prevail. If the temperature at B is reduced suddenly to 0°C and kept so, while that of A is maintained. Find the temperature u(x, t).

31. a. Find the Fourier transform of f(x) if $f(x)=\begin{cases}1-|x| & for\ |x|<1\\ 0 & for |x|>1\end{cases}$ hence prove that $\int_0^\infty \frac{\sin^4 x}{x^4}dx=\frac{\pi}{3}$.

(OR)

b. Use transform method to evaluate $\int_0^\infty \frac{x^2}{(x^2+a^2)(x^2+b^2)}dx$

32. a.i. Find $Z(a^n)$ and $Z(n^2)$.

ii. Using residues find the inverse Z-transform of $\frac{z}{(z-1)(z-2)}$.

(OR)

b. Solve the equation $y_{n+2}+6y_{n+1}+9y_n=2^n$, given $y_0=y_1=0$ by using Z-transform.

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Reg. No.															

B.Tech. DEGREE EXAMINATION, NOVEMBER 2018
3rd to 7th Semester

15MA201 – TRANSFORMS AND BOUNDARY VALUE PROBLEMS
(For the candidates admitted during the academic year 2015 – 2016 to 2017-2018)

Note:
(i) **Part - A** should be answered in OMR sheet within first 45 minutes and OMR sheet should be handed over to hall invigilator at the end of 45th minute.
(ii) **Part - B** and **Part - C** should be answered in answer booklet.

Time: Three Hours Max. Marks: 100

PART – A (20 × 1 = 20 Marks)
Answer **ALL** Questions

1. The partial differential equation formed by eliminating arbitrary constant a, b is $z=(x+a)(y+b)$
   (A) $z=p+q$ (B) $z=p-q$
   (C) $z=p/q$ (D) $z=pq$

2. The complementary function of $(D^2+2DD'+D'^2)z=0$ is
   (A) $\phi_1(y-x)+\phi_2(y-x)$ (B) $\phi_1(y-x)+x\phi_2(y-x)$
   (C) $\phi_1(y-x)+\phi_2(y+x)$ (D) $\phi_1(y-x)+x\phi_2(y+x)$

3. The particular integral of $(D^2-2DD')z=e^{2x}$
   (A) $e^{2x}/4$ (B) $e^{2x+y}/4$
   (C) e^{2x} (D) $e^{2x}/2$

4. The complete solution of $z=px+qy+p^2q^2$ is
   (A) $z=ax+by^2+ab^2$ (B) $z=ax^2+by+ab^2$
   (C) $z=ax+by+a^2b^2$ (D) $z=ax+by+c$

5. sin$x$ is a periodic function with period
   (A) π (B) π/2
   (C) 2π (D) 4π

6. The constant a_0 of 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

7. The RMS value of $f(x)=x$ in $-1\le x\le 1$ is
   (A) 1 (B) 0
   (C) $1/\sqrt{3}$ (D) −1

8. Half range cosine series for f(x) is (0, π) is

(A) $\sum_{n=1}^{\infty} a_n \cos nx$

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

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

(D) $\frac{a_0}{2} - \sum a_n \cos nx$

9. The proper solution of the problems of vibration of string is

(A) $y(x,t) = (Ae^{\lambda x} + Be^{-\lambda x})(ce^{\lambda at} + De^{\lambda at}$

(B) $y(x,t) = (Ax+B)(ct+1)$

(C) $y(x,t) = (A\cos\lambda x + B\sin\lambda x)(C\cos\lambda at + D\sin\lambda at)$

(D) $y(x,t) = Ax+B$

10. The one dimensional wave equation is

(A) $\frac{\partial u}{\partial t} = a^2 \frac{\partial^2 u}{\partial x^2}$

(B) $\frac{\partial^2 y}{\partial t^2} = a^2 \frac{\partial^2 y}{\partial x^2}$

(C) $\frac{\partial y}{\partial t} = a \frac{\partial^2 y}{\partial x^2}$

(D) $\frac{\partial^2 y}{\partial x^2} = a \frac{\partial^2 y}{\partial t^2}$

11. One dimensional heat equation is used to find

(A) Density
(B) Temperature distribution
(C) Time
(D) Displacement

12. A rod of length l has its ends A and B kept at 0° and 100° respectively, until steady state conditions prevail. Then the initial condition is given by

(A) $u(x,0) = ax+b+100l$

(B) $u(x,0) = \frac{100x}{l}$

(C) $u(x,0) = 100xl$

(D) $u(x,0) = (x+l)100$

13. $F\left[e^{iax} f(x)\right]$

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

14. $F\left[xf'(x)\right] =$

(A) $\frac{dF(s)}{ds}$

(B) $i\frac{dF(s)}{ds}$

(C) $-i\frac{dF(s)}{ds}$

(D) $-\frac{dF(s)}{ds}$

15. The fourier cosine transform of $Fc\left[e^{-4x}\right]$

(A) $\sqrt{\frac{2}{\pi}} \frac{4}{16+s^2}$

(B) $\sqrt{\frac{2}{\pi}} \frac{4}{4+s^2}$

(C) $\sqrt{\frac{\pi}{2}} \frac{4}{16+s^2}$

(D) $\sqrt{\frac{\pi}{2}} \frac{4}{4+s^2}$

16. $F\left[f(x) * g(x)\right] =$

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

17. What is Z(7)

(A) $\frac{z}{z-1}$

(B) $7\frac{z}{z-1}$

(C) $\frac{1}{7}\frac{z}{z-1}$

(D) $\frac{z-1}{z}$

18. What is $Z\left[na^n\right]$

(A) $\frac{az}{(z-a)^2}$

(B) $\frac{z}{(z-a)^2}$

(C) $\frac{a}{(z-a)^2}$

(D) $\frac{z}{(z-a)^3}$

19. If $z\left[f(t)\right] = F(z)$ then $\lim_{z\to\infty} F(z) =$

(A) $f(0)$
(B) $f(1)$
(C) $\lim_{x\to\infty} f(t)$
(D) $f(\infty)$

20. $\phi(z) = \frac{z^n(2z+4)}{(z-2)^3}$ has a pole of order

(A) 2
(B) 1
(C) 3
(D) 4

PART – B (5 × 4 = 20 Marks)
Answer **ANY FIVE** Questions

21. Form the Partial differential equation by eliminating f from $z = xy + f(x^2+y^2+z^2)$.

22. Find the half range Fourier sine series for $f(x) = x$ in $0 < x < \pi$.

23. Write the one dimensional heat flow equation and all the possible solutions.

24. Find the Fourier sine transform of e^{-ax} $a > 0$.

25. Find Z-transform of $r^n \cos n\theta$.

26. Find $z^{-1}\left(\frac{1}{(z-1)(z-2)}\right)$ by convolution.

27. Solve $p^2+q^2 = x+y$.

PART – C (5 × 12 = 60 Marks)
Answer **ALL** Questions

28. a. Solve (i) $x^2p - y^2q = (x-y)z$ (ii) $p^2 + q^2 = z$.

(OR)

b. Solve the equation $\left(D^2 + 4DD' - 5D'^2\right)z = xy + \sin(2x+3y)$.

29. a. Find the Fourier series expansion of period 2 for the function $f(x) = \begin{cases} \pi x & in\ 0 \le x \le 1 \\ \pi(2-x) & in\ 1 \le x \le 2 \end{cases}$. Deduce the sum $\sum_{n=1,3,\ldots}^{\infty} \frac{1}{n^2}$.

(OR)

b. Find the Fourier series upto the second harmonic from the data.

x	0	$\pi/3$	$2\pi/3$	π	$4\pi/3$	$5\pi/3$	2π
y	0.8	0.6	0.4	0.7	0.9	1.1	0.8

30. a. The ends of an uniform string of length $2l$ are fixed. The initial displacement is $y(x,0) = kx(2l - x)$, $0 < x < 2l$ while the initial velocity is zero. Find the displacement at any distance x from the end $x = 0$ at any time t.

(OR)

b. Find the solution of the equation $\frac{\partial u}{\partial t} = \alpha^2 \frac{\partial^2 u}{\partial x^2}$ that satisfies the condition $u(0,t) = 0$ and $u(l,t) = 0$ for $t \ge 0$ and $u(x,0) = \begin{cases} x, & for\ 0 < x < \frac{l}{2} \\ l - x & for\ \frac{l}{2} < x < l \end{cases}$.

31. a. Find the Fourier transform of $f(x)$ if $f(x) = \begin{cases} 1 - |x|, & for\ |x| < 1 \\ 0 & for\ |x| > 1 \end{cases}$ and hence prove that $\int_0^{\infty} \frac{\sin^4 x}{x^4} dx = \frac{\pi}{3}$.

(OR)

b. Show that $e^{-x^2/2}$ is self-reciprocal under Fourier transform by finding the Fourier transform of $e^{-a^2x^2}$, $a > 0$.

32. a. Find (i) $Z\left(2^n \cos\frac{n\pi}{2}\right)$ (ii) $Z^{-1}\left(\frac{z(z+1)}{(z-1)^3}\right)$ using the method of residues.

(OR)

b. Solve using Z-transform $y_{n+2} - 3y_{n+1} - 10y_n = 0$, given that $y_0 = y_1 = 0$.

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Reg. No.														

B.Tech. DEGREE EXAMINATION, MAY 2019
1st to 7th Semester

15MA201 – TRANSFORMS AND BOUNDARY VALUE PROBLEMS
(For the candidates admitted during the academic year 2015 – 2016 to 2017-2018)

1

Note:
(i) **Part - A** should be answered in OMR sheet within first 45 minutes and OMR sheet should be handed over to hall invigilator at the end of 45th minute.
(ii) **Part - B** and **Part - C** should be answered in answer booklet.

Time: Three Hours Max. Marks: 100

PART – A (20 × 1 = 20 Marks)
Answer **ALL** Questions

1. The partial differential equation formed by eliminating the arbitrary function 'f' from $z = f\left(x^2 - y^2\right)$ is
(A) $qx + py = 0$ (B) $qx = py$
(C) $qx = p$ (D) $py = q$

2. The complete integral of $z = px + qy + \sqrt{1 + p^2 + q^2}$ is
(A) $z = ax - by$ (B) $z = ax + by$
(C) $z = ax + by + \sqrt{1 + a^2 + b^2}$ (D) $z = ax + by - \sqrt{1 + a^2 + b^2}$

3. General solution of $\left(D^2 + 4DD' - 5D'\right)^2 z = 0$
(A) $z = f_1(y - 5x) + f_2(y + x)$ (B) $z = f_1(y + 5x) + f_2(y + x)$
(C) $z = f_1(y - 5x) + f_2(y - x)$ (D) $z = f_1(y) + f_2(y - x)$

4. The particular integral of $\left(D^2 + 2DD' + D'^2\right) = e^{x-y}$ is
(A) e^{x-y} (B) $\frac{x^2}{2}e^{x-y}$
(C) $\frac{x}{2}e^{x-y}$ (D) $\frac{x^2}{2}e^{x+y}$

5. If $f(x) = |x|$ in $(-\pi, \pi)$ then the constant term a_0 of the Fourier series is
(A) 2π (B) 0
(C) $\pi/2$ (D) π

6. If $f(x) = |\sin x|$ then its period is
(A) π (B) 2π
(C) 0 (D) $\pi/2$

7. The root mean square value of $f(x) = x$ in $-1 \le x \le 1$ is
(A) 1 (B) 0
(C) $\frac{1}{\sqrt{3}}$ (D) -1

8. Half-Range sine series for $f(x)$ in $(0,\pi)$ is

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

(C) $\frac{a_0}{2}+\sum_{1}^{\infty} a_n \cos nx$ (D) $\frac{a_0^2}{4}+\frac{1}{2}\sum_{n=1}^{\infty}\left(a_n^2+b_n^2\right)$

9. In wave equation $\frac{\partial^2 y}{\partial t^2}=a^2\frac{\partial^2 y}{\partial x^2}$, a^2 stands for

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

(C) Tm (D) T^m

10. The steady state solution of $u_t=\alpha^2 u_{xx}$ is

(A) $u=c_1x$ (B) $u=c_1+c_2t$

(C) $u=c_1x+c_2$ (D) $u=zero$

11. Classify $u_{xx}+2u_{xy}+u_{yy}=0$

(A) Parabolic (B) Elliptic

(C) Hyperbolic (D) Geodesic

12. The number of initial and boundary conditions to solve $\frac{\partial^2 y}{\partial t^2}=a^2\frac{\partial^2 y}{\partial x^2}$ are

(A) Three (B) Two

(C) Four (D) One

13. If $F\{f(x)\}=F(s)$, then $F\{f(ax)\}=$

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

(C) $aF\left(\frac{s}{a}\right)$ (D) $F(as)$

14. The Fourier sine transform of $e^{-ax}\,(a>0)$ is

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

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

15. $F^{-1}[F(s)G(s)]=$

(A) $f(x)g(x)$ (B) $f(x)*g(x)$

(C) $f(x)+g(x)$ (D) $f(x)-g(x)$

16. If $F\{f(x)\}=F(s)$ then $\int_{-\infty}^{\infty}|f(x)|^2\,dx=$

(A) $\int_{0}^{\infty}|F(s)|^2\,ds$ (B) $\int_{-\infty}^{\infty}|F(x)|^2\,dx$

(C) $\int_{-\infty}^{\infty}|F(s)|^2\,ds$ (D) $\int_{0}^{\infty}|F(x)|^2\,dx$

17. $Z\{(-1)^n\}=$

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

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

18. $Z\left[na^n\right]=$

(A) $\frac{z}{(z-a)^3}$ (B) $\frac{a}{(z-a)^2}$

(C) $\frac{z}{(z-a)^2}$ (D) $\frac{az}{(z-a)^2}$

19. $z\left(\sin\frac{n\pi}{2}\right)=$

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

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

20. Poles of $f(z)=\frac{z^n}{(z+1)(z+2)}$ are

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

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

PART – B (5 × 4 = 20 Marks)
Answer **ANY FIVE** Questions

21. Form a partial differential equation by eliminating arbitrary constants a, b, from $(x-a)^2+(y-b)^2=z^2\cot^2\alpha$.

22. Find half-range sine series of $f(x)=a$ in $(0,l)$.

23. Write down the three mathematically possible solutions of one dimensional heat flow equation.

24. Find the Fourier transform of $f(x)$ defined as $f(x)=\begin{cases}1 & for\ |x|<a\\ 0 & for\ |x|>a\end{cases}$.

25. Find the Z-transform of $\frac{1}{n(n-1)}$.

26. Solve the equation $pq+p+q=0$.

27. Find the Fourier sine transform of $f(x)$ defined as $f(x)=\begin{cases}\sin x & when\ 0<x<a\\ 0 & when\ x>a\end{cases}$.