UNIT-I

PARTIAL DIFFERENTIAL EQUATIONS

1. The complete integral of $p = q$ is ____

(i) $z = ax + by$ (ii) $z = a(x + y) + b$ (iii) $z = ax + by + c$

(iv) $z = ax - by + a$

2. The complete integral of $q = 2py$ is ____

(i) $z = ax + ay^2 + b$ (ii) $z = ax^2 - ay^2 + b$ (iii) $z = ax + by$

(iv) $z = 2xy$.

3. The complete integral of $pq = 1$ is

(i) $az = a^2x + y + ac$ (ii) $z = ax + ay + c$ (iii) $az = x + y + c$

(iv) $z = x + y + c$.

4. The solution to $pq = x$ is

(i) $z = \frac{x^2}{2a} + ay + c$ (ii) $z = \frac{y^2}{2a} + ax + c$ (iii) $z = x + y + 1$

(iv) $z = x - ay$.

5. The partial differential equation formed by eliminating arbitrary constant is

$z = (x + a)(y + b)$ is

(i) $z = p + q$ (ii) $z = p - q$ (iii) $z = \frac{p}{q}$ (iv) $z = pq$.

6. The partial differential equation formed by eliminating arbitrary constant in

$z = ax + by + ab$

(i) $z = px + qy + ab$ (ii) $z = ax + by + pq$ (iii) $z = px + qy + pq$

(iv) $c = px + qy + pq$

7. The partial differential equation formed by eliminating arbitrary function in $z = f(x^2 + y^2)$ is

(i) $xp = yq$ (ii) $xy = pq$ (iii) $xq = yp$ (iv) $x + p = y + q$

8. The general integral of $z = xp + yq$ is

(i) $\Phi\left(\frac{x}{y}, \frac{y}{z}\right) = 0$ (ii) $\Phi(x + y, y + z) = 0$ (iii) $\Phi\left(x - y, \frac{x}{z}\right) = 0$

(iv) $\Phi\left(\frac{x}{y}, y + z\right) = 0$.

9. The general integral of $p + q = 1$ is

(i) $x - y = f(y - z)$ (ii) $\Phi(x + y, y - z) = 0$ (iii) $f(x - y, y - z) = 0$

(iv) $x = y + f(y + z)$

10. The solution to $z^2 = pq$ is

(i) $x + ay + c = \sqrt{a}\, logz$ (ii) $x - ay + c = logz$ (iii) $ax + y = \log az$

(iv) $ax + y = \text{a} \log z$

11. The solution which has number of arbitrary constants equal to number of independent variables is

(i) general integral (ii) complete integral (iii) particular integral

(iv) singular integral

12. The complete integral of $p^2 + q^2 = x + y$ is

(i) $z = \frac{2}{3}(x - a)^{\frac{3}{2}} + \frac{2}{3}(y - a)^{\frac{3}{2}} + b$ (ii) $z = \frac{2}{3}(x + a)^{\frac{3}{2}} + \frac{2}{3}(y + a)^{\frac{3}{2}} + b$

(iii) $z = \frac{2}{3}(x + a)^{\frac{3}{2}} + \frac{2}{3}(y - a)^{\frac{3}{2}} + b$ (iv) $z = \frac{2}{3}(x + a)^{\frac{3}{2}} + \frac{2}{3}(a - y)^{\frac{3}{2}} + b$

13. Solve $(D^3 - 7DD'^2 - 6D'^3)z = 0$.

(i) $z = f_1(y - x) + f_2(y - 2x) + f_3(y + 3x)$

(ii) $z = f_1(y - x) + f_2(y + 2x) + f_3(y - 3x)$

(iii) $z = f_1(y + x) + f_2(y - 2x) + f_3(y + 3x)$

(iv) $z = f_1(y + x) + f_2(y - 2x) + f_3(y + 3x)$

14. Solve $(D^3 - 3D^2D')z = 0$.

(i) $z = f_1(y - x) + f_2(y - 2x) + f_3(y + 2x)$

(ii) $z = f_1(y) + f_2(y) + f_3(y + 3x)$

(iii) $z = f_1(y) + xf_2(y) + f_3(y + 3x)$

(iv) $z = f_1(y) + f_2(y) + f_3(y - 3x)$

15. The complementary function of $(D^3 - 3D^2D' + 4D'^3)z = e^{2x+y}$.

(i) $f_1(y - x) + f_2(y - 2x) + f_3(y + 2x)$

(ii) $f_1(y + x) + f_2(y + 2x) + xf_3(y - 2x)$

(iii) $f_1(y + x) + xf_2(y + 2x) + f_3(y + 2x)$

(iv) $f_1(y - x) + f_2(y + 2x) + xf_3(y + 2x)$

16. The particular integral of $(D^3 - 2D^2D')z = e^{x+2y}$ is

(i) $\frac{e^{x+2y}}{3}$ (ii) $\frac{e^x}{3}$ (iii) e^{x+2y} (iv) $\frac{-e^{x+2y}}{3}$

17. The particular integral of $(D^2)z = x^3y$ is

(i) $\frac{x^5y}{20}$ (ii) x^3y (iii) x^4y^2 (iv) x^2y^2

18. The partial differential equation $u_{xx} = u_{yy}$ is of the form

(i) parabolic (ii) elliptic (iii) hyperbolic (iv) none of these

19. The particular integral of $(D^2 + 2DD' + D'^2)z = sinhy$ is

(i) $tanhy$ (ii) $coshy + sinhy$ (iii) $coshy - sinhy$ (iv) $sinhy$

20. The complete integral of $z = px + qy + p^2 + q^2$ is

(i) $z = ax + by + a^2 + b^2$ (ii) $z = ax + by + a^2 - b^2$

(iii) $z = ax + by + c^2 + d^2$ (iv) $z = ax - by + c^2 - d^2$

21. If complete integral is $z = ax + by - 3ab$, the singular integral is

(i) $z = x + y$ (ii) $z = \frac{x}{y}$ (iii) $z = xy$ (iv) $xy = 3z$.

22. The partial differential equation is elliptic if $B^2 - 4AC$

(i) >0 (ii) ≥ 0 (iii) ≤ 0 (iv) < 0

23. The degree and order of $\frac{\partial^3 z}{\partial x^3} + \left(\frac{\partial^3 z}{\partial x \partial y^2}\right)^2 + \frac{\partial z}{\partial y} = \sin(x + 2y)$ is

(i) 2, 3 (ii) 1, 3 (iii) 3, 2 (iv) 1, 3

24. $x^2 f_{xx} + (1 - y^2) f_{yy} = 0$ is elliptic in _______ region

(i) $x \neq 0, |y| < 1$ (ii) $x \neq 0, |y| > 1$ (iii) $x = 0$ (iv) $|y| < 1$

25. The general solution of $p \tan x + q \tan y = \tan z$

(i) $f\left(\frac{\sin x}{\sin y}, \frac{\sin y}{\sin z}\right) = 0$ (ii) $f\left(sin\left(\frac{x}{y}\right), sin\left(\frac{y}{z}\right)\right) = 0$

(iii) $f(\sin x, siny) = 0$ (iv) $f(\sin y, \sin z) = 0$

MA1003 - Transforms and Boundary Value Problems

Unit-IV : Fourier Transforms

1. If f(x) is a function defined in (-l,l) and satisfies Dirichlet's conditions then

   a. $f(x) = \frac{1}{\pi}\int_0^{\infty}\int_{-\infty}^{\infty} f(t)\cos\lambda(t-x)\,dx\,d\lambda$

   $f(x) = \frac{1}{\pi}\int_0^{\infty}\int_{-\infty}^{\infty} f(t)\cos x(t-x)\,dx\,d\lambda$. b.

   b. $f(x) = \frac{1}{2\pi}\int_0^{\infty}\int_{-\infty}^{\infty} f(t)\cos\lambda(t-x)\,dx\,d\lambda$

   $f(x) = \frac{2}{\pi}\int_0^{\infty}\int_{-\infty}^{\infty} f(t)\cos\lambda(t-x)\,dx\,d\lambda$ d.

2. The Fourier transform of a function f(x) is

   a. $\frac{1}{\sqrt{2\pi}}\int_{-\infty}^{\infty} f(x)\, e^{ist}\,dt$

   b. $\frac{1}{\sqrt{2\pi}}\int_{-\infty}^{\infty} f(x)\, e^{isx}\,dx$ ✓

   c. $\frac{1}{\sqrt{2\pi}}\int_{-\infty}^{\infty} f(t)\, e^{isx}\,dx$

   d. $\frac{1}{\sqrt{2\pi}}\int_{-\infty}^{\infty} f(s)\, e^{isx}\,dx$

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

   ✓ a. $e^{-\frac{s^2}{2}}$

   b. $\frac{1}{e^{\frac{s^2}{2}}}$

   c. $\frac{1}{e^{-\frac{s^2}{2}}}$

   d. $\frac{1}{e^{x^2}}$

4. 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. $\sqrt{\frac{2}{\pi}}\frac{a}{s^2+a^2}$

5. Under Fourier cosine transform $f(x) = \frac{1}{\sqrt{x}}$ is

   a. self-reciprocal function

   b. cosine function

   c. inverse function

   d. complex function

6. The Fourier sine transform of x $e^{-\frac{x^2}{2}}$ is

   a. 0

   ✓ b. $s e^{-\frac{s^2}{2}}$

   c. $\frac{1}{e^{x^2}}$

   d. none of the above

7. $F[f(ax)] = \frac{1}{a}F\left(\frac{s}{a}\right)$

   a. $\frac{1}{s}F\left(\frac{s}{a}\right)$

   b. $\frac{1}{a}F\left(\frac{a}{s}\right)$

c. $\frac{1}{a}F\left(\frac{s}{a}\right)$

d. $\frac{1}{s}F\left(\frac{as}{a}\right)$

8. $F[f(x-a)] =$

a. $e^{ias}F(a)$

b. $e^{ias}F(x)$

c. $e^{iax}F(a)$

d. $e^{ias}F(s)$

9. $F[e^{iax}f(x)] =$

a. F(s+a)

b. F(s-a)

c. F(sa)

d. F(s/a)

10. F[f(x) cosax] =

a. [f(a)+f(s-a)]/ 2

b. [f(sa)+f(s+a)]/ 2

c. [f(s+a)+f(s-a)]/ 2

d. none of the above

11. 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)

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

a. $\int_{-\infty}^{\infty}|f(x)|^2dx$

b. $\int_{-\infty}^{\infty}|f(s)|^2ds$

c. $\int_{0}^{\infty}|f(x)|^2dx$

d. $\int_{-0}^{\infty}|f(s)|^2ds$

13. $F[xf(x)] =$

a. $\frac{dF(s)}{ds}$

b. $i\frac{dF(s)}{ds}$

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

d. $-\frac{dF(s)}{ds}$

14. $F_C[xf(x)] =$

a. $\frac{dF_S(s)}{ds}$

b. $i\frac{dF_S(s)}{ds}$

c. $-i\frac{dF_S(s)}{ds}$

d. $-\frac{dF_S(s)}{ds}$

15. $F_s[xf(x)] =$

a. $\frac{dF_C(s)}{ds}$

b. $i\frac{dF_C(s)}{ds}$

c. $-i\frac{dF_C(s)}{ds}$

d. $-\frac{dF_C(s)}{ds}$

16. The relation between Fourier transform and Laplace transform is

a. $F[f(x)] = \frac{1}{\sqrt{2\pi}}L[g(x)]$

b. $F[f(x)] = \frac{1}{\sqrt{\pi}} L[g(x)]$

c. $F[f(x)] = \frac{1}{\sqrt{2}} L[g(x)]$

c. $F[f(x)] = \frac{-1}{\sqrt{\pi}} L[g(x)]$

17. The Fourier cosine transform of $F_C[e^{-4x}]$

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 $\sqrt{\frac{\pi}{2}}\,\frac{4}{4+s^2}$

18. The Fourier transform of an odd function of x is

a. an odd function of s b. even function of s c. an odd function of x d. even function of x

19. The Fourier transform of an even function of x is

a. an odd function of s b. even function of s c. an odd function of x d. even function of x

20. . The Fourier sine transform of $F_S[\frac{1}{x}]$

a. $\sqrt{\frac{2}{\pi}}$

b $\sqrt{\frac{1}{\pi}}$

c. $\sqrt{\frac{\pi}{2}}$

d $\sqrt{\frac{\pi}{4}}$

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MA1003 – TRANSFORMS AND BOUNDARY VALUE PROBLEMS

UNIT-II : FOURIER SERIES

1. $\sin x$ is a periodic function with period

   (a) π (b) $\frac{\pi}{2}$ (c) 2π (d) 4π

2. Which one of the following function is an even function

   (a) $\sin x$ (b) x (c) e^x (d) x^2

3. $\int_{-a}^{a} f(x)dx = 0$ if f(x) is

   (a) odd (b) even (c) periodic (iv) zero

4. $\int_{-a}^{a} f(x)dx = 2\int_{0}^{a} f(x)dx$ if f(x) is

   (a) even (b) odd (c) neither even nor odd (iv) periodic

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

   (a) $2\int_0^{\pi} x dx$ (b) 0 (c) $2\int_0^{\pi}(-x)dx$ (iv) $4\int_0^{\pi/2} x dx$

6. $\tan x$ is a periodic function with period

   (a) π (b) 2π (c) 3π (d) $\pi / 2$

7. The constant a_0 of the Fourier series for the function $f(x) = x$ is $0 \le x \le 2\pi$

   (a) π (b) 2π (c) 3π (d) 0

8. The constant a_0 of the Fourier series for the function $f(x) = k$, $0 \le x \le 2\pi$

   (a) k (b) 2k (c) 0 (d) $\frac{k}{2}$

9. If f(x) is an odd function in $(-l, l)$ then value of a_n in the Fourier series expansion of f(x) is

   (a) $\frac{2}{l}\int_0^{l} f(x)\cos nx\, dx$ (b) 0 (c) $\frac{2}{l}\int_0^{l} f(x)\sin nx\, dx$ (d) $\frac{1}{l}\int_{-l}^{l} x\, dx$

10. If f(x) is an even function in $(-\pi, \pi)$ then the value of b_n in the Fourier series expansion of f(x) is

    (a) $\frac{1}{\pi}\int_{-\pi}^{\pi} f(x)\cos nx\, dx$ (b) $\frac{2}{\pi}\int_0^{\pi} f(x)\cos nx\, dx$ (c) 0 (d) $\frac{2}{\pi}\int_{-\pi}^{\pi} f(x)\sin nx\, dx$

11. The RMS value of f(x) in $a \le x \le b$ is

(a) 0 (b) $\sqrt{\frac{\int_a^b [f(x)]^2 dx}{b-a}}$ (c) $\sqrt{\frac{\int_a^b [f(x)]^2 dx}{b+a}}$ (d) $\sqrt{\frac{\sqrt{\int_a^b f(x) dx}}{b-a}}$

12. 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

13. If $\bar{y}$ is the RMS value of f(x) in $(0, 2l)$ then $\frac{a_0^2}{4} + \frac{1}{2}\sum_{n=1}^{\infty}(a_n^2 + b_n^2)$ is

(a) $\frac{\bar{y}^2}{2}$ (b) $\bar{y}$ (c) $\frac{\bar{y}}{2}$ (d) $\bar{y}^2$

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

(a) $\frac{a_0}{2} + \sum_{n=1}^{\infty} a_n \cos nx$ (b) $\frac{a_0^2}{4} + \frac{1}{2}\sum_{n=1}^{\infty}(a_n^2 + b_n^2)$ (c) $\sum_{n=1}^{\infty} b_n \sin nx$ (d) $\sum_{n=1}^{\infty} a_n \cos nx$

15. Half range sine series for f(x) in $(0, \pi)$ is

(a) $\sum_{n=1}^{\infty} a_n \cos nx$ (b) $\frac{a_0}{2} + \sum a_n \cos nx$ (c) $\sum_{n=1}^{\infty} b_n \sin nx$ (d) $\frac{a_0}{2} - \sum a_n \cos nx$

16. The function defined by $f(x) = \begin{cases} x, & -\pi \le x \le 0 \\ -x, & 0 \le x \le \pi \end{cases}$ is

(a) odd (b) neither odd nor even (c) periodic (d) even

17. The function $f(x) = \begin{cases} g(x), & 0 \le x \le \pi \\ -g(-x), & -\pi \le x \le 0 \end{cases}$ is

(a) even function (b) odd function (c) increasing function (d) periodic function

18. The value of Fourier series of f(x) in $0 < x < 2\pi$ at x = 0 is

(a) $f(0)$ (b) $f(2\pi)$ (c) $\frac{f(0) + f(2\pi)}{2}$ (iv) 0

19. The value of Fourier series f(x) in $0 < x < 2l$ at x = l is

(a) f(l) (b) f(-l) (c) f(0) (d) f(2l)

20. The value of Fourier series of $f(x) = x^2$ in $0 < x < 2$ at x = 1 is

(a) 0 (b) 4 (c) 1 (d) -1

21. Which of the following is an even function of x?

(a) x^2 (b) $x^2 - 4x$ (c) $\sin(2x) + 3x$ (d) $x^3 + 6$

22. A function f(x) with period T if

(a) $f(x+T) = f(T)$ (b) $f(x+T) = f(x)$ (c) $f(x+T) = -f(x)$

(d) $f(x+T).f(x) = 0$

23. For half range cosine series of $f(x) = \cos x$ in $(0, \pi)$ the value of a_0 is

(a) 4 (b) $\frac{2}{\pi}$ (c) $\frac{4}{\pi}$ (d) 0

24. An example for a function which neither even nor odd

(a) $x \sin x$ (b) e^{ax} (c) $x^2 \sin x$ (d) $x \cos x$

25. If f(x) is discontinuous at x = a, then the Fourier series at x = a is

(a) $\frac{f(a^-) - f(a^+)}{2}$ (b) $f(a^-) - f(a^+)$ (c) $\frac{f(a^-) - f(a^+)}{3}$ (d) $\frac{f(a^-) + f(a^+)}{2}$

MA1003 TRANSFORMS AND BOUNDARY VALUE PROBLEMS

Unit 3 One dimensional wave and heat equation

Objective type questions

1. The proper solution of the problems on vibration of string is

   (a) $y(x,t)=(Ae^{\lambda x}+Be^{-\lambda x})(Ce^{\lambda at}+De^{-\lambda at})$ (b) $y(x,t)=(Ax+B)(Ct+D)$

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

2. The one dimensional wave equation is

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

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

   (a) $\frac{T}{m}$ (b) $\frac{k}{c}$ (c) $\frac{m}{T}$ (d) $\frac{k}{m}$

4. In heat equation $\frac{\partial u}{\partial t}=\alpha^2\frac{\partial^2 u}{\partial x^2}$, α^2 stands for

   (a) $\frac{k}{\rho}$ (b) $\frac{T}{m}$ (c) $\frac{k}{\rho c}$ (d) $\frac{k}{c}$

5. The one dimensional heat equation in steady state is

   (a) $\frac{\partial u}{\partial t}=0$ (b) $\frac{\partial^2 u}{\partial t^2}=0$ (c) $\frac{\partial^2 u}{\partial x^2}-\frac{\partial u}{\partial t}=0$ (d) $\frac{\partial^2 u}{\partial x^2}=0$

6. 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) $u=(Ae^{\lambda x}+Be^{-\lambda x})e^{\alpha^2\lambda^2 t}$ (d) $u=At+B$

7. The proper solution in steady state heat flow problems is

   (a) $u=(Ae^{\lambda x}+Be^{-\lambda x})e^{\alpha^2\lambda^2 t}$ (b) $u=Ax+B$

   (c) $u=(A\cos\lambda x+B\sin\lambda x)e^{-\alpha^2\lambda^2 t}$ (d) $u=(Ae^{\lambda x}+Be^{-\lambda x})(Ce^{\lambda at}+De^{-\lambda at})$

8. The one dimensional heat equation is

   (a) $\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial y^2}=0$ (b) $\frac{\partial u}{\partial t}=\alpha^2\frac{\partial^2 u}{\partial x^2}$ (c) $\frac{\partial^2 u}{\partial t^2}=a^2\frac{\partial^2 u}{\partial x^2}$ (d) $\frac{\partial u}{\partial x}=\alpha^2\frac{\partial^2 u}{\partial t^2}$

9. 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) Four (b) Two (c) Three (d) Five

10. How many initial and boundary conditions are required to solve $\frac{\partial^2 y}{\partial t^2}=a^2\frac{\partial^2 y}{\partial x^2}$

(a) Two (b) Three (c) Five (d) Four

11. One dimensional wave equation is used to find

(a) Temperature (b) Displacement (c) Time (d) Mass

12. One dimensional heat equation is used to find

(a) Density (b) Temperature distribution (c) Time (d) Displacement

13. Heat flows from _________ temperature

(a) Higher to Lower (b) Uniform (c) Lower to higher (d) Stable

14. The tension T caused by stretching the string before fixing it at the end points is

(a) Increasing (b) Decreasing (c) Constant (d) Zero

15. A string is stretched between two fixed points x = 0 and x = l. The initial conditions are

(a) $y(0,t)=0,\ y(x,t)=0$ (b) $y(x,0)=0,\ \frac{\partial y}{\partial t}(x,0)=0$

(c) $y(0,t)=0,\ y(l,t)=0$ (d) $\left(\frac{\partial y}{\partial x}\right)_{(0,t)}=0, \left(\frac{\partial y}{\partial x}\right)_{(l,t)}=0$

16. 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

17. The general solution for the displacement y(x,t) of the string of length l vibrating between fixed end points with initial velocity zero and initial displacement f(x) is

(a) $\sum B_n \sin\left(\frac{n\pi x}{l}\right)\cos\left(\frac{n\pi at}{l}\right)$ (b) $\sum B_n \sin\left(\frac{n\pi x}{l}\right)\sin\left(\frac{n\pi at}{l}\right)$

(c) $\sum B_n \cos\left(\frac{n\pi x}{l}\right)\sin\left(\frac{n\pi at}{l}\right)$ (d) $\sum B_n \sin\left(\frac{n\pi x}{l}\right)$

18. 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) $u = \frac{10x}{l}$

19. When the ends of a rod is non-zero for one dimensional heat flow equation, the temperature function u(x, t) is modified as the sum of steady state and transient state temperatures. The transient part of the solution which

(a) Increases with increase of time (b) Decreases with increase of time

(c) Increases with decrease of time (d) Decreases with decrease of time

20. 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) $u(x,0) = (x+l)100$

ANSWERS

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

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

3. (a) $\frac{T}{m}$

Answers

1. (c) 2π
2. (d) x^2
3. (a) odd
4. (a) even
5. (a) $2\int_0^{\pi} x\,dx$
6. (a) π
7. (b) 2π
8. (b) 2k
9. (b) 0
10. (c) 0
11. (b) $\sqrt{\dfrac{\int_a^b [f(x)]^2 dx}{b-a}}$
12. (c) $\dfrac{1}{\sqrt{3}}$
13. (d) $\overset{-2}{y}$
14. (a) $\frac{a_0}{2} + \sum_{n=1}^{\infty} a_n \cos nx$
15. (c) $\sum_{n=1}^{\infty} b_n \sin nx$
16. (d) even
17. (b) odd function
18. (c) $\dfrac{f(0)+f(2\pi)}{2}$
19. (a) f(l)
20. (c) 1
21. (a) x^2
22. (b) $f(x+T)=f(x)$
23. (d) 0
24. (b) e^{ax}
25. (d) $\dfrac{f(a^-)+f(a^+)}{2}$

15MA201 – TRANSFORMS AND BOUNDARY VALUE PROBLEMS

Unit V – Z transforms and Difference Equations

Objective type questions

1. What is z(5)?

   (a) $\frac{z}{z-1}$ (b) $5.\frac{z}{z-1}$ (c) $\frac{1}{5}.\frac{z}{z-1}$ (d) $\frac{z-1}{z}$

2. $z[(-1)^n]=?$

   (a) $\frac{z+1}{z}$ (b) $\frac{z}{z-1}$ (c) $\frac{z}{1+z}$ (d) $\frac{-z}{z+1}$

3. Radius of curvature of $z[a^n]$ is

   (a) $|z|<a$ (b) $|z|>a$ (c) $|z|>|a|$ (d) $|z|<|a|$

4. What is $z[(-2)^n]$?

   (a) $\frac{z}{z+2}$ (b) $\frac{-z}{z+2}$ (c) $\frac{-z}{z-2}$ (d) $\frac{z}{z-2}$

5. Find $z\left[\frac{1}{7^n}\right]$

   (a) $\frac{7z}{z-1}$ (b) $\frac{7z}{7z-1}$ (c) $\frac{z}{7z-1}$ (d) $\frac{z}{z-1}$

6. $z[e^{-5n}]=?$

   (a) $\frac{z}{z+e^{-5}}$ (b) $\frac{z}{z-e^{-5}}$ (c) $\frac{z}{z-e^{-1}}$ (d) $\frac{z}{z+e^{-1}}$

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

8. What is $z(n^2)$?

   (a) $\frac{z}{(z-1)^3}$ (b) $\frac{z(z+1)}{z^3}$ (c) $\frac{z(z+1)}{(z-1)^3}$ (d) $\frac{z+1}{(z-1)^3}$

9. 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) $f(\infty)$

10. What is z-transform of $\frac{1}{n!}$?

(a) $e^{1/z}$ (b) e^{z} (c) $e^{-1/z}$ (d) e^{-z}

11. Radius of curvature of $f(n) = u(n - n_0)$ is

(a) $|z| > 1$ (b) $|z| < \infty$ (c) $1 < |z| < \infty$ (d) $|z| < 1$

12. Radius of curvature of $f(n) = a^{n+1}u(n+1)$

(a) $|z| > |a|$ (b) $|z| > 0$ (c) $|z| < |a|$ (d) $|z| > \frac{1}{|a|}$

13. If $z[f(k)] = F(z)$ then $z[f(-k)] = ?$

(a) $F(z)$ (b) $F\left(\frac{1}{z}\right)$ (c) $F(k)$ (d) $F\left(\frac{1}{k}\right)$

14. $z\left[\sin\frac{n\pi}{2}\right] = ?$

(a) $\frac{z^2}{z^2-1}$ (b) $\frac{z}{z^2+4}$ (c) $\frac{z}{z^2+1}$ (d) $\frac{z^2}{z^2+1}$

15. $z\left[\cos\frac{n\pi}{2}\right] = ?$

(a) $\frac{z}{z^2+1}$ (b) $\frac{z^2}{z^2+1}$ (c) $\frac{z}{z^2-1}$ (d) $\frac{z^2}{z^2-4}$

16. Find $z^{-1}\left(\frac{z}{z-a}\right)$

(a) a^{n+1} (b) a (c) a^{n} (d) a^{n-1}

17. What is $z^{-1}\left(\frac{z}{(z-a)^2}\right)$

(a) a^{n-1} (b) na^{n+1} (c) na^{n-1} (d) a^{n+1}

18. What is $z^{-1}\left(\frac{1}{z-a}\right)$?

(a) na^{n-1} (b) a^{n+1}

(c) a^{n-1}

(d) na^{n}

19. What is $z[f(n)*g(n)]$?

(a) $F(z).G^{-1}(z)$ (b) $F^{-1}(z).G^{-1}(z)$ (c) $F(z).G(z)$ (d) $F^{-1}(z).G(z)$

20. $z^{-1}(e^{1/z})$=?

(a) $\frac{1}{n+1}$ (b) $\frac{1}{(n+1)!}$ (c) $\frac{1}{n!}$ (d) $\frac{1}{n}$

21. Find $z^{-1}\left(\frac{az}{(z-a)^2}\right)$

(a) a^{n+1} (b) a^n (c) na^n (d) a^{n-1}

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

(a) n+1 (b) n (c) n-1 (d) $\frac{1}{n}$

23. Poles of $\varphi(z)=\frac{z^n}{(z-1)(z-2)}$ are

(a) z=1, z=0 (b) z=1, z=2 (c) z=0, z=2 (d) z=0

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

(a) 2 (b) 1 (c) 3 (d) 4

25. Poles of $\varphi(z)=\frac{z^n(z+1)}{(z-1)^3}$ are

(a) z=1 (b) z=-1 (c) z=0 (d) z=3

26. The difference equation formed by eliminating 'a' in $u_n = a2^{n+1}$ is

(a) $u_{n+1}-2u_n=0$ (b) $u_{n+1}=0$ (c) $u_{n+1}-u_n=0$ (d) $u_n=0$

27. Solution of $u_n = 5u_{n-1}, n \geq 1, u_0 = 2$ is

(a) $u_n = 5^n$ (b) $u_n = 2.5^n$ (c) $u_n = 2^n$ (d) $u_n=5.2^n$

4. (c) $\frac{k}{\rho c}$

5. (d) $\frac{\partial^2 u}{\partial x^2} = 0$

6. (b) $u = (A\cos\lambda x + B\sin\lambda x)e^{-\alpha^2\lambda^2 t}$

7. (b) $u = Ax + B$

8. (b) $\frac{\partial u}{\partial t} = \alpha^2 \frac{\partial^2 u}{\partial x^2}$

9. (c) Three

10. (d) Four

11. (b) Displacement

12. (b) Temperature distribution

13. (a) Higher to lower

14. (c) Constant

15. (c) $y(0,t) = 0,\ y(l,t) = 0$

16. (b) Mass of the body

17. (a) $\sum B_n \sin\left(\frac{n\pi x}{l}\right)\cos\left(\frac{n\pi at}{l}\right)$

18. (a) $u = \frac{10x}{l} + 30$

19. (b) Decreases with increase of time

20. (b) $u(x,0) = \frac{100x}{l}$

ANSWERS

1. (b)
2. (c)
3. (c)
4. (a)
5. (b)
6. (b)
7. (a)
8. (c)
9. (a)
10. (a)
11. (c)
12. (a)
13. (b)
14. (c)
15. (b)
16. (c)
17. (c)
18. (c)
19. (c)
20. (c)
21. (c)
22. (b)
23. (b)
24. (c)
25. (a)
26. (a)
27. (b)