SUBJECT NAME : **Transforms and Partial Diff. Eqn.**

SUBJECT CODE : **MA 2211**

MATERIAL NAME : **Part – A questions**

REGULATION : **R2008**

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TEXT BOOK FOR REFFERENCE : **Hariganesh Publications (Author: C. Ganesan)**

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Name of the Student: Branch:

Unit – I (Fourier Series)

1. State the Dirichlet's conditions for Fourier series. Text Book Page No.: 2.1
2. Write the conditions for a function $f(x)$ to satisfy for the existence of a Fourier series.

   Text Book Page No.: 2.1

3. State the sufficient condition for a function $f(x)$ to be expressed as a Fourier series.

   Text Book Page No.: 2.1

4. Give the expression for the Fourier Series co-efficient b_n for the function $f(x) = x \sin x$ defined in $(-2, 2)$. Text Book Page No.: 2.77

5. Find the value of a_0 in the Fourier series expansion of $f(x) = e^x$ in $(0, 2\pi)$.

6. If $x^2 = \frac{\pi^2}{3} + 4\sum_{n=1}^{\infty} \frac{(-1)^n}{n^2} \cos nx$, deduce that $\frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \ldots = \frac{\pi^2}{6}$.

7. Determine the Fourier series for the function $f(x) = x$ in $-\pi \le x \le \pi$.

8. Obtain the first term of the Fourier series for the function $f(x) = x^2,\ -\pi < x < \pi$.

   Text Book Page No.: 2.77

9. Find the constant term in the expansion of $\cos^2 x$ as a Fourier series in the interval $(-\pi, \pi)$. Text Book Page No.: 2.77

10. Expand $f(x)=1$ as a half range sine series in the interval $(0,\pi)$.

11. Find the half range sine series expansion of $f(x)=1$ in $(0,2)$.
    Text Book Page No.: 2.108

12. Write down Parseval's formula on Fourier coefficients. (Text Book Page No.: 2.93)

13. Define Root Mean square value of a function $f(x)$ over the interval (a,b).

    Text Book Page No.: 2.93

14. Find the root mean square value of $f(x)=x^2$ in $(0,\ell)$.

    Text Book Page No.: 2.95

15. Find the root mean square value of the function $f(x)=x$ in $(0,l)$.

    Text Book Page No.: 2.108

16. Without finding the values of a_0, a_n and b_n, the Fourier coefficients of Fourier series, for the function $F(x)=x^2$ in the interval $(0,\pi)$ find the value of $\left[\frac{a_0^2}{2}+\sum_{n=1}^{\infty}\left(a_n^2+b_n^2\right)\right]$. (Text Book Page No.: 2.108)

17. What is meant by Harmonic Analysis? (Text Book Page No.: 2.124)

Unit – II (Fourier Transform)

1. State Fourier integral theorem. (Text Book Page No.: 4.1)
2. Write the Fourier transform pair. (Text Book Page No.: 4.1)
3. Write the Fourier cosine transform pair. (Text Book Page No.: 4.15)
4. Write the Fourier sine transform pair. (Text Book Page No.: 4.15)
5. Find the Fourier transform of $e^{-\alpha|x|}$, $\alpha \geq 0$. (Text Book Page No.: 4.18)
6. Find the Fourier cosine transform of e^{-ax}, $x \geq 0$. (Text Book Page No.: 4.46)
7. Find the Fourier sine transform of $f(x)=e^{-ax}$, $a>0$. (Text Book Page No.: 4.46)
8. Find the Fourier sine transform of e^{-3x}. (Text Book Page No.: 4.67)

9. Find the Fourier sine transform of $\frac{1}{x}$. (Text Book Page No.: 4.57)

10. Find the Fourier transform of $f(x)=\begin{cases}1, & |x|<1\\ 0, & |x|>1\end{cases}$.

11. Find the Fourier transform of $f(x)=\begin{cases}e^{ikx}, & a<x<b\\ 0, & x<a \text{ and } x>b\end{cases}$.

    Text Book Page No.: 4.17

12. Define self reciprocal with respect to Fourier Transform. (Text Book Page No.: 4.15)

13. State Parseval's identity on Fourier transform. (Text Book Page No.: 4.13)

14. State convolution theorem in Fourier transform. (Text Book Page No.: 4.12)

15. State and prove the change of scale property of Fourier Transform.

    Text Book Page No.: 4.7

16. If $F(s)$ is the Fourier transform of $f(x)$, show that $F\left(f(x-a)\right)=e^{ias}F(s)$.

    Text Book Page No.: 4.6

17. What is the Fourier transform of $f(x-a)$, if the Fourier transform of $f(x)$ is $F(s)$?

    Text Book Page No.: 4.6

18. If $F\left\{f(x)\right\}=F(s)$, prove that $F\left\{f(ax)\right\}=\frac{1}{a}F\left(\frac{s}{a}\right)$. (Text Book Page No.: 4.7)

19. If $F_c(s)$ is the Fourier cosine transform of $f(x)$, prove that the Fourier cosine transform of $f(ax)$ is $\frac{1}{a}F_c\left(\frac{s}{a}\right)$. (Text Book Page No.: 4.43)

Unit – III (Partial Differential Equation)

1. Form the PDE from $(x-a)^2+(y-b)^2+z^2=r^2$. (Text Book Page No.: 1.4)

2. Find the PDE of the family of spheres having their centers on the z – axis.

   Text Book Page No.: 1.3

3. Form the partial differential equation by eliminating the constants a and b from $z=\left(x^2+a^2\right)\left(y^2+b^2\right)$. (Text Book Page No.: 1.6)

4. Form the partial differential equation by eliminating the arbitrary constants a and b from $z=\left(x^2+a\right)\left(y^2+b\right)$. (Text Book Page No.: 1.25)

5. Form the PDE by eliminating the arbitrary constants 'a' and 'b' from $z=ax^2+by^2$.

   Text Book Page No.: 1.7

6. Form the PDE by eliminating the arbitrary constants a,b from the relation $z=ax^3+by^3$. (Text Book Page No.: 1.25)

7. Form the PDE by eliminating the arbitrary function from $\phi\left(x^2-y^2,z\right)=0$.

8. Eliminate the arbitrary function 'f' from $z=f\left(\frac{y}{x}\right)$ and form the PDE.

   Text Book Page No.: 1.14

9. Form the partial differential equation by eliminating the arbitrary function from $z^2-xy=f\left(\frac{x}{z}\right)$. (Text Book Page No.: 1.15)

10. Find the partial differential equation of all planes cutting equal intercepts from the x and y axes. (Text Book Page No.: 1.8)

11. Find the complete integral of $p+q=pq$. (Text Book Page No.: 1.29)

12. Solve the partial differential equation $pq=x$. (Text Book Page No.: 1.80)

13. Solve $px^2+qy^2=z^2$. (Text Book Page No.: 1.85)

14. Solve the equation $\left(D-D'\right)^3 z=0$. (Text Book Page No.: 1.128)

15. Solve $\left(D^3-2D^2D'\right)z=0$. (Text Book Page No.: 1.127)

16. Solve $\left(D^2-7DD'+D'^2\right)z=0$. (Text Book Page No.: 1.123)

17. Solve $\left(D^3-4D^2D'+4DD'^2\right)z=0$.

18. Solve $\left(D^4 - D'^4\right)z = 0$. (Text Book Page No.: 1.129)

19. Find the particular integral of $\left(D^2 - 2DD' + D'^2\right)z = e^{x-y}$.

    Text Book Page No.: 1.174

20. Solve $\frac{\partial^2 z}{\partial x^2} - \frac{\partial^2 z}{\partial x \partial y} + \frac{\partial z}{\partial x} = 0$. (Text Book Page No.: 1.179)

21. Solve $(D-1)(D-D'+1)z = 0$. (Text Book Page No.: 1.180)

Unit – IV (Application of Partial Diff. Eqn.)

1. Classify the partial differential equation $4\frac{\partial^2 u}{\partial x^2} = \frac{\partial u}{\partial t}$. (Text Book Page No.: 3.2)

2. Write down all possible solutions of one dimensional wave equation.

   Text Book Page No.: 3.18

3. Write down the three possible solutions of one dimensional heat equation.

   Text Book Page No.: 3.50

4. What is the basic difference between the solutions of one dimensional wave equation and one dimensional heat equation with respect to the time?

5. In the wave equation $\frac{\partial^2 y}{\partial t^2} = c^2 \frac{\partial^2 y}{\partial x^2}$, what does c^2 stand for?

   Text Book Page No.: 3.15

6. State the assumptions in deriving the one dimensional wave equation $y_{tt} = \alpha^2 y_{xx}$.

7. In the one dimensional heat equation $u_t = c^2 u_{xx}$, what is c^2?

   Text Book Page No.: 3.46

8. A tightly stretched string with fixed end points $x = 0$ and $x = \ell$ is initially in a position given by $y(x,0) = y_0 \sin^3\left(\frac{\pi x}{\ell}\right)$. If it is released from rest in this position, write the boundary conditions. (Text Book Page No.: 3.42)

9. Define steady state condition on heat flow. (Text Book Page No.: 3.55)

10. State the assumptions in deriving the one-dimensions heat flow equation.

11. An insulated rod of length ℓ cm has its ends A and B maintained at 0°C and 80°C respectively. Find the steady state solution of the rod.

    Text Book Page No.: 3.56

12. A rod 40 cm long with insulated sides has its ends A and B kept at 20°C and 60°C respectively. Find the steady state temperature at a location 15 cm from A.

    Text Book Page No.: 3.69

13. The ends A and B of a rod 20 cm long have the temperature at 30°C and 80°C until steady state prevails. Find the steady state temperature.

14. Give three possible solutions of two dimensional steady state heat flow equation.

    Text Book Page No.: 3.78

15. Write all three possible solutions of steady state two – dimensional heat equation.

    Text Book Page No.: 3.78

16. Write the possible solutions of the Laplace equation $u_{xx} + u_{yy} = 0$.

    Text Book Page No.: 3.78

17. A plate is bounded by the lines $x = 0, y = 0, x = l$ and $y = l$. Its faces are insulated. The edge coinciding with x – axis is kept at $100^{\circ}C$. The edge coinciding with y – axis is kept at $50^{\circ}C$. The other two edges are kept at $0^{\circ}C$. Write the boundary conditions that are needed for solving two dimensional heat flow equation.

Unit – V (Z – Transform)

1. Define the unit step sequence. Write its Z – transform.

   Text Book Page No.: 5.2; 5.9

2. Find the Z – transform of $\sin\frac{n\pi}{2}$. (Text Book Page No.: 5.19)

3. If $F(z)=\dfrac{z^2}{\left(z-\frac{1}{2}\right)\left(z-\frac{1}{4}\right)\left(z-\frac{3}{4}\right)}$, find $f(0)$. (Text Book Page No.: 5.34)

4. Prove that $Z\left[a^n f(n)\right]=\bar{f}\left(\frac{z}{a}\right)$, if $Z\left[f(n)\right]=\bar{f}(z)$. (Text Book Page No.: 5.4)

5. If $Z\left[f(n)\right]=\bar{f}(z)$, the prove that $Z\left[f(-n)\right]=\bar{f}\left(\frac{1}{z}\right)$.

6. Find the Z – transform of $x(n)=\begin{cases}\frac{a^n}{n!} & \text{for } n\geq 0\\ 0 & \text{otherwise}\end{cases}$. (Text Book Page No.: 5.17)

7. Find the Z – transform of a^n. (Text Book Page No.: 5.12)

8. Find the Z – transform of n. (Text Book Page No.: 5.13)

9. Find the Z – transform of n^2. (Text Book Page No.: 5.14)

10. Find the Z – transform of $\frac{1}{n}$. (Text Book Page No.: 5.14)

11. Find $Z\left[\frac{1}{n+1}\right]$. (Text Book Page No.: 5.37)

12. Find the Z – transform of $\frac{1}{n!}$. (Text Book Page No.: 5.14)

13. State the convolution theorem on Z – transforms. (Text Book Page No.: 5.73)

14. Find the inverse Z-transform of $\frac{z}{(z+1)^2}$. (Text Book Page No.: 5.60)

15. Obtain $Z^{-1}\left[\frac{z}{(z+1)(z+2)}\right]$. (Text Book Page No.: 5.59)

16. What advantage is gained when Z – transform is used to solve difference equation?

17. Form a difference equation by eliminating arbitrary constants from $U_n=A2^{n+1}$.

    Text Book Page No.: 5.111

18. Form a difference equation by eliminating the arbitrary constant A from $y_n=A.3^n$.

    Text Book Page No.: 5.82

19. Find the difference equation generated by $y_n = an + b2^n$.

    Text Book Page No.: 5.111

20. Solve $y_{n+1} - 2y_n = 0$ given $y_0 = 3$. (Text Book Page No.: 5.111)

Text Book for Reference:

"TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS"

Publication : Hariganesh Publications **Author : C. Ganesan**

To buy the book visit **www.hariganesh.com/textbook**

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