X10659 Reg. No. : | | | | | | | | | | | | |

Question Paper Code : X 10659

B.E./B.Tech. DEGREE EXAMINATIONS, NOV./DEC. 2020
Third Semester
Civil Engineering
MA 8353 – TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS
(Common to Aeronautical Engineering/Aerospace Engineering/Agriculture Engineering/Automobile Engineering/Electrical and Electronics Engineering/ Electronics and Instrumentation Engineering/Industrial Engineering/ Industrial Engineering and Management/Instrumentation and Control Engineering/ Manufacturing Engineering/Marine Engineering/Material Science and Engineering/Mechanical Engineering/Mechanical Engineering (Sandwich) Mechanical and Automation Engineering/Mechatronics Engineering/ Production Engineering/Robotics and Automation/Bio Technology/Chemical and Electrochemical Engineering/ Food Technology/Pharmaceutical Technology)
(Regulations 2017)

Time : Three Hours Maximum : 100 Marks

Answer ALL questions.

PART – A **(10×2=20 Marks)**

1. Obtain the Partial differential equation by eliminating the arbitary constants a and b from $z = (x^2 + a)(y^2 + b)$.

2. Find the complete solution of $p^2 + q^2 = 1$.

3. State Dirichlet's Conditions.

4. Write the Complex Fourier series.

5. Write the possible solutions of the steady state two dimensional heat flow equation $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$.

6. What is meant by steady state ?

7. If the Fourier transform of f(x) is F(s), then find the Fourier transform of f(x)cosax.

8. Write the Parsevals identity of Fourier transform.

9. Find the Z-transform of a^n.

10. State Final Value Theorem.

PART – B **(5×16=80 Marks)**

11. a) i) Solve the equation $z = px + qy + \sqrt{1+p^2+q^2}$. **(8)**

ii) Solve $z^2(p^2 + q^2) = x + y$. **(8)**

(OR)

b) i) Solve $2(z + xp + yq) = yp^2$. **(8)**

ii) Solve $\frac{\partial^3 z}{\partial x^3} - 2\frac{\partial^3 z}{\partial x^2 \partial y} = \sin(x+2y) + 3x^2 y$ **(8)**

(OR)

12. a) i) Find the Fourier series expansions of $f(x) = x^2 + x$ in $(-\pi, \pi)$ of Periodicity 2π. **(8)**

ii) Obtain half range Fourier Cosine series expansion of $f(x) = (x - 1)^2$ in $0 < x < 1$ and evaluate $\frac{\pi^2}{6} = 1 + \frac{1}{2^2} + \frac{1}{3^2} + \ldots$ **(8)**

(OR)

b) i) Obtain the Fourier series expansion of $f(x) = \begin{cases} -x, & -\pi < x \le 0 \\ x, & 0 < x < \pi \end{cases}$ and evaluate $\frac{\pi^2}{6} = 1 + \frac{1}{3^2} + \frac{1}{5^2} + \ldots$ **(8)**

ii) Obtain the First three harmonics in the Fourier cosine series of y = f(x) using the following table : **(8)**

x :	0	1	2	3	4	5
y :	4	8	15	7	6	2.

13. a) A tightly stretched string of length l is fastened at bath end A & C. The string is at rest, with the point B(x = b) drawn aside through a small distance 'd' and released to execute small transverse vibration. Find the transverse displacement of any point of the string at any subsequent time. **(16)**

(OR)

b) A uniform bar of length l through which heat flows is insulated at its sides. The ends are kept at zero temperature. If the initial temperature at the interior points of the bar is given by $k(lx - x^2)$, for $0 < x < l$, find the temperature distribution in the bar after time t. **(16)**

14. a) i) Find the Fourier sine transform of $f(x) = \frac{e^{-ax}}{x}$. **(8)**

ii) Find Fourier transform of $f(x) = \begin{cases} 1, & |x| < 1 \\ 0, & |x| > 1 \end{cases}$ and hence evaluate $\int_0^\infty \frac{\sin x}{x} dx$. **(8)**

(OR)

b) i) Verify Convolution theorem for Fourier transform, if $f(x) = g(x) = e^{-x^2}$. **(8)**

ii) Find Fourier sine integral of $f(x) = \begin{cases} 1, & 0 \le x \le 1 \\ 0, & x > 0 \end{cases}$ and hence evaluate $\int_0^\infty \frac{1 - \cos(\pi\alpha)}{\alpha} \sin(x\alpha)\, dx$. **(8)**

15. a) i) Find Z-transform of 2n + 5 sin $\frac{n\pi}{4} - 3a^4$. **(8)**

ii) Find the inverse Z-transform of $\frac{4z^2 - 2z}{z^3 - 5z^2 + 8z - 4}$. **(8)**

(OR)

b) i) Using Convolution Theorem, find the inverse Z-transform of $\frac{z^2}{(z-2)(z-3)}$. **(8)**

ii) Using Z-transformation, solve $U_{n+2} + 4\,U_{n+1} + 2U_n = 3^n$ given that $u_0 = 0$, $u_1 = 1$. **(8)**
