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Question Paper Code: 53021A

B.E./B.Tech. DEGREE EXAMINATION, MAY 2021

Third Semester

Civil Engineering

15UMA321 Transforms and Partial Differential Equations

(Common to Mechanical, ECE, EEE, Chemical, AGRI, BME)

(Regulation 2015)

Duration: 1:45 hrs

Maximum: 50 Marks

PART A - (10 x 2 = 20 Marks)

Answer any ten of the following questions

1. List the Dirichlet's conditions on Fourier series. CO1- R
2. If $F(s)$ is the Fourier Transform of $f(x)$. Identify $F[f(x-a)] = e^{ias} F(s)$. CO2- R
3. Identify $z(n) = \frac{z}{(z-1)^2}$, $|z| > 1$. CO3- R
4. Identify the difference equation by eliminating arbitrary constants for,
 $y = A2^n + Bn$. CO4- R
5. List the three possible solutions for Two dimensional heat equation. CO5- R
6. What are the constants a_0 & a_n in the Fourier series expansion of
 $f(x) = x - x^3, (-\pi, \pi)$. CO1-R
7. Find the Fourier sine transform of $f(x) = \frac{1}{x}$ CO2-E
8. Find the value of $Z\left(\frac{1}{n(n+1)}\right)$ CO3-R
9. Form the PDE by eliminating the arbitrary constants 'a' and 'b' from $z = (x+a)^2 + (y-b)^2$. CO4-E
10. A rod 30 cm long has its ends A and B kept at 20 and 80 degree Celsius respectively. Find the steady state temperature distribution in the rod CO5-R

11. Find the half range sine series of $f(x) = 2$ in $0 < x < \pi$. CO1-E
12. Find the Fourier sine transform of $\frac{1}{x}, 0 < x < \infty$. CO2-E
13. Solve $Z[na^n]$. CO3-R
14. Form the PDE by eliminating f from $z = xy + f(x^2 + y^2 + z^2)$ CO4-E
15. Write all possible solutions for one dimensional wave equation. CO5-R

PART – B (3 x 10= 30Marks)

Answer any three of the following questions

16. Find the fourier series expansion $f(x) = \begin{cases} x, & 0 < x < \pi \\ 2\pi - x, & \pi < x < 2\pi \end{cases}$ and CO1 -App (10)
hence deduce that

$$\frac{1}{1^2} + \frac{1}{2^2} + \dots = \frac{\pi^2}{8}$$

17. Find the sine and cosine transform of $e^{-ax}, a > 0$. Hence, Evaluate CO2 -App (10)
 $\int_0^{\infty} \frac{x^2}{(x^2 + a^2)^2} dx$ and $\int_0^{\infty} \frac{dx}{(x^2 + a^2)(x^2 + b^2)}$.
18. Solve $y_{n+2} + 6y_{n+1} + 9y_n = 2n$ given $y_0 = y_1 = 0$, using CO3- Ana (10)
Z-transform.
19. Solve $(D^3 - 7DD'^2 - 6D'^3) z = e^{2x+y} + \sin(x + 2y) + x^2y$. CO4- App (10)
20. An infinitely long plate of width π cms with insulated surfaces has its CO5 -U (10)
temperature $u = 0$ on both long sides and one of the shorter sides. The
temperature along the short edge $y = 0$ is given by $u(x, 0) = 3x, 0 <$
 $x < \pi$. Find the steady state temperature distribution $u(x, y)$.