

22U402

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Name:

Reg.No:

FOURTH SEMESTER B.Sc. DEGREE EXAMINATION, APRIL 2024

(CBCSS - UG)

(Regular/Supplementary/Improvement)

CC19U MTS4 C04 / CC20U MTS4 C04 - MATHEMATICS - IV

(Mathematics - Complementary Course)

(2019 Admission onwards)

Time : 2.00 Hours

Maximum : 60 Marks

Credit : 3

Part A (Short answer questions)

Answer *all* questions. Each question carries 2 marks.

1. Write the difference between explicit and implicit solutions.
2. Verify that $y = \frac{1}{(1 + ce^{-x})}$ is a one-parameter family of solutions of the first order differential equation $y' = y - y^2$. Find a solution of the initial value problem $y' = y - y^2, y(-1) = 2$.
3. Solve $(1 + x)dy - ydx = 0$.
4. Define linear equations, homogeneous and non-homogeneous equations.
5. Briefly explain method of reduction of order.
6. Solve $y'' + 4y' + 7y = 0$
7. Evaluate $\mathcal{L}^{-1} \left(\frac{(s + 1)^3}{s^4} \right)$
8. Evaluate $\mathcal{L}^{-1} \left(\frac{1}{s^2 - 6s + 10} \right)$
9. Define a unit step function.
10. Find the period of the function $f(x) = \sin 3x + \cos 2x$
11. Check whether the partial differential equation $\frac{\partial^2 u}{\partial x^2} = 9 \frac{\partial^2 u}{\partial x \partial y}$ is hyperbolic, parabolic or elliptic.
12. When a boundary condition of a Laplace equation is said to be a Robin condition?

(Ceiling: 20 Marks)

Part B (Short essay questions - Paragraph)

Answer *all* questions. Each question carries 5 marks.

13. Solve $6xydx + (4y + 9x^2)dy = 0$.

14. Solve $\frac{dy}{dx} = \frac{y-x}{y+x}$.
15. Find the general solution of $y'' - 4y' + 4y = (x+1)e^{2x}$ by using Variation of Parameters.
16. Solve the initial value problem $x^2y'' + xy' + y = 0, y(1) = 1, y'(1) = 2$.
17. Evaluate $\mathcal{L}^{-1} \left\{ \frac{\frac{s}{2} + \frac{5}{3}}{s^2 + 4s + 6} \right\}$
18. Using convolution theorem evaluate $\mathcal{L}^{-1} \left\{ \frac{1}{(s^2 + k^2)^2} \right\}$
19. Find the Fourier series expansion of $f(x) = \begin{cases} 0, & \text{if } -\frac{\pi}{2} < x < 0 \\ \cos x, & \text{if } 0 \leq x < \frac{\pi}{2} \end{cases}$

(Ceiling: 30 Marks)

Part C (Essay questions)

Answer any **one** question. The question carries 10 marks.

20. a) Solve the initial value problem $y'' + y = 4x + 10\sin x, y(\Pi) = 0, y'(\Pi) = 2$.
 b) Solve $y''' + y'' = e^x \cos x$.
21. Using Laplace transforms solve the initial value problem $y'' + 4y' + 6y = 1 + e^{-t}$ with $y(0) = 0$ and $y'(0) = 0$

(1 × 10 = 10 Marks)
