23U402 (Pages: 2) Name : .....

Reg. No : .....

FOURTH SEMESTER B.Sc. DEGREE EXAMINATION, APRIL 2025

(CBCSS-UG)

(Regular/Supplementary/Improvement)

CC19U MTS4 C04 / CC20U MTS4 C04 - MATHEMATICS - IV

(Mathematics - Complementary Course)

(2019 Admission onwards)

Time: 2 Hours Maximum: 60 Marks

Credit: 3

Part A (Short answer questions)

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

1. Determine whether the function $y = e^{3x}cos2x$ is a solution of the differential equation $y^{''} - 6y^{'} + 3y = 0$.
2. Verify that $y = \dfrac{1}{x^2 + c}$ is a one-parameter family of solutions of the first order differential equation $y^{'} + 2xy^2 = 0$. Find a solution of the initial value problem $y^{'} + 2xy^2 = 0, y(0) = 1$.
3. Solve $x\dfrac{dy}{dx} = 4y$.
4. Determine whether $(tanx - sinxsiny)dx + (cosxcosy)dy = 0$ is exact.
5. State the criterion for linearly independent solutions.
6. Define deflection curve.
7. If $f(t) = (t+1)^3$, find $\mathscr{L}\{f(t)\}$
8. Using second shifting theorem evaluate $\mathscr{L}(t\mathscr{U}(t-2))$
9. Define Dirac delta function.
10. Find the coefficient of $\sin n\pi x$ in the Fourier series expansion of the function
$f(x) = \begin{cases} 1, & \text{if} \quad -1 < x < 0 \\ x, & \text{if} \quad 0 \leq x < 1 \end{cases}$
11. Check whether the partial differential equation $3\dfrac{\partial^2 u}{\partial x^2} = \dfrac{\partial u}{\partial y}$ is hyperbolic, parabolic or elliptic.
12. Write the one-dimensional heat equation.

(Ceiling: 20 Marks)

Part B (Short essay questions - Paragraph)

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

13. Solve the initial value problem $x\dfrac{dy}{dx} + y = e^x, y(1) = 2$.
14. Solve $x^2\dfrac{dy}{dx} - 2xy = 3y^4, y(1) = \dfrac{1}{2}$.

15. Find the general solution of $y''' - 5y'' + 3y' + 9y = 0$.

16. Solve $x^2y'' + xy' - y = lnx$.

17. Evaluate $\mathscr{L}^{-1}\left(\dfrac{2s-4}{(s^2+s)(s^2+1)}\right)$

18. Using Laplace transform solve the integral equation $f(t) = 1 + t - \dfrac{8}{3}\displaystyle\int_0^t (t-\tau)^3 f(\tau)d\tau$

19. Expand the function $f(x) = \begin{cases} 1, & \text{if} \quad -2 < x < -1 \\ 0, & \text{if} \quad -1 < x < 1 \\ 1, & \text{if} \quad 1 < x < 2 \end{cases}$ in an appropriate cosine or sine series.

(Ceiling: 30 Marks)

Part C (Essay questions)

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

20. a) Solve the initial value problem $5y'' + y' = -6x, y(0) = 0, y'(0) = -10$

    b) Solve $\dfrac{1}{4}y'' + y' + y = x^2 - 2x$

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)

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