

D 120575

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Name.....

Reg. No.....

**FOURTH SEMESTER (CBCSS—UG) DEGREE EXAMINATION  
APRIL 2025**

Mathematics

MTS 4C 04—MATHEMATICS—4

(2019—2023 Admissions)

Time : Two Hours

Maximum : 60 Marks

**Section A**

*Answer any number of questions.*

*Each question carries 2 marks.*

*Ceiling is 20.*

1. Solve  $(1 + x) dy - y dx = 0$ .
2. Solve initial value problem  $\frac{dy}{dx} + y = x, y(0) = 4$ .
3. Solve  $(e^{2x} - y \cos xy) dx + (2xe^{2y} - x \cos xy + 2y) dy = 0$ .
4. The function  $y_1 = x^2$  is a solution of  $x^2 y'' - 3xy' + 4y = 0$ . Find the general solution on the interval  $(0, \infty)$ .
5. Solve  $y'' - 10y' + 25y = 0$ .
6. Find a particular solution of  $y'' - 5y' + 4y = 8e^x$ .
7. Let  $f(t) = 4t^2 - 5 \sin 3t$ . Find  $\mathcal{L}(f(t))$ .
8. Evaluate  $\mathcal{L}(f(t))$  for  $f(t) = \begin{cases} 0, & 0 \leq t < 3 \\ 2, & t \geq 3 \end{cases}$ .

**Turn over**

9. Evaluate  $\mathcal{L}^{-1}\left(\frac{-2s+6}{s^2+4}\right)$ .
10. Show that the functions  $f_1(x) = x^3$ ,  $f_2(x) = x^2 + 1$  are orthogonal on  $[-2, 2]$ .
11. Show that the partial differential equation  $\frac{\partial^2 u}{\partial x^2} = 9 \frac{\partial^2 u}{\partial x \partial y}$  is hyperbolic.
12. State superposition principle.

### Section B

*Answer any number of questions.*

*Each question carries 5 marks.*

*Ceiling is 30.*

13. Solve  $xydx + (2x^2 + 3y^2 - 20)dy = 0$  by finding an appropriate integrating factor.
14. Solve the initial value problem  $\frac{dy}{dx} = (-2x + y)^2 + 7$ ,  $y(0) = 0$ .
15. Solve the initial value problem  $y'' + y = 4x + 10 \sin x$ ,  $y(\pi) = 0$ ,  $y'(\pi) = 2$ .
16. Solve  $x^2 y'' - 3xy' + 3y = 2x^4 e^x$ .
17. Use the Laplace transform to solve the initial value problem  $\frac{dy}{dt} + 3y = 13 \sin 2t$ ,  $y(0) = 6$ .
18. Evaluate :
- a)  $e^t * \sin t$ .
- b)  $\mathcal{L}(e^t * \sin t)$ .
19. Show that the set  $\{1, \cos x, \cos 2x, \dots\}$  is orthogonal on the interval  $[-\pi, \pi]$ . Also find norm of each functions in the set.

**Section C**

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

20. Solve  $4y'' + 36y = \csc 3x$  by variation of parameters.

21. Find the Fourier series of  $f(x) = \begin{cases} 0, & -\pi < x < 0 \\ x^2, & 0 \leq x < \pi \end{cases}$  on the interval  $[-\pi, \pi]$ .

(1 × 10 = 10 marks)

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Name.....

Reg. No.....

**FOURTH SEMESTER (CBCSS—UG) DEGREE EXAMINATION  
APRIL 2024**

Mathematics

MTS4C04—MATHEMATICS—4

(2019 Admission onwards)

Time : Two Hours

Maximum : 60 Marks

**Section A***Answer any number of questions.**Each question carries 2 marks.**Ceiling is 20.*

1. Solve  $dx + e^{3x} dy = 0$ .
2. Find general solution of  $x \frac{dy}{dx} - 4y = x^6 e^x$ .
3. Solve the initial value problem  $\frac{dy}{dx} = \frac{xy^2 - \cos x \sin x}{y(1-x^2)}$ ,  $y(0) = 2$ .
4. Determine whether the functions  $f_1(x) = x$ ,  $f_2(x) = x^2$ ,  $f_3(x) = 4x - 3x^2$  are linearly dependent or linearly independent on the interval  $(-\infty, \infty)$ .
5. The function  $y_1 = \ln x$  is a solution of  $xy'' + y' = 0$ . Find a second solution  $y_2(x)$ .
6. Solve the initial value problem  $4y'' + 4y' + 17y = 0$ ,  $y(0) = -1$ ,  $y'(0) = 2$ .
7. Find a homogeneous linear differential equation with constant co-efficient whose solution is  $y = c_1 \cos 8x + c_2 \sin 8x$ .
8. Let  $f(t) = \begin{cases} t, & 0 \leq t \leq 1 \\ 1, & t \geq 1 \end{cases}$ . Find  $\mathcal{L}(f(t))$ .

Turn over

9. Find  $\mathcal{L}^{-1}\left(\frac{4s}{4s^2 + 1}\right)$ .
10. Evaluate  $\mathcal{L}(t \sin kt)$ .
11. Show that the functions  $f_1(x) = x$ ,  $f_2(x) = \cos 2x$  are orthogonal on  $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$ .
12. Show that the partial differential equation  $\frac{\partial^2 u}{\partial x^2} + 2\frac{\partial^2 u}{\partial x \partial y} + \frac{\partial^2 u}{\partial y^2} + \frac{\partial u}{\partial x} - 6\frac{\partial u}{\partial y} = 0$  is parabolic.

### Section B

*Answer any number of questions.*

*Each question carries 5 marks.*

*Ceiling is 30.*

13. Solve  $(x^2 + y^2) dx + (x^2 - xy) dy = 0$ .
14. Solve the initial value problem  $\frac{dy}{dx} = \cos(x + y)$ ,  $y(0) = \frac{\pi}{4}$ .
15. Solve  $y'' - 2y' - 3y = 4x - 5 + 6xe^{2x}$ .
16. Solve the homogeneous boundary value problem  $y'' + \lambda y = 0$ ,  $y(0) = 0$ ,  $y(L) = 0$ .
17. Solve  $x^2 y'' - 3xy' + 3y = 2x^4 e^x$ .
18. Solve  $f(t) = 3t^2 - e^{-t} - \int_0^t f(\tau) e^{t-\tau} d\tau$  for  $f(t)$ .
19. Expand  $f(x) = x^2$ ,  $0 < x < L$  in a cosine series.

**Section C**

*Answer any **one** questions.*

*Each question carries 10 marks.*

20. Solve the initial value problem  $y'' + 4y' + 6y = 1 + e^{-t}$ ,  $y(0) = 0$ ,  $y'(0) = 0$  using Laplace transform.

21. Find the Fourier series of  $f(x) = \begin{cases} 0 & -\pi < x < 0 \\ x^2, & 0 \leq x < \pi \end{cases}$  on the interval  $[-\pi, \pi]$ .

C 41232

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Name.....

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**FOURTH SEMESTER (CBCSS—UG) DEGREE EXAMINATION  
APRIL 2023**

Mathematics

MTS 4C 04—MATHEMATICS—4

(2019 Admission onwards)

Time : Two Hours

Maximum : 60 Marks

**Section A***Answer any number of questions.**Each question carries 2 marks.**Ceiling is 20.*

1. Solve the initial value problem  $\frac{dy}{dx} = \frac{-x}{y}$ ,  $y(4) = -3$ .
2. Solve  $(x^2 - 9) \frac{dy}{dx} + xy = 0$ .
3. Find the value of  $k$  so that the differential equation  $(y^3 + kxy^4 - 2x) dx + (3xy^2 + 20x^2y^3) dy = 0$  is exact.
4. Verify that the functions  $e^{-3x}$ ,  $e^{4x}$  form a fundamental set of solutions of the differential equation  $y'' - y' - 12y = 0$  on  $(-\infty, \infty)$ .
5. The function  $y_1 = e^x$  is a solution of  $y'' - y = 0$  on the interval  $(-\infty, \infty)$ , use reduction of order to find a second solution  $y_2$ .
6. Find the general solution of  $y''' - 4y'' - 5y' = 0$ .
7. Solve the initial value problem  $y'' + 4y' + 5y = 35e^{-4x}$ ,  $y(0) = -3$ ,  $y'(0) = 1$ .
8. Find  $\mathcal{L}(f(t))$ , where  $f(t) = \sin 2t \cos 2t$ .
9. Evaluate  $\mathcal{L}^{-1} \left( \frac{s}{(s-2)(s-3)(s-6)} \right)$ .

**Turn over**

10. Write  $f(t) = \begin{cases} 2, & 0 \leq t < 3 \\ -2, & t \geq 3 \end{cases}$  in terms of unit step functions and find  $\mathcal{L}(f(t))$
11. Show that the functions  $f_1(x) = e^x$ ,  $f_2(x) = xe^{-x} - e^{-x}$  are orthogonal on  $[0, 2]$ ,
12. Show that the partial differential equation  $\frac{\partial^2 u}{\partial x^2} + 6 \frac{\partial^2 u}{\partial x \partial y} + 9 \frac{\partial^2 u}{\partial y^2}$  is parabolic.

**Section B**

*Answer any number of questions.  
Each question carries 5 marks. Ceiling is 30.*

13. Solve  $x \frac{dy}{dx} + y = x^2 y^2$ .
14. Solve  $\frac{dy}{dx} = (x + y + 1)^2$  by using an appropriate substitution.
15.  $y''' + y'' = e^x \cos x$ .
16. Solve  $x^2 y'' - 3xy' + 3y = 2x^4 e^x$ .
17. Solve  $y' + 6y = e^{4t}$ ,  $y(0) = 2$  using the Laplace transform.
18. Evaluate  $\mathcal{L}^{-1} \left( \frac{1}{(s^2 + k^2)^2} \right)$ .
19. Expand  $f(x) = x$ ,  $-2 < x < 2$  in a Fourier series.

**Section C**

*Answer any **one** question.*

*The question carries 10 marks.*

20. Solve the initial value problem  $y'' - 6y' + 9y = t^2 e^{3t}$ ,  $y(0) = 2$ ,  $y'(0) = 17$  using Laplace transform.

21. Expand  $f(x) = \begin{cases} 0, & -\pi < x < 0 \\ \pi - x, & 0 \leq x < \pi \end{cases}$  in a Fourier series.

C 21546

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Name.....

Reg. No.....

**FOURTH SEMESTER (CBCSS-UG) DEGREE EXAMINATION, APRIL 2022**

Mathematics

MTS 4C 04—MATHEMATICS – 4

(2019 Admission onwards)

Time : Two Hours

Maximum : 60 Marks

**Section A***Answer at least **eight** questions.**Each question carries 3 marks.**All questions can be attended.**Overall Ceiling 24.*

1. Write the order and degree of the differential equation  $\frac{d^2y}{dx^2} + \left(\frac{dy}{dx}\right)^2 + 4y = \sin x$ .
2. Verify that  $y = xe^x$  is a solution of  $y'' - 2y' + y = 0$ .
3. Show that  $(25x^2 - 5y)dx + (3y^2 - 5x)dy = 0$  is an exact differential equation.
4. Find the integrating factor corresponding to the differential equation  $\frac{dy}{dx} + y \tan x = \cos x$ .
5. Reduce  $\frac{dy}{dx} = (y - 2x^2) - 7$  to an equation with separable variables.
6. Find the general solution of  $y'' - y' - 2y = 0$ .
7. Find the particular integral of  $y'' + 5y' + 6y = e^{2x}$ .
8. Find the Laplace transform of  $\sin 3t \cos 2t$ .
9. Find the Laplace transform of  $e^{-3t} t^3$ .
10. Write the inverse Laplace transform of  $\frac{s}{s^2 + 16}$ .
11. Show that the functions  $f_1(x) = x^3$  and  $f_2(x) = x^2 + 1$  are orthogonal on  $[-1, 1]$ .
12. Show that the partial differential equation  $3 \frac{\partial^2 u}{\partial x^2} = \frac{\partial u}{\partial y}$  is parabolic.

(8 × 3 = 24 marks)

**Turn over**

**Section B**

Answer at least **five** questions.

Each question carries 5 marks.

All questions can be attended.

Overall Ceiling 25.

13. Solve  $(1+x)y dx + (1-y)x dy = 0$ .

14. Solve  $(x^2 + y^2) \frac{dy}{dx} = xy$ .

15. Solve  $y'' + y = \tan x$  using the method of variation of parameter.

16. Find the Laplace transform of  $\frac{1 - \cos t}{t^2}$ .

17. Find the inverse Laplace transform of  $\frac{s^2 + 2s + 5}{s^3}$ .

18. Apply convolution theorem to evaluate the inverse Laplace transform of  $\frac{s^2}{(s^2 + a^2)(s^2 + b^2)}$ .

19. Solve  $\frac{\partial u}{\partial x} - 2 \frac{\partial u}{\partial y} - u = 0$  using method of separation of variables.

(5 × 5 = 25 marks)

**Section C**

Answer any **one** question.

The question carries 11 marks.

20. Solve  $x^3 y''' - x^2 y'' + 2xy' - 2y = \cos(2 \log x)$ .

21. Expand  $f(x) = x \sin x$  as a Fourier series in  $0 < x < 2\pi$ .

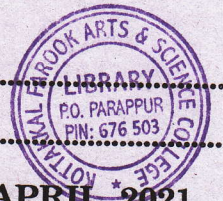
(1 × 11 = 11 marks)

C 3556

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Name.....

Reg. No.....



FOURTH SEMESTER (CBCSS—UG) DEGREE EXAMINATION, APRIL 2021

Mathematics

MTS 4C 04—MATHEMATICS—4

Time : Two Hours

Maximum : 60 Marks

Section A

Answer at least **eight** questions.

Each question carries 3 marks.

All questions can be attended.

Overall Ceiling 24.

1. If  $x = C_1 \cos 4t + C_2 \sin 4t$  is a solution of  $x'' + 16x = 0$ ,  $x(\pi/2) = -2$ ,  $x'(\pi/2) = 1$ , then find  $C_1$  and  $C_2$ .
2. Write any two solutions of  $y'' = y'$  by inspection.
3. Solve  $\frac{dy}{dx} = \sin 5x$ .
4. Check whether  $\frac{dy}{dx} = \frac{xy^2 - \cos x \sin x}{y(1-x^2)}$  is an exact differential equation.
5. Write the integrating factor corresponding to the differential equation  $\frac{xdy}{dx} - 4y = x^6 e^x$ .
6. Show that  $y = 3e^{2x} + e^{-2x} - 3x$  is a unique solution of  $y'' - 4y = 12x$ ,  $y(0) = 4$ ,  $y'(0) = 1$ .
7. Check whether  $y_1 = e^{3x}$  and  $y_2 = e^{-3x}$  are linearly independent solutions of  $y'' - 9y = 0$ .
8. If  $y_1 = x^2$  is a solution of  $x^2 y'' - 3xy' + 4y = 0$ , find a second solution.
9. Find the Laplace transform of  $e^{-3t}$ .
10. Find the inverse Laplace transform of  $\frac{6-2s}{s^2+4}$ .
11. Check whether  $f_1(x) = x$ ,  $f_2(x) = \cos 2x$  are orthogonal in  $[-\pi/2, \pi/2]$ .
12. Show that the partial differential equation  $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$  is elliptic.

(8 × 3 = 24 marks)

Turn over

## Section B

Answer at least five questions.

Each question carries 5 marks.

All questions can be attended.

Overall Ceiling 25.

13. Solve  $(x^2 + y^2)dx + (x^2 - xy)dy = 0$ .
14. Solve the initial value problem  $\frac{dy}{dx} = (-2x + y)^2 - 7, y(0) = 0$ .
15. Find the particular integral of  $(D - 3)^3 y = xe^{-2x}$ .
16. Using the method of variation of parameters solve  $y'' + 3y' + 2y = 3e^{-2x} + x$ .
17. Convert the equation  $xy'' - 3y' + x^{-1}y = x^2$  as a linear equation with constant co-efficients.
18. Find the Laplace transform of  $\frac{\cos at - \cos bt}{t}$ .
19. Find the half range sine series of  $f(x) = \cos x$  in  $0 < x < \pi$ .

(5 × 5 = 25 marks)

## Section C

Answer any one question.

Each question carries 11 marks.

20. Solve the differential equation  $\frac{d^2y}{dt^2} - 3\frac{dy}{dt} + 2y = 4, y(0) = 2, y'(0) = 3$ , using Laplace Transform.
21. Obtain the Fourier series of  $f(x) = x^2 - 2$  in the interval  $(-2, 2)$ .

(1 × 11 = 11 marks)