D 140846 **(Pages : 3)** **Name.......................................**

Reg. No..................................

FOURTH SEMESTER (CBCSS–UG) DEGREE EXAMINATION, APRIL 2026

Mathematics

MTS4C04—MATHEMATICS – 4

(2019 Admission Onwards)

Time : Two Hours Maximum : 60 Marks

Part A

Answer any number of questions.
Maximum marks 20.

1. Show that $y = \frac{x^4}{16}$ is a solution of $y' = xy^{1/2}$.

2. Write the order and degree of the differential equation $(y'')3 + y' = e^y$.

3. Check whether $\cos(x+y)dx + \left(3y^2 + 2y + \cos(x+y)\right)dy = 0$ is an exact differential equation.

4. Find the integrating factor corresponding to the differential equation $\cos^2 x \frac{dy}{dx} + y = \tan x$.

5. Find the Wronskian corresponding to the differential equation $y'' + 7y' - 8y = e^{2x}$.

6. Solve $y'' - 4y' + 4y = 0$.

7. Find the particular integral of $y'' + 4y = \cos x$.

8. Write the Laplace transform of $t \cos 5t$.

9. Write the unit step function $u(t-a)$.

10. Write the inverse Laplace transform of t^6.

Turn over

11. Find norm of $f(x)$ if $f(x)=\cos x$ in $[-\pi,\pi]$.

12. Show that the partial differential equation $\frac{\partial^2 u}{\partial x^2}=\frac{\partial^2 u}{\partial y^2}$ is hyperbolic.

(Maximum marks 20)

Part B

Answer any number of questions.
Maximum marks 30.

13. Solve $\left(y^2+2xy\right)dx+\left(2xx^2-xy\right)dy=0$.

14. Solve $\frac{dy}{dx}+\frac{2x}{1+x^2}y=\frac{1}{\left(1+x^2\right)^2}$.

15. Solve $y''-2y'+y=x\sin x$.

16. If $\mathrm{L}\left[f(t)\right]=\frac{1}{s\left(s^2+w^2\right)}$, find $f(t)$.

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

18. Express the following function in terms of unit step function and hence find its Laplace transform :

$$f(t)=\begin{cases}2 & \text{if } 0<t<\pi \\ 0 & \text{if } \pi<t<2\pi \\ \sin t & \text{if } t>2\pi\end{cases}.$$

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

(Maximum marks 30)

Part C

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

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

21. Obtain the Fourier series expansion of $f(x) = x - x^2$ in $-\pi \le x \le \pi$.

(1 × 10 = 10 marks)