

C 21546

(Pages : 2)

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)