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 $\left(25x^2-5y\right)dx+\left(3y^2-5x\right)dy=0$ 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 $\frac{dy}{dx}=\left(y-2x^2\right)-7$ 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 $\left(x^2+y^2\right)\frac{dy}{dx}=xy$.

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 $\frac{s^2}{\left(s^2+a^2\right)\left(s^2+b^2\right)}$.

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

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

(1 × 11 = 11 marks)