



K23U 3433

Reg. No. :

Name :

**III Semester B.Sc. Degree (CBCSS – OBE – Regular/Supplementary/
Improvement) Examination, November 2023**

(2019 to 2022 Admissions)

Complementary Elective Course in Mathematics

3C03 MAT – CH : MATHEMATICS FOR CHEMISTRY – III

Time : 3 Hours

Max. Marks : 40

PART – A

Answer **any four** questions. **Each** question carries **1** mark.

1. Solve $y' = \cosh 5x$.
2. Give an example of a first order ordinary differential equation.
3. Let $y_1 = e^{4x}$ and $y_2 = e^{-1.5x}$. Find the Wronskian $W(y_1, y_2)$.
4. Find the Laplace transform of e^{at} .
5. Check whether $\sin(x^2)$ is an even function or an odd function.

PART – B

Answer **any seven** questions. **Each** question carries **2** marks.

6. Verify that $y = \frac{c}{x}$ (c an arbitrary constant) is a solution of the ODE $xy' = -y$ for all $x \neq 0$.
7. Solve the initial value problem $y' = \frac{-4x}{y}$, $y(2) = 3$.
8. Check whether the differential equation $2xy \, dx + x^2 \, dy = 0$ is exact or not.
9. Determine whether $y_1(x) = x$, $y_2(x) = x^2$, $y_3(x) = 4x - 3x^2$ are linearly independent on the interval $(-\infty, \infty)$.
10. Find the general solution of $4y'' - 25y = 0$.

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11. Find the Laplace transform of $e^{at}\cos\omega t$.
12. Find the inverse Laplace transform of $\frac{s+10}{s^2-s-2}$.
13. Find the Laplace transform of $(t+1)^2e^t$.
14. Find the Fourier series of the function $f(x) = x^2, -\pi < x < \pi$.
15. Prove that $\cos nx$ and $\cos mx$ ($n \neq m$) are orthogonal on the interval $[-\pi, \pi]$.

PART – C

Answer **any four** questions. **Each** question carries **3** marks.

16. Test for exactness and if exact solve $\sin x \cos y \, dx + \cos x \sin y \, dy = 0$.
17. Find the general solution of $y' = 2y - 4x$.
18. Solve the initial value problem $y'' + y' - 2y = 0, y(0) = 4, y'(0) = -5$.
19. Solve $x^2y'' - 6xy' + 9y = 0, y(1) = 1, y'(1) = 1$.
20. Using method of convolution, find the inverse Laplace transform of $\frac{1}{(s^2+1)^2}$.
21. Solve the Volterra integral equation $y(t) - \int_0^t (1+\tau) y(t-\tau) \, d\tau = 1 - \sinh t$.
22. Find the Fourier series of $f(x) = \begin{cases} -k & \text{if } -\pi < x < 0 \\ k & \text{if } 0 < x < \pi \end{cases}$ and $f(x+2\pi) = f(x)$.

PART – D

Answer **any two** questions. **Each** question carries **5** marks.

23. Solve $y' + y \sin x = e^{\cos x}, y(0) = -2.5$.
24. Solve $y'' + 9y = \sec 3x$ by the method of variation of parameters.
25. Using Laplace transform, solve $y'_1 = -y_1 + 4y_2, y'_2 = 3y_1 - 2y_2, y_1(0) = 3, y_2(0) = 4$.
26. Find two half range expansions of the function $f(x) = \pi - x, 0 < x < \pi$.



K23U 3739

Reg. No. :

Name :

III Semester B.Sc. Degree (CBCSS – Supplementary)
Examination, November 2023
(2017 – 2018 Admissions)
COMPLEMENTARY COURSE IN MATHEMATICS
3C03MAT-CH : Mathematics for Chemistry – III

Time : 3 Hours

Max. Marks : 40

SECTION – A

All the first 4 questions are **compulsory**. They carry 1 mark each.

1. Verify that $y = \cos x + \sin x$ is the solution of the differential equation $y' + y = 2\cos x$.
2. Let L^{-1} denotes the inverse Laplace transform operator. If $F(s) = \frac{1}{s^2 + 3}$. Then $L^{-1}[F(s)]$ is
3. Give examples for odd functions and even functions.
4. Give one dimensional heat equation.

SECTION – B

Answer **any 7** questions from among the questions 5 to 13. These questions carry 2 marks each.

5. Verify that $y = a \cos(\pi x) + b \sin(\pi x)$ is a solution of the differential equation $y'' + \pi^2 y = 0$.
6. Solve the initial value problem $yy' + 4x = 0$, $y(0) = 3$.
7. Check whether the differential equation $(\cos y \sin hy + 1) dx - (\sin y \cosh x) dy = 0$ is exact.
8. Find the Wronskian $W(y_1, y_2)$ of the functions $y_1(x) = e^x$, $y_2(x) = (x + 1) e^x$.
9. Find the general solution of the Euler Cauchy equation $x^2 y'' - 6y = 0$.
10. Solve the differential equation $y'' + 16y = 0$.
11. Define unit step function. Write the Laplace transform of unit step function.
12. Find the Laplace transform of $f(t) = \sin^2 4t$.
13. Check whether the PDE $u_{xx} + 2u_{xy} + u_{yy} = 0$ is hyperbolic, parabolic or elliptic.

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SECTION – C

Answer **any 4** questions from among the questions **14** to **19**. These questions carry **3** marks **each**.

14. Solve the linear first order differential equation $y' = 4y + x$.
15. Find the ODE $y'' + ay' + by = 0$, given that e^x, e^{-4x} form the basis for the solutions.
16. Find the inverse Laplace transform of
- a) $F(s) = \frac{2s + 5}{(s - 3)^2}$
- b) $F(s) = \frac{s + 2}{(s + 2)^2 + 16}$.
17. Find the Fourier series expansion for $f(x) = \begin{cases} -4x, & \text{if } -\pi < x < 0 \\ 4x, & \text{if } 0 \leq x < \pi \end{cases}$.
18. Transform the PDE into normal form $u_{xx} - 2u_{xy} + u_{yy} = 0$.
19. Solve the PDE $u_{xx} = u$.

SECTION – D

Answer **any 2** questions from among the questions **20** to **23**. These questions carry **5** marks **each**.

20. Find the orthogonal trajectory of the family of circle $x^2 + (y - c)^2 = c^2$.
21. By method of undetermined coefficients solve the differential equation $y'' + 4y' - 2y = 2x^2 - 3x + 6$.
22. Using Laplace transform solve the initial value problem $y'' - y' = t, y(0) = 1, y'(0) = 1$.
23. Find the Fourier series expansion for $f(x) = \begin{cases} 0, & \text{if } -\pi < x < 0 \\ \pi - x, & \text{if } 0 \leq x < \pi \end{cases}$.