K21U 1834

Reg. No. : .....

Name : .....

III Semester B.Sc. Degree CBCSS (OBE) Reg./Sup./Imp. Examination, November 2021
(2019-2020 Admission)
COMPLEMENTARY ELECTIVE COURSE IN MATHEMATICS
3C03 MAT-CH : Mathematics for Chemistry – III

Time : 3 Hours Max. Marks : 40

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

1. Solve $y' + y \sin x = e^{\cos x}$.
2. Verify that $y = 1 + \cos x$, $y = 1 + \sin x$ are solutions of non-homogeneous linear ODE $y'' + y = 1$. What about their sum ?
3. Find the inverse Laplace transform of $\frac{5s - 1}{s^2 - 25}$.
4. Define the fundamental period of a function. What is the fundamental period of the function $\cos \pi x$?
5. Write the formula for finding the Fourier series of a function and its Fourier coefficients. **(4×1=4)**

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

6. Solve $\cos(x + y)\, dx + [3y^2 + 2y + \cos(x + y)]\, dy = 0$.
7. If y_1 and y_2 are solutions of the homogeneous equation $y' + p(x)\, y = 0$, then show that $y_1 + y_2$ and ay_1, a is a constant, are also solutions of this equation.
8. Find the solution of ODE $y' = (x + 1)\, e^{-x} y^2$.
9. Solve the initial value problem $y'' + y' - 2y = 0$, $y(0) = 4$, $y'(0) = -5$.

P.T.O.

10. Solve $(x^2D^2 - 4xD + 6)\, y = 0$.

11. Find the inverse Laplace transform of $\ln \frac{s+a}{s-a}$.

12. Find the Laplace transform of $te^{-kt} \sin t$.

13. Solve the initial value problem using Laplace transforms
$y'' - y = t,\ y(0) = 1,\ y'(0) = 1$.

14. Find the Fourier series expansion of $f(x) = x,\ -\pi < x < \pi$.

15. Write the Fourier cosine series expression of
$f(x) = \cos \pi x,\ \frac{-1}{2} < x < \frac{1}{2},\ p = 1$. (7×2=

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

16. Find the integrating factor of the differential equation $(x^2 + y^2)\, dx - 2xydy = 0$ and then solve it.

17. Find the general solution of $y' + y = \frac{-x}{y}$.

18. By method of undetermined coefficients solve $y'' + y = 0.001x^2$.

19. Let $y_1 = 1,\ y_2 = e^{-2x}$. Show that y_1 and y_2 are linearly independent. Find a second order differential equation with y_1 and y_2 as solutions and then solve it.

20. Solve the Volterra integral equation $y(t) - \int_0^t (1+\tau)\, y(t-\tau)\, d\tau = 1 - \sinh t$.

21. Solve the system using Laplace transform
$y_1' + y_2 = 0,\ y_1 + y_2' = 2 \cos t,\ y_1(0) = 1,\ y_2(0) = 0$.

22. Find the Fourier series of the function
$f(x) = x + \pi,\ -\pi < x < \pi,\ f(x + 2\pi) = f(x)$. (4×

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

23. Solve the following differential equations.

a) $y' = (x + y - 2)^2, y(0) = 2$

b) $\sec^2 y \frac{dy}{dx} + 2x \tan y = 0$.

24. Using method of variation of parameters solve $y'' + 4y' + 3y = 65 \cos 2x$.

25. Write the following function using unit step functions and find its transform.

$$f(t) = \begin{cases} 2 & \text{if } 0 < t < 1 \\ \frac{1}{2}t^2 & \text{if } 1 < t < \frac{\pi}{2} \\ \cos t & \text{if } t > \frac{\pi}{2} \end{cases}$$

26. Find the Fourier series expansion of

$$f(x) = \begin{cases} -k & \text{if } -2 < x < 0 \\ k & \text{if } 0 < x < 2 \end{cases}.$$

(2×5=10)
