K26U 0903

Reg. No. : ....

Name : ....

Second Semester B.Sc. (Hons) Mathematics Degree (C.B.C.S.S. – O.B.E. – Supplementary) Examination, April 2026
(2021 – 2023 Admissions)
CORE COURSE
2B08BMH – Ordinary Differential Equations

Time : 3 Hours

Max. Marks : 60

SECTION – A

Answer **any 4** questions. **Each** question carries **1** mark.

1. Find the value of k if $y = xe^x$ and $y = x^2e^x$ and $y = x^3e^x$ are three independent solutions of $y''' - 3y'' + 3y' - 3ky = 0$.
2. Define an integrating factor of an equation of the form $M(x, y)dx + N(x, y)dy = 0$?
3. What do you mean by a basis for a differential equation of the form $y'' + p(x)y' + q(x)y = 0$?
4. Write down the Picards iterative formula to solve $y' = f(x, y)$, $y(x_0) = y_0$ at the n^{th} iterative stage.
5. Find $y_1 = f(t)$ and $y_2 = g(t)$ from the system : $y_1' = y_2$; $y_2' = y_1$. **(4×1=4)**

SECTION – B

Answer **any 6** out of 9 questions. **Each** question carries **2** marks.

6. Solve : $\sqrt{1-x}\dfrac{dy}{dx} = \dfrac{1}{\sqrt{1-y}}$.
7. Use Euler's method to find y(0.4) from $y' = (x + 1)/y$, $y(0) = 2$.
8. Solve : $y''' - 3y'' = 0$.
9. Give the general form of a Bernoulli's equation of first order.
10. Solve : $y'' - 6y' + 8y = 0$.

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11. Show that $\dfrac{\partial M}{\partial y} = \dfrac{\partial N}{\partial x}$ is a necessary condition for the differential equation $M(x, y)dx + N(x, y)dy = 0$ to be exact.
12. Using Runge-Kutta method of order 2 find y(0.2) from the problem : $y' = y^2 + x^2$; $y(0) = 1$.
13. Write a particular solution for the equation $\dfrac{d^2y}{dx^2} = x$.
14. Solve : $\dfrac{d^3y}{dt^3} = y$. **(6×2=12)**

SECTION – C

Answer **any 8** out of 12 questions. **Each** question carries **4** marks.

15. Using Taylor series method find y(0.2) from $y' = x/2 + y$, $y(0) = 0$.
16. Show that for the one parameter family of parabolas $y^2 = 4c(x + c)$, the orthogonal family is the same as the given family. In other words, show that the family is self orthogonal.
17. Solve : $yy' = (x - 1)e^{-y^2}$, $y(0) = 1$.
18. Find an integrating factor of : $(e^{x+y} + ye^y)dx + (xe^y - 1)dy = 0$.
19. Solve : $y' + y = y^2$, $y(0) = -1$.
20. Find y(0.4) by solving $y' = 2x - y$, $y(0) = 0.1$ using Euler's modified method.
21. Using the method of variation of parameters solve : $y'' + y \tan x$.
22. Find a general solution for the system of differential equations :

$$\begin{aligned} y_1' &= 4y_2 + 9t \\ y_2' &= -4y_1 + 5 \end{aligned}.$$

23. Solve the fourth order equation : $\dfrac{d^4s}{dt^4} - 5\dfrac{d^2s}{dt^2} + 4s = 0$.
24. Solve the initial value problem : $(\cos y \sinh x + 1)\, dx - \sin y \cosh x dy = 0$, $y(1) = 2$.

25. Reduce to variable separable form and solve : $y' = \tan(x + y)$.
26. Find the unique solution for $x = x(t)$ from the initial value problem $\dfrac{d^2x}{dt^2} + x = t$ where $x(0) = 1$, $x'(0) = 1$. **(8×4=32)**

SECTION – D

Answer **any 2** out of 4 questions. **Each** question carries **6** marks.

27. a) Solve : $y'' - 5y' + 6y = 3e^{3t} + 6\cos(2t)$ using method of undetermined coefficients.

    b) Solve for $y_1(t)$ and $y_2(t)$ from the equations :

    $$\begin{aligned} y_1' &= 3y_1 - 4y_2 + 20\cos t \\ y_2' &= y_1 - 2y_2. \end{aligned}$$

    Also $y_1(0) = 0$, $y_2(0) = 8$.
28. Compare the answer with the actual value of y(0.1) by solving $y' = x - y$, $y(0) = 1$ using Runge-Kutta method of order 4.
29. a) Use Picards method to find y(0.3) from the initial value problem : $\dfrac{dy}{dx} = x^2 + y$, $y(0) = 1$

    b) Solve the initial value problem : $(e^{x+y} + ye^y)dx + (xe^y - 1)dy = 0$; $y(0) = -1$.
30. Solve : $x^3y''' - 3x^2y'' + 5xy' - 6y = x^4 \ln x$ where $x > 0$. **(2×6=12)**

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