K23U 0515

Reg. No. : ....

Name : ....

VI Semester B.Sc. Degree (CBCSS – OBE – Regular/Supplementary/ Improvement) Examination, April 2023
(2019 and 2020 Admissions)
CORE COURSE IN MATHEMATICS
6B12MAT : Numerical Methods, Fourier Series and Partial Differential Equations

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Time : 3 Hours Max. Marks : 48

PART – A

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

1. Forward difference operator $\Delta f(x_i)$ = ________

2. Using Picard's method, obtain a solution up to the second approximation to the equation $\frac{dy}{dx} = 2y - x$ such that $y(0) = 1$.

3. Define odd function and give an example.

4. Define a periodic function and find the period of $\cos \pi x$.

5. Write the Laplacian equation in Polar coordinates.

PART – B

Answer **any 8** questions. **Each** question carries **two** marks.

6. Find the Lagrange interpolation polynomial for the following data :

x	1	2	4
f(x)	1	7	61

7. Find the second divided difference of $f(x) = \frac{1}{x}$, using points x_0, x_1, x_3.

8. Show that $\mu = \sqrt{\left(1 + \frac{1}{4}\delta^2\right)}$.

P.T.O.

9. Obtain the approximate value of y(1.2) for the initial value problem $y' = -2xy^2$, y(1) =1 using Taylor series second order with step size h = 0.1.

10. Using Euler method, find y(0.02), $y' = 2y$ with y(0) = 1 and h = 0.01.

11. Using Heun's method, find y(0.2), $y' = x^2 + y^2$ with y(0) = 1 and h = 0.1.

12. State Euler formula for Fourier coefficients.

13. Find the Fourier series of f(x) = x, – L < x < L, f(x + 2L) = f(x).

14. Verify that the function $u = x^2 + t^2$ is a solution of wave equation with suitable c.

15. Solve $u_{xx} - u = 0$.

16. Determine the type and normal form of the PDE $u_{xx} - 16u_{yy} = 0$.

PART – C

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

17. Find ln(9.2) with n = 3, using Lagrange interpolation formula with the given table :

x	9.0	9.5	10	11.0
ln x	2.19722	2.25129	2.30259	2.39790

18. Using divided differences interpolation, find f(x) as a polynomial if

x	– 3	– 2	– 1	1	2	3
f(x)	18	12	8	6	8	12

19. Construct Newton's Backward Interpolation, table and Interpolating polynomial for the data :

x	– 4	– 2	0	2	4	6
f(x)	– 139	– 21	1	23	141	451

20. Using Picard's method, obtain a solution up to the fourth approximation to the equation $\frac{dy}{dx} = y + x$ such that y(0) = 1.

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21. Given $\frac{dy}{dx} = 1 + y^2$ where y(0) = 0. Find y(0.2) correct to four decimal places by Runge-Kutta second order formula.

22. Find the Fourier series of the function $f(x) = |x|, -2 \le x \le 2$ and $f(x + 4) = f(x)$.

23. Consider the elastic string of length L whose ends are held fixed the string is set in motion from its equilibrium position with an initial velocity.

$$u_t(x, 0) = g(x)\begin{cases} \frac{2x}{L}, & 0 \le x \le \frac{L}{2} \\ \frac{2(L-x)}{L}, & \frac{L}{2} \le x \le L \end{cases}$$

Find the displacement u(x, t) of the string.

PART – D

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

24. Using Lagrange interpolation, obtain the value of $e^{-0.15}$. Determine the maximum absolute error at this point. Compare it with actual error. If

x	0.1	0.2	0.4
$f(x) = e^x$	.904837	.818731	.670320

25. Use Runge-Kutta fourth-order method with h = 0.2 to find the value of y at x = 0.2 and x = 0.4, given $\frac{dy}{dx} = 1 + y^2$ where y(0) = 0.

26. Find the Fourier series of the function $f(x) = \begin{cases} x, & \frac{-\pi}{2} < x \le \frac{\pi}{2} \\ (\pi - x), & \frac{\pi}{2} < x < \frac{3\pi}{2} \end{cases}$.

27. Dérive D'alembert solution of wave equation.

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