CAMBRIDGE INSTITUTE OF TECHNOLOGY

K R Puram, Bangalore – 560036

QUESTION BANK

NUMERICAL METHODS-2

Taylor's Series Method

1. Employ Taylor's series method to find an approximate solution to find y at x = 0.1 given $\frac{dy}{dx} = x - y^2$, y(0) = 1 by considering up to fourth degree term.
2. Employ Taylor's series method to obtain the value of y at x = 0.1 and 0.2 for the differential equation $\frac{dy}{dx} = 2y + 3e^x$, y(0) = 0 considering up to fourth degree term.
3. Using the Taylor's series method, find the third order approximate solution at x = 0.4 of the problem $\frac{dy}{dx} = x^2 y + 1,$ with y(0) = 0. Consider terms up to fourth degree.
4. Using the Taylor's series method, solve the initial value problem $\frac{dy}{dx} = x^2 y - 1,$ y(0) = 1 at the point x = 0.1and x = 0.2 Considering up to fourth degree term.
5. Given that $\frac{dy}{dx} = x^2 + y^2$ and y(0) = 1, to find an approximate value of y at x = 0.1 and x = 0.2 by Taylor's series method.
6. Given that $\frac{dy}{dx} = x + y$ and y(1) = 0, to find an approximate value of y at x = 1.1 and x = 1.2 by Taylor's series method.
7. Using the Taylor's series method, solve $y' = x^2 + y$ given that y = 10 at x = 0 initially considering the terms up to the fourth degree.

Modified Euler's Method

8. Solve the following by Euler's modified method $\frac{dy}{dx} = log(x+y)$, $y(1) = 2$ to find y (0.2) by taking h = 0.2.Carry out two modifications.
9. Determine the value of y when $x = 0.1$, given that $y(0) = 1$ and $y' = x^2 + y^2$ using Modified Euler's formula.
10. Use Modified Euler's method to solve $\frac{dy}{dx} = y + e^x$, $y(0) = 0$ find y(0.2) taking $h = 0.1$.
11. Solve the differential equation $\frac{dy}{dx} = -xy^2$ under the initial condition y(0) = 2, by using the modified Euler's Method, at the points x = 0.1 take the step size h = 0.1.
12. Using Euler's modified method solve for y at $x = 0.1$, $h = 0.1$ and $\frac{dy}{dx} = \frac{y-x}{y+x}$, $y(0) = 1$ carry out three modifications.

13. Given $\frac{dy}{dx}+y-x^2=0,\ \ y(0)=1$ find $y(0)=1$ take $h=0.1$ using modified Euler's Method.

14. Given $\frac{dy}{dx}=1+\frac{y}{x},\ \ y=2\ \ at\ \ x=1$ find the approximate value of y at $x=1.2$ by taking step size $h=0.2$ applying modified Euler's method.

15. Use Modified Euler's method find y at $x=0.1$ given $\frac{dy}{dx}=3x+\frac{y}{2},\ y(0)=1\ taking\ \ h=0.1$ perform three iterations.

Runge – Kutta method of fourth order

16. Employ Runge – Kutta method to solve $\frac{dy}{dx}=3x+\frac{y}{2},\ \ y(0)=1$ find y at x = 0.2 by taking $h=0.2$.

17. Apply Runge – Kutta method of order 4, to find an approximate value of y for x = 0.1 if $\frac{dy}{dx}=x+y^2$ given that $y=1$ when $x=0$.

18. Solve $\frac{dy}{dx}=x+y,\ \ y(0)=1$ find y at $x=0.2$ using Runge – Kutta method. Take $h=0.2$.

19. Employ Runge – Kutta method to solve $\frac{dy}{dx}=\frac{y^2-x^2}{y^2+x^2},\ \ y(0)=1$ find y at $x=0.2$ by taking $h=0.2$.

20. Using fourth order Runge – Kutta method find y(0.2) for the equation $\frac{dy}{dx}=\frac{y-x}{y+x},\ \ y(0)=1$ taking $h=0.2$

21. Employ Runge – Kutta method to solve $\frac{dy}{dx}=3e^x+2y,\ \ y(0)=0$ find y at x = 0.1 by taking $h=0.1$.

Predictor and Corrector methods

22. Find $y(1.4)$ by using Milne's Predictor and Corrector method, given $\frac{dy}{dx}=x^2+\frac{y}{2}$

X	1	1.1	1.2	1.3
Y	2	2.2156	2.4649	2.7514

23. Given $\frac{dy}{dx}=xy+y^2,\ y(0)=1,\ y(0.1)=1.1169, y(0.2)=1.2773, y(0.3)=1.5049,$ find y (0.4) using the Milne's predictor – corrector method. Apply the corrector formula twice.

24. Apply Milne's method to compute y (1.4) correct to four decimal places $\frac{dy}{dx}=x^2+\frac{y}{2}$ and the following data: $y(1)=2,\ \ y(1.1)=2.2156,\ y(1.2)=2.4649\ \ y(1.3)=2.7514$.

25. The following table gives the solution of $5xy' + y^2 - 2 = 0$. Find the value of x = 4.5 using Milne's and Milne's method predictor and corrector formulae. Use the corrector formula twice

x	4	4.1	4.2	4.3	4.4
y	1	1.0049	1.0097	1.0143	1.0187

26. If $\frac{dy}{dx} = 2e^x - y,\ y(0) = 2,\ y(0.1) = 2.010,\ y(0.2) = 2.040,\ y(0.3) = 2.090$, find y (0.4) correct to four decimal places by using Milne's method.