HASMUKH GOSWAMI COLLEGE OF ENGINEERING, VAHELAL

APPLIED MATHEMATICS FOR ELECTRICAL ENGINEERING (3130908)

TUTORIAL 5: NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS

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1. Explain the Euler's method to find numerical solution of $\frac{dy}{dx} = f(x, y), y(x_0) = y_0$.

2. Use Runge-Kutta second order method to find the approximation value of $y(0.2)$ given that $\frac{dy}{dx} = x - y^2, y(0) = 1 \, and \, h = 0.1$.

3. Use Euler's method to find $y(1.4)$ given that $\frac{dy}{dx} = xy^{1/2}, y(1) = 1$.

4. Use Taylor's series method to solve $\frac{dy}{dx} = x^2 y - 1, y(0) = 1$. Also find $y(0.03)$.

5. Use Runge-Kutta fourth order method to find the approximation value of $y(1.1)$ given that $\frac{dy}{dx} = x - y, y(1) = 1 \, and \, h = 0.05$.

6. Using improved Euler's method, solve $\frac{dy}{dx} + 2xy^2 = 0$ with the initial condition $y(0) = 1$ and compute $y(1)$ taking $h = 0.2$. Compare the answer with exact solution. **Ans**=0.5034

7. Apply Runge-Kutta fourth order method to calculate $y(0.2)$ given $\frac{dy}{dx} = x + y, y(0) = 1$ taking $h = 0.1$. **Ans**=1.2428

8. Apply Taylor's method to obtain approximate value of y at $x = 0.2$ for the differential equation $\frac{dy}{dx} = 2y + 3e^x, y(0) = 0$. Compare the numerical solution obtained with the exact solution. **Ans**=0.8112

9. Solve the following by Euler's modified method:

$\frac{dy}{dx} = \log(x + y), y(0) = 2 \, at \, x = 1.2 \, and \, 1.4 \, with \, h = 0.2$ **Ans**=2.5351, 2.6531

10. Using Runge-Kutta method of fourth order solve $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$ with $y(0) = 1$ at $x = 0.2, 0.4$ **Ans**=1.196 , 1.3752

11. Apply Runge-Kutta method to find approximate value of y for $x = 0.2$ in steps of 0.1, if $\frac{dy}{dx} = x + y^2$, given that $y = 1$ where $x = 0$. **Ans**=1.2736

12. Using improved Euler's method, solve $\frac{dy}{dx} = 1 - y$ with $y(0) = 0$ and tabulate the solution at $x = 0.1, 0.2$ compare answer with exact solution.