# D. Y. Patil College of Engineering & Technology

Kasaba Bawada, Kolhapur 416006

(An Autonomous Institute)

**Academic Year:** 2023-24 **Semester:** II **Class:** F.Y.B.Tech.

**Course:** Differential Equations and Numerical Techniques **Course Code:** 231FYL111

## Tutorial-V

### Numerical Solution of Ordinary Differential Equations of First Order and First Degree (Picard's Method and Taylor's Series Method)

| **Course Outcomes (COs):** After successfully completion of this tutorial, the students will be able to: | |
|---|---|
| 111.3 | Apply the numerical methods to solve ordinary differential equations. |

| | |
|---|---|
| Q.1 | Apply Picard's method to solve $\frac{dy}{dx} = y - x$ with the initial condition $y = 2$ at $x = 0$ up to third approximation |
| Q.2 | Apply Picard's method to solve $\frac{dy}{dx} = 2y - 1$ with the initial condition $y(0) = 1$ up to third approximation |
| Q.3 | Apply Picard's method to solve $\frac{dy}{dx} = 3x + y^2$ with the initial condition $y(0) = 1$ up to third approximation |
| Q.4 | Apply Picard's method to solve $\frac{dy}{dx} = x + x^4 y$ with the initial condition $y(0) = 3$ up to third approximation |
| Q.5 | Solve $\frac{dy}{dx} = x^2 y - 1$ with $y_0 = 1$ when $x_0 = 0$ and find $y$ at $x = 0.03$ by Taylor's method up to four decimal places . |
| Q.6 | Using Taylor's series method, obtain a solution of the differential equation $\frac{dy}{dx} = y - xy$, with $x_0 = 0, y_0 = 1$ at $x = 0.1$ |
| Q.7 | Using Taylor's series method, solve the differential equation $\frac{dy}{dx} = 1 + xy$, with $y(0) = 1$ and compute $y(0.1)$ correct to four decimal places |
| Q.8 | Solve $\frac{dy}{dx} = x^2 + y$ with $y(0) = 1$ and find $y$ at $x = 0.1$ by Taylor's method up to four decimal places . |

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## Tutorial-VI

### Numerical Solution of Ordinary Differential Equations of First Order and First Degree (Euler's Method and Runge-Kutta Method)

| **Course Outcomes (COs):** After successfully completion of this tutorial, the students will be able to: | |
|---|---|
| 111.3 | Apply the numerical methods to solve ordinary differential equations. |

| | |
|---|---|
| Q.1 | Using Euler's methods, calculate the approximate value of y when $x = 0.1$ Given that $\frac{dy}{dx} = x + y + xy$ with $y(0) = 1$ taking $h = 0.025$ |
| Q.2 | Solve by Euler's method, $\frac{dy}{dx} = x + \sqrt{y}, \quad y(2) = 4, h = 0.2$ at $x = 3$ |
| Q.3 | Solve by Euler's method, $\frac{dy}{dx} = x + y, \quad y(0) = 1, h = 0.2$ at $x = 1$ |
| Q.4 | Calculate approximate value of y by Runge-Kutta method. Given that $\frac{dy}{dx} = 3x + y^2$ with $x_0 = 1, y_0 = 1.2, at\ x = 1.1$ taking h=0.1 |
| Q.5 | Calculate approximate value of y by Runge-Kutta method. Given that $\frac{dy}{dx} + \frac{y}{x} = \frac{1}{x^2}$ with $y(1) = 1, at\ x = 1.1$ taking h=0.1 |
| Q.6 | Calculate approximate value of y by Runge-Kutta method. Given that $\frac{dy}{dx} = \frac{1}{x+y}$ with $y(0) = 1, at\ x = 1$ taking h=1 |

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## Tutorial-VII

### Numerical Solutions of Algebraic and Transcendental Equations-I (Bisection Method and Newton-Raphson Method)

| **Course Outcomes (COs):** After successfully completion of this tutorial, the students will be able to: | | |
|---|---|---|
| 111.4 | Apply the numerical techniques to solve algebraic and transcendental equations. | |

| | |
|---|---|
| Q.1 | Using Bisection method, find approximate root of $x^3 - 6x + 3 = 0$ in the interval (0,1). Perform four iterations only. |
| Q.2 | Using Bisection method, find approximate root of $xe^x - 1 = 0$ in the interval (0,1). Perform four iterations only. |
| Q.3 | Using Bisection method, find approximate root of $x^2 - logx - 12 = 0$ in the interval (3,4). Perform four iterations only. |
| Q.4 | Find the approximate root of $x^3 - 2x - 5 = 0$ using Newton-Raphson method by taking $x_0 = 2$. Carry out three iterations only. |
| Q.5 | Use Newton-Raphson method to find the approximate value of $\sqrt{3}$ by taking $x_0 = 1$. Carry out three iterations only. |
| Q.6 | Find the approximate root of $2x + sinx + 5 = 0$ using Newton-Raphson method by taking $x_0 = -2$. Carry out three iterations only. |