BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION SP2023)

CLASS: BTECH
BRANCH: ECE, EEE, CSE, IT

SEMESTER: IV
SESSION: SP/2023

SUBJECT: MA203 NUMERICAL METHODS

TIME: 03 Hours

FULL MARKS: 50

INSTRUCTIONS:
1. The question paper contains 5 questions each of 5 marks and total 25 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
4. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates.

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|---|---|---|---|---|
| Q.1(a) | Find the negative root of $x^3 - 4x + 9 = 0$ lying between 2 and -3 using Bisection Method. Perform five iterations only correct to three decimal places. | [5] | 1 | 2 |
| Q.1(b) | Use the method of iteration to solve the equation $3x - \log_{10} x - 6$. Take initial approximation $x_0 = 2$. | [5] | 1 | 3 |
| Q.2(a) | Solve the following system of equations using Gauss-Elimination method. $5x - 2y + 3z = 18$, $x + 7y - 3z = -22$, $2x - y + 6z = 22$ | [5] | 2 | 2 |
| Q.2(b) | Find the solution of the system. $28x + 4y - z = 32$, $2x + 17y + 4z = 35$, $x + 3y + 10z = 24$ with initial approximation $(x_0, y_0, z_0) = (0,0,0)$ correct to 4 decimal place using Gauss Seidel method. | [5] | 2 | 3 |
| Q.3(a) | Find the value of $y$ at $x = 6$ from the following data. | [5] | 3 | 2 |
| Q.3(b) | Find $y'(0.5)$ and $y''(0.5)$ from the following data. | [5] | 3 | 3 |
| Q.4(a) | On dividing the interval into 10 equal parts and applying Simpson's 1/3rd rule, find the value of the integral $\int_0^5 \frac{dx}{4x+5}$ correct to 4 decimal places. | [5] | 4 | 3 |
| Q.4(b) | Evaluate $\int_{1.0}^{1.3} \sqrt{x}\, dx$ taking $h = 0.05$ by Trapezoidal rule. | [5] | 4 | 2 |
| Q.5(a) | Consider the initial value problem (IVP) $\frac{dy}{dx} = \frac{y-x}{y+x}, y(0) = 1$. Taking step size $h = 0.02$, find the value of $y(0.1)$ using Euler's method correct to 4 decimal places. | [5] | 5 | 2 |
| Q.5(b) | Consider the initial value problem (IVP) $\frac{dy}{dx} = x + y, y(0) = 1$. Taking step size $h = 0.1$, find the value of $y(0.2)$ using Runge-Kutta fourth order method correct to 4 decimal place | [5] | 5 | 3 |

| $x$ | 3 | 7 | 9 | 10 |
|---|---|---|---|---|
| $y$ | 168 | 120 | 72 | 63 |

| $x$ | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| $f(x)$ | 1 | 1 | 15 | 40 | 85 |

:::::24/04/2023 M:::::