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INDIAN INSTITUTE OF INFORMATION TECHNOLOGY AND MANAGEMENT, GWALIOR

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Department: Engineering Sciences
Lecturer: Dr. Anuwedita Singh
TA: NA
Course: ANM(Major Exam 24-25)

Student Name:

Roll. Number:

Question 1

(A) Using Newton-Raphson method derive the formulas to find $N^{1/q}, N > 0$, q integer.

(B) Solve the system using Gauss Seidel method by considering $x_1^0 = x_2^0 = x_3^0 = 0$ up to 5 iterations

$$4x_1 + 2x_2 + 3x_3 = 8$$
$$3x_1 - 5x_2 + 2x_3 = -14$$
$$-2x_1 + 3x_2 + 8x_3 = 27$$

[Mark: 4+6]

Question 2

(A) Evaluate $I = \int_1^2 \frac{dx}{3+5x}$, using the Simpson's 1/3 rule with 4 and 8 subintervals. Compare with the exact solution and find the absolute errors in the solution.

[Mark: 5]

Question 3

(A) What is Picard's iteration method for an initial value problem (IVP)

$$\frac{dy}{dx} = f(x, y), \quad y(x_0) = y_0, \quad x_0 > 0.$$

(B) Compute $y(0.1)$ and $y(0.2)$ up to 6 significant digits, from the IVP using Picard's iteration method

$$\frac{dy}{dx} = x + y, \quad y(0) = 1.$$

[Mark: 4+6]

Question 4

(A) What is Euler's method, and derive the error formula for an initial value problem (IVP)

$$\frac{dy}{dx} = f(x, y), \quad y(x_0) = y_0, \quad x_0 > 0.$$

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(B) Using Euler's method compute y_1 and y_2 and the corresponding error term by taking $h = 0.1$ from the IVP

$$\frac{dy}{dx} = 1 + xy^2, \ \ y(0) = 1.$$

[Mark: 4+6]

Question 5

(A) Solve the following IVP using modified Euler's method and obtain approximations to $y(0.2)$, and $y(0.4)$ with $h = 0.2$

$$\frac{dy}{dx} = -2xy^2, \ \ y(0) = 1.$$

(B) Given $y' = x^3 + y$, $y(0) = 2$, compute $y(0.2)$, $y(0.4)$ and $y(0.6)$ using the Runge-Kutta method of fourth order.

[Mark: 4+6]