CHUKA  **UNIVERSITY**

UNIVERSITY EXAMINATIONS

EXAMINATIONS FOR THE AWARD OF DEGREE OF MASTER OF SCIENCE IN APPLIED MATHEMATICS

MATH 826: NUMERICAL ANAYSIS II

STREAMS:

TIME: 3 HOURS

DAY/DATE : THURSDAY 7 /10/ 2021 **8.30 AM – 11.30 AM**

INSTRUCTIONS:

- Answer any THREE questions

QUESTION ONE (20MARKS)

a. Using Taylors Series method with the first three derivatives, solve the Initial Value Problem at $x = 0.50$ with $h = 0.25$

y^1 = 1- y given that $y(0) = 0$ (8marks)

b. Taking $h = 0.4$, use the 4th order Runge Kutta method to solve $\frac{dy}{dt} = t + y,\ y(0) = 1$,from $t = 0$ *to* $t = 1$ (12marks)

QUESTION TWO (20MARKS)

a. Evaluate $\int_0^{\pi/2} \int_0^{\pi/2} \sqrt{Sin(x+y)}\, dx\, dy$ using the numerical double integration method based on the Trapezoidal rule (10marks)

b. Use Taylors series to find the series solution of the system subject to the initial condition $x=1 \text{ and } y=-1$ (10marks

$$\frac{dx}{dt} = x\,y + 2t$$
$$\frac{dy}{dt} = 2ty + x$$

QUESTION THREE (20MARKS)

a. Using Picard's method solve $\frac{dy}{dt} = t+y,$ at $x=0.2$ up to 3 approximations given that $y(0)=1$

(8Marks)

b. i. Outline the Runge Kutta methods of order 2,3and 4 (9Marks)

ii. Explain the advantages of the Runge Kutta method of 4th order over the other methods

(3Marks)

QUESTION FOUR (20MARKS)

a. Use Euler's method to solve the IVP $y' = x+y\ ;\ y(0)=1, taking\ h=0.1$ (10Marks)

b. Solve the IVP using the Adam's Moulton method at $x=1.0$ taking $h=0.2$ and compare with the analytic solution $\frac{dy}{dt} = y - t^2 : y(0)=1$

(10Marks)

QUESTION FIVE (20MARKS)

a. Use RK - 4th order method to solve for $y \text{ at } x=1.2 \text{ and } x=1.4$

$\frac{dy}{dx} = \frac{2xy + e^x}{x^2 + xe^x}$ given that $x_0 = 1 \text{ and } y_0 = 0$

(10Marks)

b. Solve numerically using Milne's Predictor –Corrector method taking $h = 0.05$

$y' = x + y$ with $0.20 \le x \le 0.30; x_0 = 0, y_0 = 1$ given that

$y_1' = 1.1026, y_2' = 1.2104 \text{ and } y_3' = 1.3237$

(10Marks)

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