UNIVERSITY OF FORT HARE
Department of Pure and Applied Mathematics

MNU 122

SUPPLEMENTARY EXAMINATIONS
JANUARY 2019

Time: 3 Hours

Subject: COMPUTATIONAL METHODS

Marks: 100

This question paper consists of 2 pages

Internal Examiner(s)

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Instructions

Answer ALL Questions
Symbols have the usual meanings.

Question One

1.1 Consider the following matrices:

$$A = \begin{bmatrix} 6 & 2 \\ -1 & 5 \end{bmatrix} B = \begin{bmatrix} 3 & -1 \\ 11 & -3 \end{bmatrix} C = \begin{bmatrix} 0 & 1 & 2 \\ -1 & 3 & 2 \\ 2 & 8 & 3 \end{bmatrix} D = \begin{bmatrix} 10 & 0 & 11 \\ -2 & 3 & -1 \\ 5 & -25 & 4 \end{bmatrix}$$

Perform the following matrix operations where possible. Give reasons why some operations may not be possible.

(i) $3B - 2A$

(ii) $4C$

(iii) $2AB$

(iv) DC

(8)

1.2 Solve the system of linear equations using the Gauss-Jordan Elimination Method.

$$\begin{cases} x + y + z = 5 \\ 2x + 3y + 5z = 8 \\ 4x + 5z = 2 \end{cases}$$

(10)

Question Two

2.1 Without a detailed plotting of points, sketch the graphs of the following functions, showing relevant information on the graphs.

(i) $5xy = 40$

(ii) $y = 4x - x^2$

(9)

2.2 If $R = a + \frac{b}{d^2}$, find the best values for a and b from the set of corresponding values below:

d	0.1	0.2	0.3	0.5	0.8	1.5
R	5.78	2.26	1.6	1.27	1.53	1.1

(15)

2.3 If the function relating I and V is $I = aV^n$, determine the values of the constants a and n that best fit the set of values recorded.

V	8	12	15	20	28	36
I	41.1	55.6	65.8	81.6	105	127

(15)

Question Three

3.1 Using the Bisection Method, estimate the positive root of the function $f(x) = x^2 - sin(x) - 0.5$ to 5 decimal places, with an accuracy of $f(x) < 0.01$

(15)

3.2 Use the Newton Method to find $\sqrt{10}$ to 5 decimal places, with an accuracy of $f(x) < 0.001$. Let $x_0 = 3$

(8)

Question Four

4.1 Use the Central Difference formula to approximate $f'(x)$ of $f(x) = ln(x)$ at $x = 1.8$ for $h = 0.1$, $h = 0.05$ and $h = 0.01$. Determine the absolute error for these approximations.

(8)

4.2 Use Simpson's Rule with $n = 10$ to approximate the integral $\int_1^2 \frac{1}{x} dx$. How large should n be to guarantee that this approximation is accurate to within 0.0001?

(10)