KABARAK UNIVERSITY

UNIVERSITY EXAMINATIONS

THIRD SEMESTER, 2020/2021 ACADEMIC YEAR

EXAMINATION FOR THE DEGREE OF BACHELOR OF EDUCATION, COMPUTER SCIENCE, ACTUARIAL SCIENCE

REGULAR

MATH 314: NUMERICAL ANALYSIS

STREAM: Y3S2 **TIME:**

EXAMINATION SESSION: DEC 2020 **DATE:**

INSTRUCTIONS TO CANDIDATES

1. **Answer Question 1 and any other two questions in the answer booklet provided.**
2. **Do not write on your question papers. All rough work should be done in your answer booklet.**
3. **Clearly indicate which question you are answering.**
4. **Write neatly and legibly.**
5. **Edit your work for language and grammar errors.**
6. **Follow all the instructions in the answer booklet**

SECTION A: (Compulsory) TOTAL MARKS FOR THIS SECTION IS 30.

1. a) Given that

$$u = \frac{5xy^2}{z^3}$$

and that Δx, Δy and Δz denotes errors in x, y and z respectively such that

$$x = y = z = 1 \qquad \Delta x = \Delta y = \Delta z = 0.001$$

Find the maximum relative error **(6 Marks)**

b) Convert $(777)_8$ into decimal system **(6 Marks)**

c) Find $\frac{dy}{dx}(1.5)$ from the following table

x	1.5	2.0	2.5	3.0	3.5	4.0
y	3.375	7.000	13.625	24.000	38.875	59.000

(6 Marks)

d) Compute the approximate value of

$$\int_{-3}^{4} x^4 \, dx$$

Using Simpson's $\frac{3}{8}$ rule **(6 Marks)**

e) Compute and interpret the condition number

$$f(x) = \sin x \qquad \text{for} \qquad a = 0.51\pi$$

(6 Marks)

SECTION B. TOTAL MARKS FOR THIS SECTION IS 40.

ANSWER ANY TWO QUESTIONS FROM THIS SECTION. EACH QUESTION IN THIS SECTION CARRIES 20 MARKS.

2. a) Compute the missing value in the following table

x	0	1	2	3	4
y	580	556	520	-	384

(6 Marks)

b) Find the root given the function

$$e^x - 3x = 0$$

correct to 2dp using bisection method (Hint: $1.5 \leq x \leq 1.6$) **(7 Marks)**

c) Apply Lagrange formula to find the cubic polynomial which includes the following values

x	0	1	4	6
y	1	-1	1	-1

(7 Marks)

3. (a)Using Newton's forward interpolation formula, compute the value of $\cos 52^0$ from the following set of data and estimate the error

x	45^0	50^0	55^0	60^0
$y = \cos x$	0.7071	0.6428	0.5736	0.5000

(8 Marks)

b) Find the real root of the equation

$$x^3 - 3x - 5 = 0$$

using Newton-Raphson's Method **(6 Marks)**

c) Express the function

$$f(x) = 3x^3 + x^2 + x + 1$$

in factorial notation with an interval of unity **(6 Marks)**

4. a) Solve the given system using Gauss-Seidel Iterative Method

$$\begin{aligned} 83x + 11y - 4z &= 95 \\ 7x + 52y + 13z &= 104 \\ 3x + 8y + 29z &= 71 \end{aligned}$$

(10 Marks)

b) Use the method of Gauss Jacobi to obtain solution to the system

$$\begin{aligned} 2x + 4y + z &= 7 \\ 3x + y - z &= 3 \\ x - y + 4z &= 4 \end{aligned}$$

(10 Marks)

5. a) Use Newton's divided difference formula to derive the equation for the interpolating polynomial for the given set of data

x(degree)	0	1	2	3	4	5
f(x)	3	2	7	24	59	118

(10 Marks)

b) Apply Romberg's integration formula to find

$$\int_0^{1.2} \frac{dx}{1+x}$$

correct to 5decimal places **(10 Marks)**