



(Knowledge for Development)

KIBABII UNIVERSITY
UNIVERSITY EXAMINATIONS
2022/2023 ACADEMIC YEAR
3RD YEAR FIRST SEMESTER
MAIN EXAMINATION

**FOR THE DEGREE OF BACHELOR OF EDUCATION AND
BACHELOR OF SCIENCE**

COURSE CODE: MAA 312

COURSE TITLE: NUMERICAL ANALYSIS I

DATE: 22/12/2022

TIME: 2:00 PM – 4:00 PM

INSTRUCTIONS TO CANDIDATES

Answer Question One and Any other TWO Questions

TIME: 2 Hours

This Paper Consists of 3 Printed Pages. Please Turn Over.

QUESTION ONE (30 MARKS)

- (a) Define the term Number system (2 marks)
- (b) State the general form of decimal system (2 marks)
- (c) Convert $(345)_8$ to hexadecimal (3 marks)
- (d) State two sources of errors during numerical computation (2 marks)
- (e) Use the Newton-Raphson iteration method to determine the a root of the equation $x^2 - 4x + 3 = f(x)$ at $x_0 = 0.5$ for $n = 0,1,2$. (6 marks)
- (f)
- (i) Solve $f(x) = x^3 + 4x^2 - 10 = 0$ has roots $[1, 2]$ since $f(1) = -5$ and $f(2) = 14$ using Bisection method (Perform five iterations) (6 marks)
- (ii) Find the error after 5^{th} iterations (1 mark)
- (g) Use secant method to determine the root of the equation $\cos x - xe^x = 0$ taking initial points as $x_0 = 0$ and $x_1 = 1$ to 4^{th} iterations (5 marks)
- (h) Apply the iterative formulae to solve $x^2 = 18$. (Perform 3^{rd} iterations) (3 marks)

QUESTION TWO (20 MARKS)

- (a) Given the data below.

x_n	1.0	1.3	1.6	1.9	2.2
$f(x_n)$	0.7652	0.6210	0.4554	0.2818	0.1104

- (i) Set up the divided difference table (perform to 3^{rd} divided difference) (14 marks)
- (b) Compute the approximate value at $f(1.1)$ using the Newton forward divided difference formula with $h = 0.3$ and $s = \frac{1}{3}$ (6 marks)

QUESTION THREE (20 MARKS)

- (a) Construct the Lagrange interpolation polynomial of degree 2 for the function $f(x) = \frac{1}{x}$ on the interval $[2, 4]$ with interpolation points or nodes $x_0 = 2$, $x_1 = 2.5$ and $x_2 = 4$ (10 marks)
- (b) Solve the system using Crout's method; (10 marks)
- $$x_1 + 5x_2 + x_3 = 14$$
- $$2x_1 + x_2 + 3x_3 = 13$$
- $$3x_1 + x_2 + 4x_3 = 17$$

QUESTION FOUR (20 MARKS)

- (a) Use trapezoidal rule and Simpson's rule for a function f on the interval $[0, 2]$ to evaluate $\int_0^2 f(x)dx \simeq f(0) + f(2)$ and $\int_0^2 f(x)dx \simeq \frac{1}{3}\{f(0) + 4f(1) + f(2)\}$.

(15mark)

$f(x)$	x^2	x^4	$\frac{1}{x+1}$
Trapezoidal rule			
Simpson's rule			
Exact value			

- (b) Compute the percentage error by trapezoidal rule at $f(x) = \frac{1}{x+1}$ (5marks)

QUESTION FIVE (20 MARKS)

- (a) Solve the system using Cholesky's method; (10marks)

$$x - 3y + 4z = 9$$

$$-3x - 34y + 17z = 38$$

$$4x + 17y + 18z = 25$$

- (b) Given a system $y - 3x - 3 = f(x, y) = 0$ and $x^2 + y^2 - 25 = g(x, y) = 0$, Apply Newtons method to approximate the roots nearer $(1,4)$ at a fixed point $J(x_0, y_0)$ for $n = 0,1,2,3$.

(10marks)