(Knowledge for Development)

KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS

2021/2022 ACADEMIC YEAR

SECOND YEAR SECOND SEMESTER

MAIN EXAMINATION

FOR THE DEGREE OF BACHELOR OF SCIENCE

COURSE CODE: MAT 252

COURSE TITLE: ENGINEERING MATHEMATICS

DATE: 4/10/2021 **TIME:** 9:00 AM - 11:00 AM

INSTRUCTIONS TO CANDIDATES

Answer Question One and Any other TWO Questions

TIME: 2 Hours

QUESTION ONE (30 MARKS)

(a) Using the convergence test, show whether at $x_1 = 5$, the iterative formula will converge or not.

(i) $x_{n+1} = \frac{x_n^2+3}{5}$ (4 marks)

(ii) $x_{n+1} = 5 - \frac{3}{x_n}$ (4 marks)

(b) Use Newton-Raphson method to form an iterative formula that can be used to solve the equation $sinx - 1 + x^2 = 0$ (9 marks)

(c) Evaluate $\nabla^2(2^x)$ (7 marks)

(d) Prepare a divided difference table for the data below

x	3	7	9	10
f(x)	168	120	72	63

(6 marks)

QUESTION TWO (20MARKS)

(a) Given that x_n is an approximation of the root of the equation $x^3 + 2x - 1 = 0$

(i) Use Newton-Raphson method to show that a better approximation, x_{n+1}, is given by $x_{n+1} = \frac{2x^3+1}{3x^2+2}$ (6 marks)

(ii) Taking $x_1 = 0.3$, determine the root to four decimal places. (6 marks)

(b) Show that the equation $e^x - 3x = 0$ has a root between 0 and1 (3 marks)

(c) Use Simpson's one -third rule to evaluate $\int_0^3 \frac{1}{1+x^5}\, dx$, taking n=6 (5 marks)

QUESTION THREE (20 MARKS)

(a) Given the data below

x	-1	0	1	2	3	4	5
f(x)	-6	-3	0	9	30	69	132

(i) Construct a finite difference table (3 marks)

(ii) Use the finite difference table constructed in (i) above to evaluate f(-0.4) and f(3.5) (8 marks)

(b) Find the polynomial that fits the data

x	1	2	3	4
f(x)	-1	-2	-1	2

Hence use it to find f(1.7) (6 marks)

(c.) Find the equation that can be solved using the iterative formula

$$x_{n+1} = \frac{2x_n}{3} + \frac{4}{x_n^2}$$

(3 marks)

QUESTION FOUR (20 MARKS)

(a) Find (i) $f^1(x)$ $(ii) f^{11}(x)$ at the point x=1.1 using the table below

x	1.0	1.2	1.4	1.6	1.8	2.0
f(x)	0	0.1	0.5	1.25	1.40	3.90

(8 marks)

(b) Find using the method of Regula falsi the solution of the equation

$x^3 + x^2 - 3x - 3 = 0$ near 1 taking two steps correct to 3 decimal places

(8 marks)

(c.) Evaluate $E^2(2^X)$

(4 marks)

QUESTION FIVE (20 MARKS)

(a) Use Euler's method to approximate the value of $\frac{dy}{dx} = y - 2x$ given y(0)=1 in $0 \leq x \leq 2$ taking h=0.4

(8 marks)

(b) In the table below, one of the entries for f(x) is wrongly recorded, use finite differeces to locate this error and correct it

x	0	1	2	3	4
f(x)	3	6	13	18	24

(9 marks)

(c.) Define $\Delta f(x)$

(3 marks)