(Knowledge for Development)

KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS

2017/2018 ACADEMIC YEAR

SECOND YEAR SECOND SEMESTER

SPECIAL/SUPPLEMENTARY EXAMINATION

FOR THE DEGREE OF BACHELOR OF SCIENCE

COURSE CODE: MAT 252

COURSE TITLE: ENGINEERING MATHEMATICS II

DATE: 12/10/18 **TIME:** 11.30 AM -1.30 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) Given the equation $x^2-5x+3=0$ two iterative formulae can be formed to solve the equation

(i) Form these two iterative formulae (6 marks)

(ii) One of these iterative formulae will converge. Starting with $x_1=5$ test for convergence. (4 marks)

(iii) Hence use the one that will converge to find a solution for $x^2-5x+3=0$ to three significant figure (4 marks)

(b) Find the polynomial of the lowest possible degree which assumes the values 3,12,15, -21 when x has the values 3,2,1,-1 respectively using Newton's divided difference formula (6 marks)

(c) (i) For the equation $x\log_{10}x = 1.2$ show that a root exists between x=2 and x=3.

(ii) Use regula-falsi method to find its root correct to three decimal places.

(10 marks

QUESTION TWO (20MARKS)

(a) Given that x_n is an approximation to the root of the equation.

$x^3-2x^3-4=0$

(i) Show using Newton-Raphson method that a better approximation $x_n^1 + 4$ is given by

$$x_{n+1} = \frac{2x_n^3-3x_n^2+4}{3x_n^2-6x_n}$$ (7 marks)

(ii) Hence taking the first approximation $x_1= 3.5$, find to four decimal places, the root of the equation (5 marks)

(b) Show that $\nabla^2(2^x) = 2^x - 2.2^{x-h} + 2^{x-2h}$ (4 marks)

(c) Estimate the missing value in the table

x	1	2	3	4	5
f(x)	2	5	7	-	32

(4 marks)

QUESTION THREE **(20 MARKS)**

(a) The table below represents a polynomial function f(x)

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

Use Newton-Gregory interpolation formula to determine to four significant figure the values of

(i) F(-0.2)

(ii) F (3.4) (10 marks)

(b) With a step size of $\Delta x = 0.2$ compute three steps of Euler's method to approximate the solution of

$\frac{dy}{dx} = -0.3y$ starting with y=25 for x=1

giving your answer to four significant figures (6 marks)

(c) For the shift operation E, show that

$$E^2 f(x) = f(x + 2h)$$ (4 marks)

QUESTION FOUR (20 MARKS)

(a) (i) Use Simpsons 1/3 rule to find the area under the circle.
$f(x) = 0.2+25x-200x^2+675x^3-900x^4+400x^5$ in the range [0,0.8] using 4 strips to 6 decimal places (7 marks)

(ii) Determine the exact area (3 marks)

(i) Hence determine the error to 6 decimal places (2 marks)

(b) Use the trapezoidal rule to evaluate
$\int_0^{\pi} sinx\ dx$ using 6 intervals correct to four decimal places (8 marks)

QUESTION FIVE (20 MARKS)

(a) Given that

$$f(0) = 1, \quad f(1) = 3, \quad f(3) = 55$$

(ii) Find the lagrange interpolation polynomial which fits the data (9 marks)

(iii)Hence find an approximate value for f(2) (2 marks)

(iv) Using inverse interpolation obtain a value of x when $y = 19$ given the following values

X	0	1	20
y	0	1	20

(9 marks)