MUEO

MOI UNIVERSITY

OFFICE OF THE DEPUTY VICE CHANCELLOR
(ACADEMICS, RESEARCH & EXTENSION)

UNIVERSITY EXAMINATIONS

2018/2019 ACADEMIC YEAR

THIRD YEAR SECOND SEMESTER EXAMINATION

FOR THE DEGREE OF
BACHELOR OF SCIENCE,
BACHELOR OF SCIENCE WITH EDUCATION & ARTS EDUCATION

COURSE CODE: MAT 317

COURSE TITLE: NUMERICAL ANALYSIS I

DATE: 12TH JULY, 2019 **TIME:** 9.00 A.M.-12.00 NOON

INSTRUCTION TO CANDIDATES

- SEE INSIDE

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MOI UNIVERSITY

UNIVERSITY EXAMINATIONS

MAIN EXAMINATION

2018/2019 ACADEMIC YEAR

THIRD YEAR, SECOND SEMESTER EXAMINATIONS

FOR THE DEGREE OF BACHELOR OF EDUCATION, BACHELOR OF SCIENCE, BACHELOR OF SCIENCE WITH EDUCATION BACHELOR OF ARTS WITH EDUCATION.

COURSE CODE: **MAT 317**

COURSE TITLE: **NUMERICAL ANALYSIS 1**

INSTRUCTION TO CANDIDATES

- Attempt **ALL** questions in Section **A** and any **THREE** questions in sections **B.**

SECTION A: (31 MARKS)

QUESTION ONE (16 MARKS)

(a) Find the interval of length 1 for which the root of the equation $x\log_{10} x - 1.2 = 0$ lie.

(3mks)

(b) Find the approximate value of the root of the equation $x^3 + x - 1 = 0$ near $x = 1$ using the method of false position. Perform three iterations.

(5mks)

(c) Use Simpsons $\frac{1}{3}$ rule with n = 6 to estimate to three decimal places $\int_1^4 \sqrt{1 + x^3}\, dx$

(4mks)

(d) The values in the table below are for a polynomial of degree three.

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

The value for $f(4)$ is missing, use interpolation techniques to find this missing value.

(4mks)

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QUESTION TWO (15 MARKS)

(a) Find the first and second derivatives of the functions tabulated below at the point $x = 1.1$

x	1	1.2	1.4	1.6	1.8	2.0
y	0	0.1	0.5	1.25	2.4	~~3.0~~ 4.0

(5mks)

(a) Given that x_n is an approximation to the root of the equation $x^3 - 3x^2 - 4 = 0$

(i) Show using Newton – Raphson method that a better approximation x_{n+1} is given by $x_{n+1} = \dfrac{2x_n^3 - 3x_n^2 + 4}{3x_n^2 - 6x_n}$ (5mks)

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

SECTION B (39 MARKS)

QUESTION THREE (13 MARKS)

(a) (i) Give the condition in which Jacob's iterative method can be used to solve a system of simultaneous equations (3mks)

(ii) Hence use the Jacob's method to six steps to solve the system of equations

$4x + y + 3z = 17$

$x + 5y + z = 14$

$2x - y + 8z = 12$

(8mks)

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

QUESTION FOUR (13 MARKS)

(a) The table below satisfies the function $y = f(x)$

x	-4	-2	0	2	4	6	8	10	12
f(x)	422	38	-10	-10	134	902	3158	8150	17510

Use Newton forward or backward finite difference to evaluate

(i) f (-3.6)

(ii) f (10.8) (10mk)

(b) What is meant by interpolation as used in Numerical Analysis? (3mks)

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QUESTION FIVE (13 MARKS)

(a) Solve the system of equations below using the Gauss - Seidel rule method up to the 4^{th} iteration

$6x + y + z = 105$

$4x + 8y + 3z = 155$

$5x + 4y - 10z = 65$ (7 mks)

(b) Find the form of the function $f(x)$ under suitable assumption from the following data using Newton's divided difference interpolation formula, hence find the value of f(4.6)

x	0	1	2	5
f(x)	2	3	12	147

(8 Mks)

QUESTION SIX (13 NARKS)

(a) Given that f(0) = 1, f(1) = 3 and f(3) = 55

i. Find the lagrange interpolation polynomial which fits the data (5mks)

ii. Hence find the approximate value of f (2) (3mks)

(b) Use Simpsons - $\frac{3}{8}$ rule to estimate $\int_0^3 \frac{1}{1+x}dx$ when n = 6 giving your answer correct to four decimal places. (5mks)

QUESTION SEVEN (MARKS)

(a) Use trapezoidal rule with n = 8 to estimate $\int_1^5 \sqrt{1+\ x^2}\,dx$ correct to two decimal places (6mks)

(b) Use the lagrange inverse interpolating formula to obtain the value of x when y = 19 given the following values of x and y (5mks)

X	0	1	20
Y	0	1	20

(c) What is meant by iteration as used in numerical analysis (2mks)

$x = \frac{17}{4} - \frac{1}{4}y + \frac{3}{4}z$

$y = \frac{14}{5} - \frac{1}{5}x - \frac{1}{5}z$

$z = \frac{3}{2} - \frac{1}{4}x + \frac{1}{6}y$

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