(The University Of Choice)

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)
(MAIN EXAMINATIONS)

UNIVERSITY EXAMINATIONS
2021/2022 ACADEMIC YEAR

THIRD YEAR SECOND SEMESTER EXAMINATIONS

FOR THE DEGREE
OF
BACHELOR OF SCIENCE (ENGINEERING)

COURSE CODE: MAT 202 E/MAT 204

COURSE TITLE: ENGINEERING MATHEMATICS II

DATE: TUESDAY 28ND APRIL 2022 TIME: 3.00-5.00 P.M

Instructions to candidates:
Attempt Question One [Compulsory] and Any Other Two Questions.
Time: 2 hours

QUESTION ONE (30 MARKS) (COMPULSORY)

a) Apply the Gauss-Seidel Scheme up to $n=3$, taking $(x_0, y_0, z_0) = (1,1,1)$ to the

system: $\begin{aligned} 4x - y &= 1 \\ -x + 4y - z &= 2 \\ -y + 4z &= 3 \end{aligned}$ **(5Marks)**

b) Find the approximate root of $2x - \log x - 7 = 0$ by the fixed point iteration. Let $x_0 = 1$ up to x_7

(5Marks)

c) Using Linear interpolation formula find the equation for the given coordinates (6, 8) and (10, 16). What is the value of y when $x = 7$? **(4Marks)**

d) Find the sixth term of the sequence 8, 12, 19, 29, 42, ... **(5Marks)**

e) Use the table below to find $\dfrac{dy}{dx}, \dfrac{d^2 y}{dx^2}$ of $y^3 = x$ at $x = 50$ and $x = 55$. Compare your results with the analytic ones. **(6Marks)**

X	50	51	52	53	54	55
Y	3.375	7.000	13.625	24.000	38.875	59.00

f) Given that $y_3 = 2, y_4 = 2, y_5 = -6, y_5 = 8, y_6 = 9, y_7 = 17$. Calculate $\Delta^4 y_3$ **(5Marks)**

QUESTION TWO (20 MARKS)

a) Solve the system of equations below by Crout's Method **(6Marks)**
$$\begin{aligned} 4x - y + z &= 7 \\ 4x - 8y + z &= -21 \\ -2x + y + 5z &= 15 \end{aligned}$$

b) Consider the following table of values. **(5Marks)**

X	1	1.1	1.2	1.3	1.4	1.5
Y	2	2.1	2.3	2.7	3.5	4.5

Use Newton's Backward difference formula to find f(1.45)

c) Find $\int_0^1 e^{2x} dx$ given that h=0.2. Use Trapezoidal rule and compare your results with analytic results and find the relative error. **(5Marks)**

d) Find the binary form of the decimal number $(17.25)_{10}$ and the denary form of the binary number $(101.1101)_2$ **(4Marks)**

QUESTION THREE (20 MARKS)

a) Evaluate the integral $\int_0^1 \dfrac{dx}{1+x^2}dx$, for $h_1=0.25$ and $h_2=0.125$ using Romberg's method (4 d.p). Compare with analytic results. **(5 Marks)**

b) Show that: (i) $D = \dfrac{1}{h}\left[\Delta - \dfrac{\Delta^2}{2} + \dfrac{\Delta^3}{2} + \ldots\right]$, (ii) $\Delta = E-1$ (iii) $E = (1-\nabla)^{-1}$ **(6 Marks)**

c) Find the first term of the sequence whose second and subsequent terms are 8, 3, 0, -1, 0 , ... **(4Marks)**

d) Find a root of an equation $f(x) = x^3 - x - 1$ using the Secant Method. Let $x_0 = 1, x_1 = 2$ up to x_4 correct to 5 decimal places. **(5Marks)**

QUESTION FOUR (20 MARKS)

a) By the Least squares Method, find the best find the best fitting straight line to the data given below. **(5Marks)**

X	5	10	15	20	25	30
y	16	19	23	26	30	33

b) Find y_{-1} if $y_0 = 2,\ y_1 = 9, y_2 = 28, y_3 = 65, y_4 = 126\ y_5 = 217$ **(5Marks)**

c) Find $f(15)$ using Newton's forward difference formula given the table below **(5Marks)**

X	10	20	30	40	50	60
y	46	66	81	93	101	117

d) Assuming that a root of $x^3 - 9x + 1 = 0$ lies in the interval (2,4), find the approximate root by the bisection method (use 6 d.p and find x_7). **(5Marks)**

QUESTION FIVE (20 MARKS)

a) Solve the system below using Gauss-Jacobi Method
$$x + 2y + z = 3$$
$$2x + 3y + 3z = 10$$
$$3x - y + 2z = 13$$
(5Marks)

b) Use Simposon's Rule to evaluate $\int_4^{5.2} (\ln x)dx$, taking $h = 0.2$. Compare with the analytic results. **(5Marks)**

c) The function tabulated below is $y = 2e^x - x - 1$. Find the third order derivative of the function at $x = 0.4$ and $x = 0.9$ correct to 4 decimal places.. Compute the percentage error of the estimated result with respect to actual result. **(6Marks)**

x	0.4	0.5	0.6	0.7	0.8	0.9
y	1.5836	1.7974	2.0442	2.3275	2.6511	3.0192

d) Use Lagrange's formula to fit a polynomial to the data and hence find $f(2.5)$ **(4Marks)**

X	-1	0	2	3
Y	-8	3	1	12

END OF EXAMINATION: GOOD LUCK