TECHNICAL UNIVERSITY OF MOMBASA

UNIVERSITY EXAMINATIONS 2017/2018

EXAMINATION FOR THE DEGREE OF BACHELOR OF TECHNOLOGY IN ELECTICAL ENGINEERING

AMA 4263 ENGINEERING MATHEMATICS II

SPECIAL/ SUPPLIMENTARY EXAMINATIONS
SERIES: SEPTEMBER 2018

DATE: DECEMBER 2017 **DURATION: 2 HOURS**

INSTRUCTIONS: ANSWER QUESTION ONE AND ANY OTHER TWO

QUESTION ONE (30 MARKS)

(a.) Define what interpolation. **(4 Marks)**

(b.) Explain the two methods:

(i.) Lagrange interpolation **(2 Marks)**

(ii.) Newton's divided differences **(2 Marks)**

(c.) Evaluate $\int_0^1 \frac{4dx}{1+x^2}$ with five ordinates by using

(i.) Trapezoidal rule **(4 Marks)**

(ii.) Simpson's rule **(4 Marks)**

(d.) Find an interpolating polynomial for the data points (0, 1), (2, 2), and (3, 4), using Lagrange interpolation. Find P(1.8). **(4 Marks)** (e.) Use divided differences to find the interpolating polynomial passing through the points (0, 1), (1, 0), (2, 2), (3, 4). **(4 Marks)**

(f.) Use Romberg integration to compute $R_{3,3}$ for $\int_0^{\pi} \sin x dx$. **(6 marks)**

Question TWO

(a.) Solve $\int_0^2 f(x)dx$ when *f*(x) is

(i.) $(1 + x^2)^{1/2}$ using Trapezoidal rule **(3 Marks)**

(ii.) $(1 + x)^{-1}$ using Simpson's 1/3 rule **(3 Marks)**

(iii.) e^x **(2 Marks)**

(b.) Determine values of h that will ensure an approximation error of less than 0.00002 when approximating $\int_0^{\pi} \sin x dx$ employing

(i.) Composite Trapezoidal rule and **(4 Marks)**

(ii.) Composite Simpson's rule. **(4 Marks)**

(c.) The following is a table of values for *f*(x) = tan x,

x	1	1.1	1.2	1.3
tan x	1.5574	1.9648	2.5722	3.6021

Use linear interpolation to estimate tan (1.15). **(4 Marks)**

Question THREE

(a.) Use the Runge-Kutta method of order four with h = 0.2, N = 5, and $t_i = 0.2i$ to obtain approximations to the solution of the initial-value problem:

$$y' = y - t^2 + 1, 0 \le t \le 2, y(0) = 0.5.$$ **(10 Marks)**

(b.) Use the Adams Bashforth fourth-order predictor-corrector method with h = 0.2 and starting values from the Runge-Kutta fourth order method to solve the initial-value problem

$$y' = y - t^2 + 1, 0 \le t \le 2, y(0) = 0.5.$$ **(10 Marks)**

Question FOUR

(a.) Prepare a Newton's divided difference table for the polynomials of each degree $0 \leq d \leq 5$ which pass through the points $(-1, -5)$, $(0, -1)$, $(2, 1)$, and $(3, 11)$? **(5 Marks)**

(b.) Let $f(x) = \cos x$, $x_0 = 0.2$, $x_1 = 0.3$, $x_2 = 0.4$. Compute $f[x_0, x_1, x_2]$. **(5 Marks)**

(c.) Obtain a numerical solution, using Euler's method of differential equation

$\frac{dy}{dx} = y - x$ With the initial conditions that at x = 0, y = 2, for the range x=0 (0.1) 0.5. **(10 Marks)**

Question FIVE

a) Given $x_0 = 3$, find a root of $x^3 - 3x - 5 = 0$ correct to 3 decimal places using the Newton-Raphson method **(6 Marks)**

(b.) Using Taylor's series, find the solution of the differential equation

$xy' = x - y$, y(2) = 2 at x = 2.1 correct to 5 decimal places. **(7 Marks)**

(c.) Consider the function f(x) = cos x - x = 0. Approximate a root of f(x) using

(i.) a fixed-point method, and **(4 Marks)**

(ii.) Newton-Raphson's Method **(3 Marks)**