TECHNICAL UNIVERSITY OF MOMBASA

Faculty of applied and Health Sciences

DEPARTMENT OF MATHEMATICS AND PHYSICS

UNIVERSITY EXAMINATION FOR DEGREE IN:

BACHELOR OF SCIENCE IN CIVIL AND MEDICAL ENGINEERING

SMA 2471: NUMERICAL ANALYSIS

SPECIAL/ SUPPLIMENTARY EXAMINATIONS

SERIES: **September 2018**

TIME: 2 HOURS

Instructions to Candidates

You should have the following for this examination
-Answer Booklet, examination pass and student ID

This paper consists of 5 questions. Question one is compulsory. Answer any other two questions
Do not write on the question paper.

QUESTION ONE (30 marks)

a) Prove that $\left(\frac{\Delta^2}{E}\right)e^x.\frac{Ee^x}{\Delta^2 e^x}=e^x$ the interval of differencing being h

(6 marks)

b) Given $f(2)=4,\quad f(2.5)=5.5$ Find the linear interpolating polynomial using Aitkens iteration method and use it to find an approximate value of $f(2.2)$

(6 marks)

c) Using the data $\sin(0.1)=0.09983$ and $\sin(0.2)=0.19867$ Find an approximate Value of $\sin(0.15)$ by Lagrange interpolation.

(5 marks)

d) Given the following values of $f(x)=\log x$, find the approximate value of $f'(2.0)$ using the method based on quadratic interpolation.

x	2.0	2.2	2.6
log x	0.69315	0.78846	0.95551

(5 marks)

e) Find the by Taylors series method to degree three the value of y at $x = 0.1$ correct to 5 decimal places from the differential equation $\frac{dy}{dx} = x^2 y - 1, \quad y(0) = 1$

(6 marks)

f) Define interpolation

(2 marks)

QUESTION TWO (20 marks)

a) Given that $f(0) = 1,\ f(1) = 3,\ f(3) = 5.5$. Find the unique polynomial of degree 2 or less which fits the given data. Hence evaluate the polynomial at 2.5 using Lagrange's fundamental polynomials.

(15 marks)

b) Solve the difference equation $\left(\Delta^2 - 3\Delta + 2\right) y_x = 0$

(5 marks)

QUESTION THREE (20 marks)

a) A slider in a machine moves along a fixed straight rod. Its distance x cm along the rod is given below for various values of the time t seconds. Find the velocity and acceleration of the slider when t=0.3 seconds.

t	0	0.1	0.2	0.3	0.4	0.5	0.6
x	30.13	31.62	32.87	33.64	33.95	33.81	33.24

(10 marks)

b) Given $\frac{dy}{dx} = x^2(1 + y)$ and y(1)=1, y(1.2)=1.548, y(1.3)=1.979, evaluate y(1.4) using Milne's Predictor-Corrector method.

(10 marks)

QUESTION FOUR (20 marks)

a) Given the differential equation $\frac{dy}{dx} = x - y$ with the condition $y(0) = 1$. Use Picard's method to obtain y for $x = 0.2$ up to degree five correct to five places of decimal.

(14 marks)

b) Obtain the exact value for (a) above at $x = 0.2$

(6 marks)

QUESTION FIVE (20 marks)

a) Given $\frac{dy}{dx} = x + z, \quad \frac{dz}{dx} = x - y^2$ with $y(0) = 2,\ z(0) = 1$. Obtain the first Taylors algorithm y_1, z_1 for $y(0.1), y(0.2)$

(15 marks)

b) Given $f(2) = 4, \quad f(2.5) = 5.5$. Find the linear interpolating polynomial using Newton's divided difference method and use it to find an approximate value of $f(2.4)$

(5 marks)