UNIVERSITY OF EMBU

2017/2018 ACADEMIC YEAR

SECOND SEMESTER EXAMINATIONS

THIRD YEAR EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE

SMA 322: NUMERICAL ANALYSIS I

DATE: APRIL 10, 2018 **TIME: 11:00 AM – 1:00 PM**

INSTRUCTIONS:

Answer Question ONE and ANY other two Questions

QUESTION ONE (30 MARKS)

a)

i) Describe three types of errors in numbers. (3 marks)

ii) If 0.333 is the approximate value of $\frac{1}{3}$. Find percentage error? (3 marks)

b) If $y = x^3 + x^2 - 2x + 1$, calculate the values of y for $x = 0,1,2,3,4,5$. From the difference table find the value of y at x=6 by extending the table and verify that the same value is obtained by subtraction. (5 marks)

x	0	1	2	3	4	5
y						

c) Write the expression for:

i) Newton-Gregory forward formulae. (2 marks)

ii) Sterling's formulae (2 marks)

d) If error denoted by **e** is detected in f(x) complete the table to show how that error propagates in a difference table. (5 marks)

f(x)	Δ f(x)	Δ^2f(x)	Δ^3f(x)	Δ^4f(x)	Δ^5f(x)
e					

e) Given the following functional values. Find a 2nd degree Lagrange interpolation x_0 =-2, f_0 =-8.52, x_1 =1, f_1 =3.00, x_2 =2 and f_2 =7.48 (4 marks)

f) Use Simpson's third rule to evaluate $\int_0^1 \frac{dx}{1+x}$ correct to three decimal places (4 marks)

g) Show that $\Delta E^{-1} = \nabla$ (2 marks)

QUESTION TWO (20 MARKS)

a) Use the Newton-Raphson method to find $\sqrt[3]{24}$ (5 marks)

b) Use iterative method to find the root of the equation $x^2 - 3x + 1 = 0$ which lies between (0,1). Giving your answer to 3 d.p (8 marks)

c) Use Cote's formula to show that $\int_{x_0}^{x_2} f(x)dx = (x_2 - x_0)\left\{\frac{1}{6}y_0 + \frac{4}{6}y_1 + \frac{1}{6}y_2\right\}$

(7 marks)

QUESTION THREE (20 MARKS)

a) Using the following table of values. Calculate $f'(2)$and $f'(2.05)$using Sterling's formulae

(8 marks)

	1.7	1.8	1.9	2.0	2.1	2.2
f(x)	0.58824	0.55556	0.52632	0.50000	0.47619	0.45455

b) If $x_0 = -2, x_1 = 2\ and\ x_2 = 6$, show that the sum of Lagrange's coefficient add up to 1

(6 marks)

c) Use the trapezoidal rule to evaluate $\int_0^{\frac{\pi}{2}} \sin x dx$ by dividing the interval $(0, \frac{\pi}{2})$ into 10 equal parts. Find the error using the exact value. (6 marks)

QUESTION FOUR (20 MARKS)

a) Use Bessel's formulae to find $f(0.36)$ (8 marks)

x	0.1	0.2	0.3	0.4	0.5	0.6
f(x)	1.172	1.008	0.878	0.782	0.720	0.692

b) Evaluate the following where $h = 1$

i) $(E^{-1}\Delta)x^3$ (3 marks)

ii) $(\nabla + \Delta)^2(x^2 + x + 1)$ (5 marks)

c) The following is a data of a third degree polynomial. Use shift operator E to find the missing term. (4 marks)

x	0	1	2	3	4
p(x)	1	3	9	-	81

QUESTION FIVE (20 MARKS)

a) By constructing a difference table. Find the 7^{th} term and hence a general term for the following

x	1	2	3	4	5	6
y	0	0	2	6	12	20

(7 marks)

b) The following data represent a polynomial of what degree?

x	0	1	2	3	4	5
f(x)	1	0.5	8.0	35.5	95.0	198.5

(7 marks)

c) If h(k) is the function given for k = a, b, c and d where the intervals b − a, c − b and d − c are not necessarily equal, complete the divided difference table below (6 marks)

k	h(k)	$\Delta h(k)$	$\Delta^2 h(k)$	$\Delta^3 h(k)$
a				
b				
c				
d				

--END-