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KIRIRI WOMENS' UNIVERSITY OF SCIENCE AND TECHNOLOGY
UNIVERSITY EXAMINATION, 2022/2023 ACADEMIC YEAR
SECOND YEAR, SECOND SEMESTER EXAMINATION
FOR THE DEGREE OF BACHELOR OF SCIENCE
(MATHEMATICS)

Date: 12th April, 2022
Time: 8.30am – 10.30am

KMA 107 - INTRODUCTION TO NUMERICAL ANALYSIS

INSTRUCTIONS TO CANDIDATES

ANSWER QUESTION ONE (COMPULSORY) AND ANY OTHER TWO QUESTIONS

QUESTION ONE (30 MARKS)

- a) i) Convert the hexadecimal number $(2A7.3E2)_{16}$ to Denary number system. (3 marks)
- ii) Convert $(01111010000100100001)_2$ to hexadecimal number system. (3 marks)
- b) Convert $(39.B8)_{16}$ to octal. (5 marks)
- c) Given the following data, evaluate y at $x = 0.6$. (5 marks)

x	0.1	0.3	0.5	0.7	0.9	1.1	1.3
y	0.003	0.067	0.148	0.248	0.37	0.518	0.697

- f) Evaluate $\int_0^1 \frac{dx}{1+x^2}$ using Trapezoidal rule and $h = 0.2$. (5 Marks)
- g) Suppose that $x = \frac{5}{7}$ and $y = \frac{1}{3}$. Use five digit arithmetic to approximate $p + q$ and determine the absolute and relative errors using chopping method. (4 Marks)
- h) Use bisection method to find the smallest positive root to the equation $x^3 - x - 11 = 0$ (5 marks)

QUESTION TWO (20 MARKS)

- a) Convert the following Octal numbers into their denary equivalent;
- i) $(15347.321)_8$ (2 marks)
 - ii) $(2963.4X12)_{12}$ (3 marks)
 - iii) $(4B5.2AC8)_{16}$ (2 marks)
- b) Convert the following numbers to the stated number system
- i) 0.50246_{10} to duodecimal (3 marks)
 - ii) 44892.6531_{10} to octal form (2 marks)
 - (iii) 27384.426_{10} to hexadecimal form (3 marks)
 - (iv) 171.356_{10} to binary form (3 marks)
- c) Convert $(011110100001001000010010)_2$ to octal number system. (2 marks)

QUESTION THREE (20MARKS)

- a) Perform five iterations of the bisection method to obtain the smallest positive root of the equation

$$f(x) = x^3 - 5x + 1 = 0 \quad (8 \text{ marks})$$

- b) Find the approximate value of

$$I = \int_0^{\pi} \sin x dx$$

Using (i) Trapezoidal rule

- (ii) Simpson's $\frac{1}{3}$ - rule by dividing the range of integration into six equal parts.

(12 marks)

QUESTION FOUR (20 MARKS)

- a) Prove the following relations

(i) $(1 + \Delta)(1 - \nabla) \equiv 1$

(3marks)

(ii) $(\Delta - \nabla) \equiv \Delta \nabla.$

(3 marks)

- b) Evaluate the following:
- i) $\Delta^2(ab^{cx})$ (3 marks)
- ii) $\nabla^2(2^x)$ (3 marks)
- c) Suppose that $x = \frac{2}{7}$ and $y = \frac{3}{4}$. Use five digit chopping for calculating $x + y$ and $x \times y$. (8 marks)

QUESTION FIVE (20 MARKS)

- a) i) Change $(245)_{10}$ to binary. (3 marks)
- ii) Convert $(243)_8$ to hexadecimal. (3 marks)
- b) Consider the following table of values

x	1	1.1	1.2	1.3	1.4	1.5
$f(x)$	2	2.1	2.3	2.7	3.5	4.5

Use Newton's forward difference formula to estimate the value of $f(1.45)$.

(7 marks)

- c) Evaluate $f(1.8)$ given the following table of values:

x	1.5	2.0	2.5	3.0	3.5	4.0
f(x)	3.375	7	13.625	24	38.875	59

(7 marks)