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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 AND COMPUTER SCIENCE)**

Date: 3<sup>rd</sup> August, 2022  
Time: 11.30am – 1.30pm

**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 duodecimal number  $(2X5.136)_{12}$  to Denary number system. (3 marks)
- ii) Convert  $(11111010000100100001)_2$  to hexadecimal number system. (3 marks)
- b) i) Convert  $(36.532)_8$  to hexadecimal number system. (4 marks)
- ii) Compute the binary subtraction  $101101-001110$  (2 marks)
- c) The population of a town is as follows:

Year	1971	1981	1991	2001	2011	2021
Population '000000'	20	24	29	36	46	51

- Estimate the population in the year 1976. (5 marks)
- d) Evaluate  $\int_0^{10} \frac{dx}{1+x^2}$  using Simpson's rule and  $h = 0.1$ . (4 marks)
- e) 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)
- f) Use bisection method to find the smallest positive root to the equation  $x^3 + x - 1 = 0$  correct to 3 decimal places. (5 marks)

## **QUESTION TWO (20 MARKS)**

- a) Convert the following Octal numbers into their denary equivalent;
- i)  $(362.35)_8$  (4 marks)
  - ii)  $(567.325)_{12}$  (4 marks)
  - iii)  $(42A.12)_{16}$  (4 marks)
- b) Convert the following numbers to the stated number system
- i)  $0.556_{10}$  to octal form (3 marks)
  - ii)  $492.651_{10}$  to duodecimal form (4 marks)
  - iii)  $2784.426_{10}$  to hexadecimal form (4 marks)
  - iv)  $25.625_{10}$  to binary form (4 marks)
- c) Convert  $(11110100001001000010010)_2$  to octal number system. (3 marks)

## **QUESTION THREE (20 MARKS)**

- a) Perform five iterations of the bisection method to obtain the smallest positive root of the equation  $f(x) = x^3 + 10x^3 + 8x - 50$  correct to three decimal places. (8 marks)
- b) Find the approximate value of
- $$I = \int_1^2 \frac{1}{x} dx$$
- Using i) Trapezoidal rule
- ii) Simpson's  $\frac{1}{3}$  - rule by dividing the range of integration into 10 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)  $\nabla^2(ab^{cx})$  (3 marks)
  - ii)  $\Delta^2(2^x)$  (3 marks)
- c) Suppose that  $x = \frac{2}{9}$  and  $y = \frac{3}{7}$ . Use five digit arithmetic to approximate  $x + y$  and  $x \times y$ . Determine the absolute and relative errors using rounding off method. (8 marks)

**QUESTION FIVE (20 MARKS)**

- a) i) Change  $(10110)_2$  into a decimal number. (3 marks)
- ii) Convert  $(3462)_8$  into a decimal number. (3 marks)
- b)  $F(x)$  is a polynomial in  $x$  with the following functional values:  $f(2)=f(3)=27$ ,  $f(4)=78$ ,  $f(5)=169$ . Find the function  $f(x)$ . (7 marks)
- c) Evaluate  $f(15)$  given the following table of values:

x	10	20	30	40	50
f(x)	46	66	81	93	101

(7 marks)