



NATIONAL OPEN UNIVERSITY OF NIGERIA

Plot 91, University Village Cadastral Zone, Nnamdi Azikiwe Express Way, Jabi-Abuja.

FACULTY OF SCIENCES

DEPARTMENT OF COMPUTER SCIENCE

2023_1 POP EXAMINATION²³¹

Course Code: CIT335

Course Title: COMPUTATIONAL SCIENCE AND NUMERICAL METHODS

Credit Unit: 3 units

Instruction: Answer Question one and any other three (3) questions **Time:** 3hrs

- 1 a. State a detailed definition the term: Real Number. **[5 mark]**
 - b. What are the constituents of a Machine number? Give 2 typical examples of machine numbers. **[4 marks]**
 - c. State the formula for y in its equivalent form order to eliminate cancellation error in $y = \sqrt{(x + \delta)} - \sqrt{x}$, where $x > 0$ and $|\delta|$ is very small. **[8 mark]**
 - d. State the formula for y in it equivant form in order to eliminate cancellation error in $y = \cos(x + \delta) - \cos(x)$, where $|\delta|$ is very small. **[8 mark]**
- 2 a. State a detailed definition of the term: machine arithmetic. **[5 mark]**
 - b. List the condition error number in machine arithmetic? Give 2 typical examples of each mentioned. **[5 mark]**
 - c. State the algebraic equation of a polynomial of n degree. **[5 mark]**
3. a. Define the term: condition number. **[3 marks]**
 - b. List two types of condition number. Give 2 typical examples of each mentioned. **[4 marks]**

- c. Let $(x) = \sqrt{(x^2 + 1)} - 1$. Rewrite the formula to avoid loss of significance. **[8 marks]**
4. a. Define errors in computational science. **[3 marks]**
- b. State the four (4) sources of error. Give an example of each source of error. **[8 marks]**
- c. State the Mean value theorem of differential calculus. **[4 marks]**
5. a. State the relative error and error bound of $y=x_1 \cdot x_2$ and $y=x_1/x_2$ **[10 marks]**
- b. Explain the term: Error propagation **[5 marks]**
6. a. Derive the error propagation formula for the function $y = \log x$. **[5 marks]**
- b. Convert:
- i. 10001112 to base ten
 - ii. 2345 to base two
 - iii. ADE3 to base ten
 - iv. 65328 to base two
 - v. 10010001.0001 to base ten **[10 marks]**