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**KIRIRI WOMENS' UNIVERSITY OF SCIENCE AND TECHNOLOGY**  
**UNIVERSITY EXAMINATIONS, 2024/2025 ACADEMIC YEAR**  
**SECOND YEAR, FIRST SEMESTER EXAMINATION**  
**FOR THE DEGREE OF BACHELOR OF SCIENCE IN COMPUTER SCIENCE**  
**(SPECIAL EXAMINATION)**

**KCS 311 SCIENTIFIC COMPUTING**

**Date: 13<sup>TH</sup> AUGUST, 2024**

**Time: 11:30 AM – 1:30 PM**

**INSTRUCTIONS TO CANDIDATES**

**ANSWER QUESTION ONE (COMPULSORY) AND ANY OTHER TWO QUESTIONS**

**QUESTION ONE: COMPULSORY (30 MARKS)**

- a) Define the term scientific computing. **(2 Marks)**
- b) Why is scientific computing termed to be a scientific area that spans many disciplines? **(2 Marks)**
- c) Define the following terms: **(4 Marks)**
  - i. Algorithms
  - ii. Numerical Simulation
  - iii. Parallel Computing
  - iv. Computational scientist
- d) Why is high performance computing important in scientific computing? **(3 Marks)**
- e) Outline the reason of using differential equations in scientific computing especially when developing continuous models. Use an appropriate example to support your answer. **(5 Marks)**
- f) Differentiate: **(6 Marks)**
  - i. Static models and dynamic models
  - ii. Descriptive models and prescriptive models
  - iii. Deterministic models and stochastic models
- g) State two reasons why numerical simulations are important. **(2 Marks)**
- h) Selecting the right Mathematical equation is essential for developing a correct model. Outline the three approaches of selecting mathematical equations **(6 Marks)**

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

- a) Outline four ways of testing mathematical models that are used in scientific computing. **(8 Marks)**
- b) State two reasons why one should stop the mathematical modelling process. **(2 Marks)**
- c) Identify three objectives of mathematical modelling. **(3 Marks)**
- d) Outline three advantages of using mathematics as a modelling language. **(3 Marks)**
- e) Explain the two approaches of classifying mathematical models. **(4 Marks)**

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

- a) Using an example of a model for telephone queue, differentiate the three approaches of modelling discrete systems in scientific computing. **(9 Marks)**
- b) Define the following components of a system as used discrete models: **(3 Marks)**
  - i. Entity
  - ii. Attribute
  - iii. Activity
- c) Continuous modelling is generally broken down into several steps. Outline the 6 steps. **(6 Marks)**
- d) In order to develop the conceptual model two approaches are feasible. State the two approaches. **(2 Marks)**

## **QUESTION FOUR (20 MARKS)**

- a) Define the following as used in high performance computing: **(3 Marks)**
  - i. HPC Cluster
  - ii. High throughput computing
  - iii. Supercomputers
- b) State four advantages and four challenges of using High performance computing systems. **(8 Marks)**
- c) Outline the three components of high-performance computing solutions. **(6 Marks)**
- d) There a few issues that should be considered during Implementation of numerical algorithms. State any three. **(3 Marks)**

## **QUESTION FIVE (20 MARKS)**

- a) Outline four categories of software (tools and libraries) that are used in scientific computing. **(8 Marks)**
- b) State four reasons that make python suitable for scientific computing. **(4 Marks)**
- c) Outline the function of the following python libraries in scientific computing. **(3 Marks)**
  - i. Numpy
  - ii. SciPY
  - iii. Mat - plotLib
- d) Identify three areas where computational science is applicable. **(3 Marks)**
- e) Outline two functions of a computational scientist **(2 Marks)**