NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF APPLIED SCIENCES

DEPARTMENT OF INFORMATICS AND ANALYTICS

GEO-INFORMATICS II

SCI4204

Second Semester Examinations 2024

This examination paper consists of 4 pages.

Time Allowed: **3 hours**

Total Marks: **100**

Examiner's Name: **Mr. S Ncube**

External Examiner: **Dr L.C. Sakala**

INSTRUCTIONS

1. Answer any four (4) questions.
2. Each question carries 25 marks.

MARK ALLOCATION

QUESTION	MARKS
1.	**25**
2.	**25**
3.	**25**
4.	**25**
5.	**25**
Total of 4 Questions	**100**

Question One

The city of Bulawayo wants to develop a real-time crime tracking web application to improve public safety.

a) Explain how Python APIs (with libraries such as Folium and Geopandas) can be used to develop an interactive crime mapping system. [8 marks]

b) Design a database schema that would store crime incidents with attributes such as location, type of crime, time, and suspect details. [9 marks]

c) Discuss the advantages and potential challenges of using real-time crime mapping for law enforcement. [8 marks]

Question Two

a) Critique the Routine Activity Theory (RAT) and the Crime Pattern Analysis (CPA) in modern day crime fighting. [8 marks]

b) Explain how machine learning and spatial analytics improve the detection of unauthorised movements in a geo-fenced border zone. [9 marks]

c) A crime analyst uses hotspot mapping to identify high-crime areas. Explain the process and how predictive analytics can assist police in crime prevention strategies. [8 marks]

Question Three

A massive wildfire has broken out in Matabeleland, and response teams need GIS-based solutions for crisis management.

a) Describe how spatial analysis and satellite imagery can help assess fire damage and guide emergency response teams. [8 marks]

b) Design a geospatial mobile application that provides real-time updates on wildfire spread and evacuation routes. [9 marks]

c) Explain how geospatial data from drones can be integrated into disaster response strategies. [8 marks]

Question Four

a) Discuss how spatial data analysis can help formulate land use and housing development policies. [8 marks]

b) Explain the role of GIS in climate change mitigation, using examples of flood risk mapping and environmental monitoring. [9 marks]

c) Describe how Participatory GIS (PGIS) can involve local communities in decision-making for sustainable development. [8 marks]

Question Five

The Bulawayo City Council (BCC) faces serious environmental challenges due to overflowing sewers and uncollected solid waste. These issues are leading to health hazards, pollution, and urban degradation. The council seeks a GIS-based mobile application to monitor, report, and manage these problems in real-time.

Tasks:

Design a GIS-driven smart city app to help BCC address these environmental issues. Your answer should cover the following:

a) Problem Analysis – Explain how overflowing sewers and uncollected waste affect public health, the environment, and urban living. [5 marks]

b) Application Features – Outline the core functionalities of the mobile app, including:

- Citizen reporting system (how users report issues)
- Real-time GIS tracking of problem areas
- Integration with BCC waste management & sewer teams [10 marks]

c) Technical Architecture – Describe the technologies and tools you would use to develop the app, such as:

- Programming languages
- GIS & mapping APIs
- Database & cloud services [10 marks]

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