UNIVERSITY of RWANDA

# COLLEGE OF SCIENCE AND TECHNOLOGY

## DEPARTMENT OF CIVIL, ENVIRONEMTAL AND GEOMATICS ENGINEERING

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**SGE2263 GNSS for Geomatics I 04/03/2025 Time: 1hr**

1. Explain the following terms as used in GNSS. [2]
   i. Ephemeris
   ii. Trilateration
   iii. Global Navigation Satellite System
   iv. Space vehicle numbers
2. Explain what multipath errors are in GNSS and how they can be minimized. [2]
3. Describe signal components. [3]
4. Discuss the origins of satellite navigation and the role of the United States military in the development of GPS. [3]
5. The receiver's clock is not perfectly synchronized with the satellite's clock, and the time delay between the satellite transmitting and the receiver receiving the signal is measured to be **0.090 microseconds (μs)**. The speed of light is approximately $3 \times 10^8$ **(m/s)**. Calculate the pseudo-range and explain what pseudo range is. [5]
6. With the aid of a sketch explain the Global Positioning System structure. [5]

**GOOD LUCK!!!!!!**

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END OF SEMESTER II EXAMINATION -ACADEMIC YEAR 2024-2025

YEAR: 2 SEMESTER: II PROGRAMME(S): SGE

**MODULE CODE & TITLE: SGE2262 GNSS FOR GEOMATICS I**

**DATE:** 02/06/2025 TIME: 2hours

MAXIMUM MARKS = 60

## INSTRUCTIONS

1. This paper contains FOUR (4) questions.
2. Answer THREE (3) Questions only:
   ***Question ONE (1) from Section "A" is Compulsory and Answer any TWO (2) from Section "B"***
3. Any written materials and Programmable calculators are NOT allowed.
4. Do not forget to write your Registration Number.
5. Write all your answers in the booklet provided
6. Do not write any answers on this questions paper.
7. **Start each question in a NEW page**

## SECTION: A

**Question: 1** [20]

**a.** Explain the following terms as used in GNSS.

i. Dilution of Precision [1]

ii. Ephemeris [1]

iii. Antenna phase center [1]

**b.** Solve below questions and explain Why is the signal travel time not used alone to determine user position in GNSS?

i. A GNSS signal takes 0.07 seconds to reach a user's receiver. What is the signal path length between the satellite and the user? [2]

ii. A satellite is 21,000 km away from a receiver. How long does it take for the GNSS signal to reach the user? [2]

**c.** State factors which can affect the accuracy of the position obtained for a satellite. [2]

**d.** Describe how you **create** a survey project, **collect** data using FOIF; how data **export** and **processing** is being done. [5]

**e.** Compare and contrast GLONASS, Galileo, and BeiDou in terms of system design and coverage. [6] (table)

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## SECTION: B

**Question: 2** [15]

**a.** What is the role of SBAS in Global Navigation Satellite System positioning? [4]

**b.** How does a GPS receiver determine from which satellites it is receiving the signal? [4]

**c.** From the field practical FOIF DGNSS was used. With the aid of sketch explain FOIF components and their functions. DGPS [7]

**Question: 3** [15]

**a.** GPS modernization program is an ongoing, multibillion-dollar effort to upgrade the features and overall performance of the Global Positioning System.

i. What is its major focus? [1]

ii. What is it involved in? [1]

iii. What is the name of the newer generation of Global Positioning System (GPS) satellites introduced with modernization? [1]

**b.** How can selective availability (SA) introduce errors in GNSS and what was its purpose? [2]

c. Why is signal integrity critical in aviation GNSS applications? [3]

d. Discuss the key components of an SBAS system? [7]

**Question: 4** [15]

a. Explain Global Positioning System (GPS) space segment and orbit characteristics. [6]

b. Imagine a country that wants to establish its own GNSS augmentation system. What factors should be considered when planning the infrastructure for such a system? [9]

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