

Note: This examination consists of 5 questions on 3 pages.

Marks

<u>Q. No</u>	<u>Time: 3 hours</u>	<u>Value</u>	<u>Earned</u>
1.	With the evolution of the Global Positioning System (GPS) as the most widely used Global Navigation Satellite System (GNSS), surveyors have integrated it into daily practice using a variety of positioning techniques. Alongside GPS, other GNSS constellations have been developed and are now used worldwide, offering increased coverage, redundancy, and accuracy. It is currently a common practice to apply different GNSS techniques and augmentation systems in various surveying and geodetic positioning applications.		
	a) Compare the following GPS positioning techniques: DGPS, PPP, and RTK. For each technique: • Expand the acronym. • Describe the type of observations used. • Identify the required tools and equipment. • State the achievable accuracy. • Summarize the main advantages and disadvantages. • Provide typical applications.	13	
	b) In the context of RTK, explain the concept of a Virtual Reference Station (VRS). In your explanation, include: • Why is it needed and how is it implemented? • The main benefits and potential limitations.	3	
	c) Define and differentiate between WADGPS, LADGPS, and WAAS. For each system: • Expand the acronym. • Explain how it is implemented. • Identify its main applications.	4	
2.	Geodetic positioning is strongly influenced by gravity, the gravity potential, and the Earth's gravity field. These concepts are essential because they form the foundation for defining reference surfaces, determining heights, and ensuring accuracy in geodetic applications.		
	a) Define a level surface and explain its fundamental properties in detail. Provide examples of well-known level surfaces used in geodetic positioning and describe how each of them was determined or is currently realized.	7	
	b) What is the geopotential number? Discuss how geopotential numbers are used to obtain different types of heights. Explain these heights in detail and the main factor affecting their categorization.	7	

5.	Geodetic positioning encompasses a wide range of applications that rely on different types of observations and instruments. As a result, surveyors and geodesists often need to work with multiple coordinate systems, both local and global, and perform transformations between them to ensure consistency and accuracy. Understanding the definitions, roles, and relationships of these coordinate systems is critical for precise geodetic computations and positioning tasks. a) Define local and global geodetic coordinate systems. In your explanation, discuss their origins, axes, associated coordinates, and the relationship between the two systems. b) List common examples of local and global geodetic coordinate systems that are frequently used by surveyors. c) A geodetic baseline is to be established in an area where only one control station (station K) is available, with known geodetic coordinates (ϕ_K, λ_K, h_K). A surveyor must establish a new geodetic control station (station J) and determine its geodetic coordinates (ϕ_J, λ_J, h_J) in NAD83 (CSRS). Without access to GPS equipment, the surveyor uses only a total station positioned at station K, and collects the following observations: - zenith angle θ_J - slope distance d_{KJ} - geodetic azimuth α_{KJ}. Describe in detail the computational procedure, with equations, for determining the geodetic coordinates of station J. In your approach, you may neglect the effect of the deflections of the vertical.	5	
		5	
		14	
	Total Marks:	100	