

CANADIAN BOARD OF EXAMINERS FOR PROFESSIONAL SURVEYORS

C6 - GEODETIC POSITIONING

October 2015

Note: This examination consists of 5 questions on 2 pages.

Marks

<u>Q. No</u>	<u>Time: 3 hours</u>	<u>Value</u>	<u>Earned</u>
1.	GPS is widely used for geodetic positioning purposes. Different techniques have been developed, and RTK is widely used as a technique by surveyors worldwide.		
	a) What does RTK stand for? Explain the basic principal of RTK. What is the achievable accuracy and what are the limitations?	12	
	b) Explain the concept of a virtual reference station. What are the advantages and disadvantages of this approach compared to a more old-fashioned RTK one, where the user installs her/his own reference station?	10	
	c) The RTK solution is a so called <i>ambiguity – fixed solution</i> . Explain in detail what ambiguities are, what an ambiguity – fixed solution is, and how it is obtained.	8	
2.	a) Define geodetic latitude, geodetic longitude, and height. Add a sketch.	10	
	b) The output of a commercial GPS processing package provides the ECEF Cartesian coordinates XYZ of marker A and marker B. Explain in detail (with formulas) how you calculate the difference of latitude and longitude between marker A and B.	10	
3.	What does NAD83 (CSRS) stand for? The transformation between NAD83 (CSRS) and any realization of ITRF at any arbitrary epoch (t) can be obtained by a Helmert transformation using 14 parameters instead of 7. Explain this transformation and its parameters (with formulas). What is the order of magnitude of the coordinate change you expect when transforming from NAD83 (CSRS) to ITRF2008?	15	
4.	The Canadian Height Reference System CGVD28 has been replaced recently by the new CGVD2013.		
	a) How is the CGVD2013 defined and realized? What are the advantages compared to CGVD28?	10	
	b) You just finished a GPS survey. The output of your GPS-software are Cartesian coordinates XYZ with respect to NAD83 (CSRS) of all markers. After having transformed them to UTM coordinates and to CGVD28 heights, you are asked to change to the new CGVD2013. Explain in detail the impact on the calculation of the UTM coordinates and how you get the CGVD2013 heights.	10	

5.	<p>a) What does TAI, UTC, and UT1 stand for? Explain briefly how these time references are realized nowadays.</p> <p>b) How is the <i>GPS time</i> defined and realized? What is its use? What is the relationship of GPS time with TAI, with UTC and with UT1?</p>	5	
	Total Marks:	100	