CANADIAN BOARD OF EXAMINERS FOR PROFESSIONAL SURVEYORS

C6 – GEODETIC POSITIONING   **March 2021**

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

Q. No		*Time: 3 hours*	Value	Earned
1.	a)	Define UT1 and explain how it is obtained nowadays. Which space geodetic methods contribute to its realization?	7	
	b)	What does UTC stand for? Explain the relationship between UTC and TAI as well as between UTC and UT1.	6	
	c)	GPS uses GPS-time (GPST) as its reference. Explain how GPST is defined. How does GPST relate to UTC? Is there an advantage of using GPST instead of using directly UTC as time scale for GPS?	7	
	d)	How is *official time* in Canada defined?	5	
2.	a)	What does NAD83(CSRS) stand for? Comment on its infrastructure. How has it been related to the International Terrestrial Reference system (ITRS)? What is the level of accuracy related to this datum?	10	
	b)	What does ITRF2014 stand for? Explain **briefly** how it has been obtained. What is the level of accuracy related to this datum?	5	
	c)	Explain **_with formulas_** the concept of a Helmert transformation (also called a seven-parameter transformation or sometimes a similarity transformation).	8	
	d)	Why is such a seven-parameter transformation insufficient/inappropriate for converting NAD83(CSRS) coordinates to ITRF2014 coordinates? Which transformation is used instead? Explain **_with formulas_** this transformation.	7	
3.	a)	How was the old vertical datum CGVD28 realized? What are the advantages of the new CGVD2013 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 details the impact on the calculation of the UTM coordinates and how you get the CGVD2013 heights.	5	

4.	You are in charge of digitizing and converting old road maps to NAD83 (CSRS). The total area covered is about 4 x 2 km.		
	a) On the old cadaster plans you find the mention NAD27 and a coordinate grid. After digitalisation, you have a list of coordinates in NAD27 of all interesting points. Explain how you proceed to convert these coordinates to NAD83(CSRS), knowing that you need an accuracy of 30 cm.	10	
	b) In the case where absolutely no information on the cadaster plans is given (no datum, no north orientation, no scale), how would you proceed?	5	

5.	The coordinates of marker *A* are given with respect to NAD83 (CSRS) :
	
	    Marker A : N45° 57' 04."4388 W71° 43' 20."4380
	    Marker B : N45° 55' 53."3452 W71° 43' 46."8891		

	a) Estimate roughly the azimuth from marker *A* to marker *B*. *(just giving a numerical result without commenting on how you got it will not be accepted).*	10	
	b) Explain (*without any actual numerical calculation*) how you obtain UTM coordinates for Marker *A* and the grid bearing (in UTM) from *A* to *B.*	5	
	Total Marks:	100	