CANADIAN BOARD OF EXAMINERS FOR PROFESSIONAL SURVEYORS

C6 - GEODETIC POSITIONING

October 2018

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

Time: 3 hours

Q. No		Marks Value	Earned
1.	a) What does the acronym ITRS stands for? Give the definition of the ITRS by specifying its origin and the orientation of its axes. Comment on its different realizations.	10	
	b) Define ellipsoidal latitude, longitude, and height (*add a sketch*). How are they related to the 3D Cartesian geocentric coordinates *(with formulas)*?	10	
2.	For calculating a GPS solution the satellites' positions are needed. Two different source of information are available: broadcast and precise ephemerides. a) ***Broadcast Ephemeris:*** How does the user access broadcast ephemeris? What is the format of it? Who is responsible for its determination and how is it achieved? What is its accuracy?	10	
	b) ***Precise Ephemeris:*** How does the user access precise ephemeris? What is the format of it? Who is responsible for its determination and how is it achieved? Comment on the different products available and their accuracy?	10	
	c) Enumerate two applications where you would use broadcast ephemeris and two applications where you would use precise ephemeris. Give brief justifications.	5	
3.	Natural Resources Canada has released the Canadian Geodetic Vertical Datum of 2013 (CGVD2013), which is now the new reference standard for heights across Canada. This new height reference system is replacing the Canadian Geodetic Vertical Datum of 1928 (CGVD28), which was adopted officially by an Order in Council in 1935 *(http://webapp.geod.nrcan.gc.ca/geod)*. a) How has the previous Vertical datum CGVD28 been realized and maintained?	5	
	b) How is the actual Vertical datum CGV2013 defined, realized and maintained?	5	
	c) What are the advantages of the new vertical datum? Do you see any disadvantages?	5	
4.	**GNSS :** The ionospheric delay is proportional to the inverse of the square of the frequency : $\Delta Ion \propto \frac{1}{f^2}$ or proportional to the square of the wavelength $\Delta Ion \propto \lambda^2$ a) By supposing that the phase measurements are given in meters, determine the coefficient α_1 et α_2 related to the linear combination: $\varphi_{IF}[m] = \alpha_1\varphi_1[m] + \alpha_2\varphi_2[m]$ for which the ionospheric effect is eliminated *(mathematical development is required).*	10	
	b) Assuming a ionospheric delay of 1 m on L1, calculate the ionospheric delay in meters for the L2 frequency and the widelane frequency.	10	

5.	You are responsible for a local survey in a rural region in Ontario. The network consists of 50 points distributed quite homogeneously over an area of 10 km x 10 km. Your task is to determine the UTM coordinates of all 50 points with an accuracy of 2 cm. At your disposal are 5 dual frequency receivers capable of RTK. a) Explain briefly how RTK works. Why are dual frequency measurements mandatory or at least of an enormous benefit compared to single frequency measurements? b) Why does RTK not work over long distances? c) Explain your strategy for solving this task and meeting the required accuracy in terms of number of reference stations used, occupation plan with rovers, ties to NAD83(CSRS), and total duration in days.	5 5 10	
	Total Marks:	100	