CANADIAN BOARD OF EXAMINERS FOR PROFESSIONAL SURVEYORS

C-6 GEODETIC POSITIONING

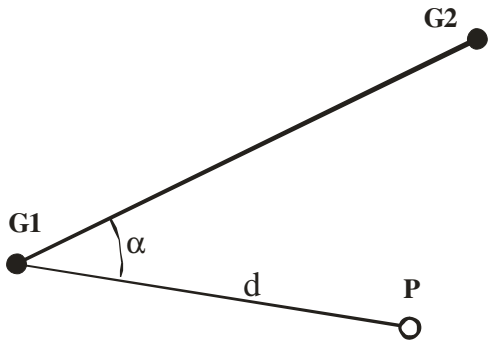
October 2012

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

Time: 3 hours

Q. No		Marks Value	Earned
1.	GPS is nowadays widely used in surveying applications where typically an accuracy of 1-5 cm is needed and obtainable by **2 very different techniques** called RTK and PPP, respectively. a) What does RTK stands for? Outline the basic principle of this technique. What are initial phase ambiguities and why is their resolution essential in RTK? or the other way round, what happens if ambiguity resolution fails? Explain in details how ambiguity resolution is achieved in RTK. b) What does PPP stands for? Explain the basic principle of this technique. c) The approaches for taking into account the ionospheric delay are different in RTK and PPP. Explain how the ionospheric delay is dealt with each technique. Comment on its impact on the coordinate determination in both techniques. d) Give a list of 4 criteria on which you decide whether to use RTK or PPP. Justify and illustrate this by giving a typical application where you would use RTK and a typical application where you would use PPP.	10 5 5 10	
2.	For the following 4 time systems : *1)* explain the acronym, *2)* give a definition of it, *3)* explain how this time system is realized nowadays, and *4)* give an application (preferably a geodetic one) where it is used. a) TAI b) GPS-Time c) UT1 d) UTC	5 5 5 5	
3.	a) Explain what NAD83(CSRS) stands for and comment on its characteristics : *1)* realization, *2)* coverage, *3)* hierarchy of markers and their accuracy, *4)* maintenance. b) The Cartesian geocentrical coordinates ***xyz*** of a certain number of markers have been determined in June 2012 with respect to the ITRF2008. Explain how you transform these coordinates to NAD83(CSRS). By approximately what amount do the coordinates change?	10 5	

4.	a) What is the reference surface used in a vertical datum? Why does it differ from an ellipsoid and by how much with respect to an ITRF-GRS80 ellipsoid? b) What is the name of the official vertical datum in Canada? Comment ***briefly*** on how this datum was established. Explain why this datum does not satisfy today's users' needs for precise height determination. c) The height obtained from GPS is basically a height above the ellipsoid. How can it be transformed in a height with respect to the official vertical datum in Canada?	5 10 5	

5.	 You are responsible of a local survey in Ontario. You first determine the coordinates of two marker ***G1*** and ***G2*** by means of GPS. Then, you install a total station (theodolite with distancemeter) on marker ***G1*** and you measure the angle α and the horizontal distance ***d*** to marker ***P*** (see sketch).
	The GPS coordinates of ***G1*** and ***G2*** you obtained are geocentric Cartesian coordinates ***xyz*** with respect to NAD83(CSRS). Your task is to determine the UTM coordinates of marker ***P***.
	a) You start by converting the ***xyz*** coordinates of ***G1*** and ***G2*** to UTM. Outline briefly how you find the UTM coordinates.
	You obtain the following result :
	`G1 : UTM-x = 500 020.657 m  UTM-y = 5 190 722.517 m  zone = 16`
	`G2 : UTM-x = 499 825.643 m  UTM-y = 5 190 832.812 m  zone = 16`
	b) Explain what UTM stands for and comment on its characteristics. Why are the y-coordinates larger than the x-coordinates ?
	c) Calculate the UTM-coordinates of marker P with a resolution of 1 mm. ***Hint*** : You might have to apply reductions to the measured values beforehand.
	Measurements : `d = 104.318 m` α `= 22°12'45"`
	The ellipsoidal height of ***G1*** is 855 m.
	(just giving a numerical result without commenting on how you got it will not be sufficient).
		3
		3
		9	

	Total Marks:	100	