CANADIAN BOARD OF EXAMINERS FOR PROFESSIONAL SURVEYORS

C6 - GEODETIC POSITIONING

March 2014

Although programmable calculators may be used, candidates must show all formulae used, the substitution of values into them, and any intermediate values to 2 more significant figures than warranted for the answer. Otherwise, full marks may not be awarded even though the answer is numerically correct.

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

Time: 3 hours

Q. No		Marks Value	Marks Earned
1.	The coordinates of marker ***A*** are **:** ***ITRF2008–POSITION (EPOCH 2005.0)*** ***ITRF2008 VELOCITY*** x = 918129.388 m v_x = −0.0158 m/yr y = −4346071.331 m v_y = −0.0041 m/yr z = 4561977.929 m v_z = 0.0042 m/yr a) Explain the acronym *ITRS* and give its definition in terms of *origin* and *orientation of axes*. Part of the definition of the *ITRS* is a so called *no-net-rotation condition*. Explain its concept and usefulness. b) What is the difference between ***the*** *ITRS* and ***an*** *ITRF*? Enumerate the different space techniques contributing to the realization of *ITRF2008*. c) Give a rough estimation (resolution of 0.1°) of the latitude and longitude of the marker ***A.*** *(just giving a numerical result without commenting on how you got it will not be accepted).* d) Explain with formulas how you obtain the velocity component in the northward, eastward, und upward direction from the above given velocity vector (*no numerical calculation is requested*).	8 6 6 5	
2.	The evolution over time of the datums used in Canada is the following: NAD27 → NAD83 → NAD83(CSRS) a) NAD83 replaced NAD27. What are the major differences between the realization of the newer NAD83 and the older NAD27? What do they have in common? b) NAD83(CSRS) replaced NAD83. What are the differences between the realization of the newer NAD83(CSRS) and the older NAD83? What do they have in common? c) Comment on the absolute and relative accuracy of NAD83 and NAD83(CSRS). Is it possible to transform coordinates from NAD83 to NAD83(CSRS)? If yes, which procedure is applied and how accurate is this transformation?	5 10 5	
3.	Two important modern space geodetic technics are VLBI and SLR. Choose one of them and explain the acronym, its functional principle, and its contribution to the determination of the Earth's rotation parameters. ***Start your answer by identifying your choice***.	10	

4.	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)*. Explain briefly how the old CGVD28 had been realized and maintained. Explain in detail how the new CGVD2013 is defined, realized and maintained. What are the advantages of the new vertical datum? Do you see any disadvantages?	5 10 10	
5.	Being involved in an old-fashioned large aerophotogrammetric survey using only ground based control points, you are in charge of determining the coordinates of about 200 of them by means of GPS. The points are homogenously distributed over an area of 50 km x 50 km. Unfortunately the responsible persons are not really experts and the only piece of information you get is that an accuracy better than 5 cm is required. a) Which technical specifications would you suggest to satisfy this requirement, in terms of: choice of receiver type, observing technique, observables used, and data processing strategy? b) Which deliveries in terms of types of coordinates, datum used and accuracy indicators do you propose?	15 5	
	Total Marks:	100	