

CANADIAN BOARD OF EXAMINERS FOR PROFESSIONAL SURVEYORS

C6 - GEODETIC POSITIONING

October 2013

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 7 questions on 2 pages.

| Q. No | Time: 3 hours | Marks | |
|-------|---|---------------------|--------|
| | | Value | Earned |
| 1 | a) What does ICRS stand for? How are the origin and axes of this reference system defined? b) What does ITRS stand for? How are the origin and axes of this reference system defined? c) Explain the transformation between ICRS and ITRS. Which parameters are involved? | 10 | |
| 2 | Explain the acronym NAD83. There are several versions of this datum. Nowadays the most important one for Canada is NAD83(CSRs). Compared to NAD83(original) what are the major improvements of NAD83(CSRs) and how have they been realized? | 10 | |
| 3 | Astronomical latitude and longitude can be determined by optical measurements on stars. Define: a) declination, b) right ascension, and c) hour angle of a star Define sidereal time and explain the difference between mean sidereal time and apparent sidereal time. | 3 3 3 6 | |
| 4 | When processing GPS data satellite ephemerides are needed. Explain in detail how a GPS receiver gets this information and in which format. What is the accuracy (in m) of the coordinates of the satellites calculated from this type of ephemerides? Who is the provider? This accuracy is insufficient when processing a PPP solution. Which type of ephemerides is needed and how can they be obtained? Who is the provider? What is the accuracy (in m) of the coordinates of the satellites calculated from this type of ephemerides? What does the acronym PDOP stand for? How is it derived? What is its use? | 6 4 5 | |
| 5 | The following information of the two markers M1 and M2 is given : M1 : $X=343263.370m$ $Y=5653573.669m$ $H=675.76m$ $mc=-1^{\circ}44'13''$ $k=0.9999017$ M2 : $X=342662.289m$ $Y=5654419.210m$ $H=704.82m$ $mc=-1^{\circ}44'38''$ $k=0.9999040$ X and Y are the UTM coordinates (zone 15), H is the orthometric height, mc is the convergence of the meridian, and k is the projection scale factor. The mean geoid undulation is $N = -48.56 m$. Calculate the horizontal distance at terrain height between M1 and M2 with a resolution of 1 mm. Calculate the geodetic azimuth from M1 to M2 with a resolution of 1 arc sec. | 9 6 | |

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| 6 | What is measured by a gravimeter? Give three applications where this type of measurements are used and comment on their role. | 9 | |
| | The FG5 is the most frequently used absolute gravimeter. Explain the basic functional principle of this instrument. | 6 | |
| 7 | In Canada a new vertical datum will be introduced in the near future, replacing the existing one. Comment briefly on the way the existing one was established and on its weaknesses compared to the new one. | 5 | |
| | How will the new vertical datum be a) defined, b) realized, and c) maintained? | 10 | |
| | In your opinion what will be the impact of this change on the everyday work of a surveyor. | 5 | |
| | | 100 | 0 |