

# National Exams December 2012

04-Geom-B4, Hydrography

3 hours duration

## NOTES:

1. If doubt exists as to the interpretation of any question, the candidate is urged to submit with the answer paper, a clear statement of any assumptions made.
2. This is a CLOSED BOOK exam. Any Casio or Sharp calculator is permitted.
3. Must attempt Question # 5 plus you can choose 3 other questions of your choice from # 1 - # 4.
4. All Questions worth 25%, must do 4 out 5 for complete paper. Must do Question 5, and choose 3 questions from #1 - #4.

### Marking Scheme

1.
  - a. 10 marks
  - b. 5 marks
  - c. 5 marks
  - d. 5 marks
2.
  - a. 15marks
  - b. 10 marks
3.
  - a. 15 marks
  - b. 10marks
4.
  - a. 15 marks
  - b. 5
  - c. 5
  - d. 5
5.
  - a. 9 marks
  - b. 8 marks
  - c. 8 marks

Front Page

Must write Question # 5 plus 3 other questions # 1, 2, 3, 4, of your choice

1.
  - a. Name and define the elements of the sonar equation. In the context of the equation, what is required for a successful echo detect?
  - b. Describe with the help of a diagram what factors affect the size of a beam footprint?
  - c. Describe the main factors that contribute to the attenuation of an acoustic signal in water?
  - d. What three parameters can be measured to determine the speed of sound in water? Choose one of the parameters and state what would happen to the sound speed if it were increased.
  
2.
  - a. Sensor Integration is one of the most important issues that have to be addressed before undertaking a multibeam echosounder survey. One issue of integration is the determination of the relative alignment angles of the sonar with respect to the motion sensor. What is the common name of this test and describe how you would conduct the various components of the test?
  - b. Briefly describe 3 major sources of uncertainty that contribute to a sounding's Total Vertical Uncertainty?
  
3.
  - a. Compare and contrast the advantages and dis-advantages of using bathymetric Lidar versus multibeam echosounders?
  - b. You have been tasked to survey a large uncharted Bay; you have a LIDAR and a multibeam system. Discuss how you could execute this survey to maximize efficiency and safety of equipment and personnel?
  
4.
  - a. Ellipsoid referenced surveys are becoming more common as techniques and technology become refined. The major hurdle is the transformation between the ellipsoid and a datum that is used for nautical products. Discuss how you would transform between the ellipsoid and a tidal based chart datum (i.e. Lower Low Water Large Tide)? Assume the area is small enough that the transformation is uniform throughout the whole area. Briefly describe 2 major advantages over traditional Water Level gauging.
  - b. Tidal signatures are classified into 4 groups, list and describe what each means?
  - c. What criteria are considered when choosing a chart datum?
  - d. What is the datum for depths and elevations in tidal waters? What about non-tidal (i.e. Lake Ontario)?

Must write Question # 5 plus 3 other questions # 1, 2, 3, 4, of your choice

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5. You are to conduct a post dredging survey in the mouth of a river with multibeam sonar where the bottom type is very fine silt. There is water level gauges located a few kilometres on either side of the work site, and the sound speed structure in the area is very dynamic.

a. Discuss your pre-survey calibration procedures, for example how would you confirm and document that your sonar is measuring what it should be and that its integration with ancillary systems are accurate.

b. What techniques and collection strategies would you employ to minimize the major sources of random error during the survey?

c. You discover the survey area, when dredged, creates a layer of fluid mud right above the bottom. Your initial survey was conducted with multibeam sonar at 300 khz. You suspect that with this high frequency you may have been detecting this layer of mud. What strategies would you employ to ensure you are getting "real" bottom? (Assume you have access to other types of equipment).