

National Exams May 2010

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. Candidates may use one of two approved Casio or Sharp calculators.
3. Four (4) questions constitute a complete exam paper. The first four questions as they appear in the answer book will be marked.
4. Each question is of equal value.
5. Most questions require an answer in essay format. Clarity and organization of the answer are important.

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1. (25%) You are to conduct a hydrographic surveying operation with a single-beam echo-sounder in an area where suspended sediment layers exist.
 - a. What frequency range would you choose for your project? Why? Name three single-beam echo-sounders that can be used for this project.
 - b. Explain one method for calibrating your echo-sounder.
 - c. What are the error sources and limitations you expect to encounter? Can you overcome them?

2. (25%)
 - a. In multibeam echo-sounding surveys, the patch test is used to detect the systematic errors in the components of the vessel attitude as well as the time offset between the positioning system and the sounder, for a particular installation. Briefly explain the various tests that are commonly carried out for this purpose.

 - b. After cleaning and processing your multibeam data, you detected a short period undulation of the data producing across track ribbing in the sun-illuminated image. Explain what might be the cause of the error.

3. (25%) You have recently purchased a bathymetric Lidar and you would like to verify the performance specifications of the system.
 - a. How would you verify the system accuracy and depth penetration? Show all details.
 - b. How can you verify the system's ability for hazard detection?
 - c. Can you use a Lidar system for seafloor classification? Explain why or why not?

4. (25%) Answer the following questions:
- a. Distinguish between continuous wave and chirp pulses. How the pulse length affects the total energy output of an acoustic transducer?
 - b. Distinguish between time delay and phase delay beam forming?
 - d. Describe with the help of a diagram the factors that affect the size of the beam footprint?
 - c. Describe the propagation of sound from a point source through the water? How does it interact with the seabed?
5. (25%) Explain each of the following terms:
- a. Lead-line method.
 - b. Induced heave.
 - c. shoal-biased surfaces.
 - d. Secchi disk.
 - e. -3 dB points.