CANADIAN BOARD OF EXAMINERS FOR PROFESSIONAL SURVEYORS

C12 - HYDROGRAPHIC SURVEYING

March 2013

Note: **This examination consists of 10 questions on 1 page.**

Marks

Q. No	Time: 3 hours	Value	Earned
1.	Define each of the following: a) Lead line b) LIDAR c) Beam width d) Band width e) Patch Test f) Uncertainty g) Cross-check line h) LAT i) Chart Datum j) S-44	2 2 2 2 2 2 2 2 2 2	
2.	a) Name the three properties of sea water that affect the speed of sound through the ocean. Which has the greatest effect near the surface? Which has the greatest effect in deep water? b) Describe Snell's Law and how it is used in acoustic ray tracing. c) Write the equation that relates frequency, wavelength and sound velocity.	5 3 2	
3.	a) What is a "bar check" and what is it used for? b) With the help of a diagram, describe the components necessary for reducing water depth measurements from the transducer face to a chart datum? c) Under normal survey conditions, why is it necessary to apply pitch and roll observations to narrow angle single beam observations and NOT necessary to wide angle single beam observations?	3 5 2	
4.	a) When using SSS, what factors must be considered when estimating along-track resolution? b) What causes the blank region at the center of a raw SSS image? c) In SSS data processing, what does the first arrival tell us?	5 2.5 2.5	
5.	a) What steps must be followed to convert multi-beam observations (time and angle) into a geo-referenced depth? Include both horizontal and vertical components in your discussion. b) Describe why time is important in multi-beam surveys. Refer to issues at the hour, second/sub-second level.	5 5	
6.	a) Describe the tide generating forces. b) What is the approximate time period of the three primary tidal constituents? c) What is harmonic analysis and what is it used for?	5 2.5 2.5	
7.	Describe four different horizontal positioning systems/methods used in hydrography. Include: positioning type, observables, measurement instrumentation, sources of uncertainty, expected uncertainty.	5	
8.	With the help of a diagram, describe the various vertical datums used in hydrographic operations.	5	
9.	a) What factors contribute to the total vertical uncertainty of a sounding derived from a multi-beam system? b) Write out the basic equation used to define the allowable vertical uncertainty as per the "S-44 IHO, 5th Edition; Standards for Hydrographic Surveying" AND define each of the variables.	5 5	
10.	Describe the procedures that should be followed when processing data collected during a hydrographic survey for charting.	10	
	Total Marks:	100	