ASSOCIATION OF CANADA LANDS SURVEYORS - BOARD OF EXAMINERS
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SCHEDULE II / ITEM 2
HYDROGRAPHIC SURVEYING AND OCEANOGRAPHY

February 2000
(1990 Regulations)
This examination consists of **4** questions on **4** pages **(Closed Book)**

Time: 3 hours **Marks**

1.	Oceanography (a) Enumerate and describe two phenomenae that result in sea level change.	5
	(b) Enumerate four water characteristics and discuss their effects on climates.	5
	(c) What are the three technical terms describing temperature, salinity and pressure variation with water depth?	5
	(d) Enumerate four characteristics of a water wave and discuss wave speed versus water depth.	5
	(e) Given that **"*i*"** is the angle between an isobar and a level surface, describe the conditions under which "*i*" is 0.	5
	(f) What would happen to "*i*" if the earth rotation would be triple of what it is now?	5
	(g) Assume the Moon to be at the local zenith of an observer on the Earth's surface. Is the tide-producing force minimum or maximum at the observer? Explain why	5
	(h) Enumerate and describe two meteorological effects on tides.	5

2.	UnderwaterAcoustic Propagation (a) Why can the target strength (in dB) be positive?	5
	(b) Discuss how a sonar system can be noise-limited or reverberation-limited.	5
	(c) What is the propagation loss due to attenuation in seawater at a depth of 8,000 m for acoustic frequencies of 20 kHz and 40 kHz, respectively	5
	d) How can the source level (SL) of a sonar system be increased?	5
	(e) In a bay with a depth of 300 m, the salinity and temperature are found to vary linearly from the surface to the bottom from 15 ppt to 25 ppt and from 20^0C to 10^0C, respectively. A surface ship mounted echosounder is used for depth determination. Evaluate the effect of the above variations on the accuracy of the depth measurements.	10

3.	Multibeam Swath Systems (MBES) and Horizontal/Vertical Accuracy A MBES is used to chart a harbour that has a depth of about 100 m using IHO S-44 Order 1 specifications. Assume that you can position the hydrographic ship using DGPS with a 2DRMS accuracy of 4 m. Analyse MBES pointing accuracy requirements as a function of swath angle to meet the Order 1 horizontal accuracy requirement. State clearly any assumption you make in your analysis to support your numerical results	20

4.	Surface versus submerged acoustic systems Compare the advantages and disadvantages of using a single beam acoustic system from a surface ship and from a submerged remotely operated vehicle. You may assume any position for the acoustic system.	10

Total Marks: 100