

**ASSOCIATION OF CANADA LANDS SURVEYORS - BOARD OF EXAMINERS  
WESTERN CANADIAN BOARD OF EXAMINERS FOR LAND SURVEYORS  
ATLANTIC PROVINCES BOARD OF EXAMINERS FOR LAND SURVEYORS**

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**SCHEDULE II / ITEM 1  
GEODETIC POSITIONING**

**February 2000**  
**(1990 Regulations)**  
**(Closed Book)**

This examination consists of **3** questions on **2** pages

**Time: 3 hours**

**Marks**

1.	<u>EM Propagation</u>	
	(a) Why is it usually easier to achieve a higher range accuracy at laser frequencies than at RF frequencies?	7
	(b) Is the selection of the formula to calculate the refractivity N important when measuring a range using a RE frequency? Justify your answer.	7
	(c) Assume that the propagation velocity is known with an accuracy of 1 m/s. What is the impact on a range measurement?	7
	(d) Describe “passive” and “active” positioning system.	7
	(e) Assume that the carrier phase of a positioning system can be measured with an accuracy of 2° Calculate the corresponding accuracy in units of length for the following frequencies: 100 kHz and 1.5 GHz	7
	(f) Take the above accuracy in (e) into account to calculate the accuracy with which the coarse range is needed to resolve the carrier phase ambiguity for each of the two frequencies used.	7
2.	<u>Geodetic Concepts</u>	
	(a) Describe the major differences between the North American Datum 83 and World Geodetic System 84	7
	(b) How self-consistent are NAD83 and WGS84? Can this cause problems?	7
	(c) How does the deflection of the vertical affect satellite-based and ground-to-ground range or pseudorange measurements?	7

	(d) Define astronomic and geodetic longitude. Why and how are they made compatible? Is it theoretically needed now that GPS has replaced classical geodetic measurements? Justify your answer.	7
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3.	<u>GPS Surveying</u> A large number of points are to be established on Canada Lands on a 20-km spacing grid with a one-sigma accuracy of 10 cm in the latitude, longitude and height component, respectively.	
	(a) Describe the observables and methods to use in order to achieve the accuracy required.	9
	(b) Discuss the use of $L_1$ versus $L_1/L_2$ receivers.	5
	(c) Orthometric heights are needed; describe how they differ from GPS-derived heights and how to obtain them	9
	(d) Enumerate six major GPS receiver characteristics required	7

**Total Marks: 100**