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

SCHEDULE II / ITEM 1 — March 2004

GEODETIC POSITIONING

Note: This examination consists of _4_ questions on _1_ page

Time: 3 hours

Q. No		Marks Value	Marks Earned
1	a) Define levelled height	5	
	b) Define orthometric height	5	
	c) Define geodetic height	5	
	d) What is the difference between orthometric and geodetic heights? What is it called?	5	
	e) Why is this difference so important for vertical positioning? How does it connect with the vertical reference frame used in Canada? Give examples.	5	
2	You are engaged to write the technical specifications for a survey using GPS. This survey is composed of two parts. In the first part, you will be installing a number of control stations, connected to nearby CBS points. In the second part, you will determine the coordinates of points (close to the control points by 10 km or less) using RTK. The final coordinates are required to have cm-level accuracy. GPS is the system of choice for the survey. What technical specifications would you suggest to satisfy the accuracy requirement, in terms of: choice of receiver types, observing techniques, observables used, error mitigation, choice of station sites, contents of a final report?	25	
3	a) The radius of curvature of the meridian section M and the radius of curvature of the prime vertical section N are given by the following equations (where a is the semi-major axis, e is the eccentricity and ϕ is the latitude). Where on the earth's surface are both M and N equal? Show your developments. $$N = \frac{a}{(1-e^2\sin^2\phi)^{1/2}}$$ $$M = \frac{a(1-e^2)}{(1-e^2\sin^2\phi)^{3/2}}$$	5	
	b) How is the Canadian Spatial Reference System defined and realized?	5	
	c) Explain the difference between NAD27 and NAD83(CSRS).	5	
	d) How is NAD83(CSRS) related to ITRF96?	5	
	e) The motion of a satellite can be described by the six Keplerian elements: the major-semi axis of the orbital ellipse, the eccentricity of the orbital ellipse, the inclination of the orbital ellipse, the argument of perigee, the right assenssion of the ascending node and the true anomaly. In a purely Keplerian orbit, which is the only Keplerian element that does change with time? Why?	5	
4	a) Describe the principles of an EDM measurement system.	5	
	b) Let us suppose that the accuracy of the velocity of propagation is 1 mm/s. How much will this impact range measurements?	5	
	c) What is the difference between a passive and an active positioning system?	5	
	d) Consider a range satellite system in which all satellites transmit the same frequency. How can a receiver distinguish among the different signals to know which one is transmitted by a particular satellite?	5	
	e) What are the effects that troposphere and ionosphere have on electomagnetic signals? How can these effects be accounted for?	5	
	Total Marks:	100	