CANADIAN BOARD OF EXAMINERS FOR PROFESSIONAL SURVEYORS
ATLANTIC PROVINCES BOARD OF EXAMINERS FOR LAND SURVEYORS

SCHEDULE I / ITEM 4 — March 2008
REMOTE SENSING & APPLIED PHOTOGRAMMETRY

Note: This examination consists of 12 questions on 2 pages. — **Marks**

Time: 3 hours

Q. No		Value	Earned
1	Briefly explain the following terms together with the factors that control them for a given digital imaging system: a) Ground Sampling Distance (GSD), b) Radiometric resolution, and c) Spectral resolution.	9	
2	a) What are the utilized wave bands of the electromagnetic radiation in LiDAR and RADAR remote sensing systems? b) You have a digital B/W (8 bits/pixel) and a color (24 bits/pixel) image. Comment on the radiometric and spectral resolutions of these images (i.e., which one has higher radiometric and which one has higher spectral resolution)	2 3	
3	a) What are the main advantages of RADAR remote sensing systems? b) What are the necessary conditions for stereo-viewing in photogrammetric plotters? c) Do we need fiducial marks for metric digital cameras? Why?	2 3 3	
4	a) Briefly explain the following terms: 1. registration, 2. geo-coding, and 3. ortho-rectification b) What are the main characteristics/differences between supervised and unsupervised classification strategies? Tabulate your answer.	6 5	
5	The following is a 3x3 sub-image of a remote sensing scene: 115 94 64 06 67 116 100 77 76 Derive the smoothed value at the central pixel using the following filters: a) 3x3 moving average, b) 3x3 median filter, and c) the following smoothing mask $\frac{1}{16}\begin{bmatrix}1 & 1 & 1\\ 1 & 8 & 1\\ 1 & 1 & 1\end{bmatrix}$	6	

6	A vertical photo, with a scale of 1"=900', was taken over a flat area lying at an average elevation of 700' above the datum. The focal length is 8.50". A distance was taken from the bottom to the top of a tower and found to be 0.154" on the photo. The distance from the principal point to the image of the bottom of the tower is 2.845". What is the height of the tower?	10	
7	a) How are the image coordinate systems defined in: i. an analogue photograph acquired by an analogue metric camera, ii. a digital image scanned from an analogue photograph captured by an analogue metric camera, and iii. a digital image acquired by a digital metric camera? b) In photography, images have varying scale. Do you agree with this statement? Why? Use a sketch to support your answer. c) What are the main differences between an image and a map?	3 3 2	
8	A distance between 2 points on a map at a scale of 1:66,000 is 29.75 mm. The distance between the same points on a vertical photo taken with a 152.34 mm focal length camera is 40.19 mm. If both points lie at an elevation of 102 metres, compute the flying height above datum.	6	
9	a) In a photogrammetric procedure that exploits the collinearity model, list possible unknown parameters that can be involved. b) In a photogrammetric procedure that exploits the collinearity model, list possible observables that can be involved. Quote an example on how each quantity can be observed. c) What are the parameters that are solved for in the following photogrammetric problems: • Single photo resection, • Photogrammetric intersection, • Bundle adjustment, and • Bundle adjustment with self-calibration.	4 6 8	
10	What are the quantities measured by a GPS/INS system onboard an imaging platform? What are the main requirements for relating these measurements to the exterior orientation parameters of the exposure stations?	6	
11	You are given a stereo-pair with identified thirty-four tie points. List the balance between the observables and the unknown parameters in a bundle adjustment procedure to solve for the exterior orientation parameters as well as the ground coordinates of tie points. Can you estimate the involved unknown parameters? Why?	6	
12	a) What is the difference between establishing the exterior orientation and the relative orientation of a stereo-pair? b) Do we need ground control points to establish the relative orientation of a stereo-pair? Why? c) How would you evaluate the precision and the accuracy of the outcome from a photogrammetric bundle adjustment procedure?	2 2 3	
	Total Marks:	100	