

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

**SCHEDULE I / ITEM 4  
REMOTE SENSING & APPLIED PHOTOGRAMMETRY**

**October 2007**

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

**Marks**

**Q. No**

**Time: 3 hours**

**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, c) Spectral resolution, and d) Resolving power.	12	
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 spectral resolution?).	2 3	
3	a) Explain how you can use the spectral reflectance curve to identify the moisture content in vegetation and soil. b) What are the necessary conditions for stereo-viewing in photogrammetric plotters? c) Do we need Fiducial marks for metric digital cameras? Why?	3 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	A vertical photo, with a scale of 1"=850', was taken over a flat area lying at an average elevation of 650' above the datum. The focal length is 8.250". A distance was taken from the bottom to the top of a tower and found to be 0.152" on the photo. The distance from the principal point to the image of the top of the tower is 2.845". What is the height of the tower?	10	
6	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 of 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 with self-calibration?	3 6 6	

7	a) How are the image coordinate systems defined in an analogue photograph acquired by an analogue metric camera, a digital image scanned from analogue photograph acquired by an analogue metric camera, and a digital image acquired by a digital metric camera?	3										
	b) In photography, images have varying scale. Do you agree with this statement? Why? Use a sketch to support your answer.	3										
	c) What are the main differences between an image and a map?	2										
8	A distance between 2 points on a map at a scale of 1:64,000 is 28.75 mm. The distance between the same points on a vertical photo taken with a 152.44 mm focal length camera is 45.19 mm. If both points lie at an elevation of 82 metres, compute the flying height above datum.	6										
9	<p>The following is a 3x3 sub-image of a remote sensing scene:</p> <table style="margin-left: 40px;"> <tr><td>112</td><td>96</td><td>94</td></tr> <tr><td>86</td><td>57</td><td>106</td></tr> <tr><td>120</td><td>87</td><td>46</td></tr> </table> <p>Derive the smoothed value at the central pixel using the following filters:</p> <p>a) 3x3 moving average,  b) 3x3 median filter, and  c) the following smoothing mask</p> $\frac{1}{12} \begin{bmatrix} 1 & 1 & 1 \\ 1 & 4 & 1 \\ 1 & 1 & 1 \end{bmatrix}$	112	96	94	86	57	106	120	87	46	6	
112	96	94										
86	57	106										
120	87	46										
10	a) Classify and describe the types of points based on their role in a photogrammetric bundle adjustment procedure.	2										
	b) Classify and describe the types of points based on their appearance in photogrammetric images.	2										
11	You are given a stereo-pair with twenty-five identified 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 are the alternative methodologies for deriving the Exterior Orientation Parameters (EOP) of an image block?	2										
	b) Do we need ground control points to establish the relative orientation of a stereo-pair? Why?	2										
	c) How would you evaluate the precision and the accuracy of the outcome from a photogrammetric bundle adjustment procedure?	4										
<b>Total Marks:</b>		100										