

CANADIAN BOARD OF EXAMINERS FOR PROFESSIONAL SURVEYORS

C-7 REMOTE SENSING & PHOTOGRAMMETRY

October 2013

Although programmable calculators may be used, candidates must show all formulae used, the substitution of values into them, and any intermediate values to 2 more significant figures than warranted for the answer. Otherwise, full marks may not be awarded even though the answer is numerically correct.

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

<u>Q. No</u>		<u>Time: 3 hours</u>	<u>Marks</u>	
			<u>Value</u>	<u>Earned</u>
1.	a) 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).		3	
	b) 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	
2.	a) What are the advantages of RADAR remote sensing systems?		2	
	b) Briefly explain the following terms together with the factors that control them for a given digital imaging system: 1) Radiometric resolution, 2) Spectral resolution, 3) Geometric resolution, and 4) Temporal resolution.		8	
3.	a) What is the conceptual basis of the photogrammetric Collinearity equations?		2	
	b) What is the conceptual basis of the photogrammetric Coplanarity condition?		2	
	c) Give a brief definition of the following entities: Nadir point, principal point, principal distance, focal length, flying height, as well as optical axis of a lens system.		3	
4.	a) Briefly explain the following terms: 1) Registration, 2) Geo-coding, and 3) Ortho-rectification.		5	
	b) What are the main characteristics/differences between supervised and unsupervised classification strategies? Tabulate your answer.		5	
5.	a) What is meant by accuracy and precision?		2	
	b) What are the factors affecting the precision of the outcome from a photogrammetric bundle adjustment procedure?		2	
	c) What are the factors affecting the accuracy of the outcome from a photogrammetric bundle adjustment procedure?		2	
	d) How would you evaluate the precision and the accuracy of the outcome from a photogrammetric bundle adjustment procedure?		2	
6.	a) What is the maximum number of independent rotation angles needed to define a three-dimensional rotation matrix? Why?		2	
	b) What are the parameters that are solved for in the following photogrammetric problems: 1) Single photo resection, 2) Photogrammetric intersection, 3) Bundle adjustment, and 4) Bundle adjustment with self-calibration?		6	
7.	a) Explain how to use the spectral reflectance curve to identify the moisture content in vegetation and soil.		2	
	b) What are the main characteristics of a metric camera?		2	
	c) What are the key information items you expect to have in a camera calibration certificate for a metric analogue camera?		2	

8.	a) What are the alternative methodologies for deriving the Interior Orientation Parameters (IOP) of a photogrammetric camera?	2	
	b) Classify and describe the types of points based on their role in a photogrammetric bundle adjustment procedure.	2	
	c) Explain why active microwave systems are more suited for high resolution remote sensing when compared to passive microwave systems.	2	
	d) What is the EM radiation waveband used in LiDAR systems? Are LiDAR systems active or passive systems?	2	
9.	a) How many ground control points are needed to establish the relative orientation between the images of a stereo-pair? Why?	2	
	b) How many ground control points are needed to establish the absolute orientation of a 3D model? Why?	2	
	c) You are given a stereo-pair with identified thirty-five tie points. List the balance between the observables and 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?	4	
10.	An aerial camera with IMC is used to acquire photography at a flying height of 4500 m above ground. The focal length is 150.00 mm. The aircraft is flying at 320 km/hr and an exposure time of 1/300 second is used. How far across the focal plane must the film travel during the exposure in order to obtain an image with no image motion blurring?	6	
11.	a) List the required input and necessary steps for generating an orthophoto using differential rectification.	5	
	b) Describe the conceptual basis of image smoothing in the frequency domain.	3	
	c) Describe the conceptual basis of image sharpening (enhancement) in the frequency domain.	3	
12.	a) How are the image coordinate systems defined in: <ul style="list-style-type: none"> 1. a digital image scanned from a photograph captured by an analogue metric camera, and 2. a digital image acquired by a digital metric camera? 	3	
	b) Where in the image is there no atmospheric refraction effect? Why?	2	
	c) Where in the image is there no radial lens distortion? Why?	2	
	d) Where in the image is there no relief displacement? Why?	2	
Total Marks:		100	