CANADIAN BOARD OF EXAMINERS FOR PROFESSIONAL SURVEYORS

C-7 REMOTE SENSING & PHOTOGRAMMETRY March 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 twelve questions on two pages. **Marks**

Q. No Time: 3 hours Value Earned

Q. No		Value	Earned
1.	a) What is the conceptual basis of the photogrammetric Collinearity equations? b) What is the conceptual basis of the photogrammetric Coplanarity condition? 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.	2 2 3	
2.	a) What are the alternative methodologies for deriving the Interior Orientation Parameters (IOP) of a photogrammetric camera? b) Classify and describe the types of points based on their role in a photogrammetric bundle adjustment procedure. c) Explain why active microwave systems are more suited for high resolution remote sensing when compared to passive microwave systems. d) What is the EM radiation waveband used in LiDAR systems? Are they active or passive systems?	2 2 2 2	
3.	a) What is meant by accuracy and precision? b) What are the factors affecting the precision of the outcome from a photogrammetric bundle adjustment procedure? c) What are the factors affecting the accuracy of the outcome from a photogrammetric bundle adjustment procedure? d) How would you evaluate the precision and the accuracy of the outcome from a photogrammetric bundle adjustment procedure?	2 2 2 2	
4.	a) What are the advantages of RADAR remote sensing systems? 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.	2 8	
5.	a) Explain how to use the spectral reflectance curve to identify the moisture content in vegetation and soil. b) What are the main characteristics of a metric camera? a) What are the key information items you expect to have in a camera calibration certificate for a metric analogue camera?	2 2 2	
6.	a) What is the maximum number of independent rotation angles needed to define a three-dimensional rotation matrix? Why? 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?	2 6	
7.	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.	5 5	

8.	a) Aerial images have varying scale. Use a sketch to illustrate this fact. Sketch a special case where the scale in a photograph is considered constant. b) How many ground control points are needed to establish the relative orientation between the images of a stereo-pair? Why? c) How many ground control points are needed to establish the absolute orientation of a 3D model? Why?	2 2 2	
9.	a) Why is it important to reduce the aberration and distortion effects in aerial imagery? b) What is meant by the depth of field? What are the factors that affect the depth of field of a digital imaging system? c) Where in the image is there no radial lens distortion? Why?	2 4 2	
10.	a) What are the alternative methodologies for establishing the exterior orientation parameters of an imaging system? b) What is the objective of a bundle adjustment procedure involving an image block with ground control and tie points? c) How are the image coordinate systems defined in: 1) an analogue photograph acquired by an analogue metric camera, 2) a digital image scanned from an analogue photograph captured by an analogue metric camera, and 3) a digital image acquired by a digital metric camera?	4 3 3	
11.	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). 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?	3 6	
12.	a) You are given a stereo-pair with identified thirty-six 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? b) A distance between 2 points on a map at a scale of 1:66,000 is 29.85 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 meters, compute the flying height above datum.	5 5	
	Total Marks:	100	