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<table>
<tr><td colspan="2" align="center">**SCHEDULE I / ITEM 4**
REMOTE SENSING & APPLIED PHOTOGRAMMETRY</td><td align="right">**October 2008**</td></tr>
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Note: This examination consists of 13 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) Radiometric resolution, b) Spectral resolution, and c) Ground Sampling Distance (GSD).	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 (11 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) 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	The following is a 3x3 sub-image of a remote sensing scene:
	
	   65 74 74
	   66 37 86
	   120 87 97
	
	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
	
	$$\frac{1}{14}\begin{bmatrix} 1 & 1 & 1 \\ 1 & 6 & 1 \\ 1 & 1 & 1 \end{bmatrix}$$
		6	

6	A vertical photo, with a scale of 1"=950', was taken over a flat area lying at an average elevation of 600' above the datum. The focal length is 8.40". A distance was taken from the bottom to the top of a tower and found to be 0.164" on the photo. The distance from the principal point to the image of the bottom of the tower is 2.855". What is the height of the tower?	10	
7	An aerial camera with IMC is used to acquire photography at a flying height of 4200 m above ground. The focal length is 153.25 mm. The aircraft is flying at 275 km/hr and an exposure time of 1/250 second is used. How far across the focal plane must film travel during the exposure in order to obtain an image with no image motion blurring?	8	
8	A distance between 2 points on a map at a scale of 1:62,500 is 26.65 mm. The distance between the same points on a vertical photo taken with a 152.21 mm focal length camera is 46.19 mm. If both points lie at an elevation of 64 metres, compute the flying height above datum.	7	

9	a) What is the target function (i.e., objective) of a bundle adjustment procedure involving an image block with ground control and tie points?
	b) What are the parameters that are solved for in the following photogrammetric problems?
	    i. Single photo resection,
	    ii. Photogrammetric intersection,
	    iii. Bundle adjustment, and
	    iv. Bundle adjustment with self-calibration.
		2
		
		8	

10	a) What is meant by the exterior orientation of an imaging system? What are the involved parameters? b) What are the alternative methodologies for determining the exterior orientation parameters of an imaging system?	2 3	
11	You are given a stereo-pair with identified twenty-five 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	What are the quantities measured by a GPS/INS system onboard an aerial imaging platform? What are the main requirements for relating these measurements to the exterior orientation of the exposure stations?	6	
13	a) What are the factors affecting the precision of the outcome from a photogrammetric bundle adjustment procedure? b) What are the factors affecting the accuracy of the outcome from a photogrammetric bundle adjustment procedure? c) How would you evaluate the precision and the accuracy of the outcome from a photogrammetric bundle adjustment procedure?	3 2 3	
	Total Marks:	100	