

**ASSOCIATION OF CANADA LANDS SURVEYORS - BOARD OF EXAMINERS  
WESTERN CANADIAN BOARD OF EXAMINERS FOR LAND SURVEYORS  
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**SCHEDULE I / ITEM 4  
REMOTE SENSING & APPLIED PHOTOGRAMMETRY**

**March 2002**

**Note: This examination consists of 12 questions on 3 pages.**

**Marks**

**Q.No**

**Time: 3 hours**

**Value   Earned**

1	Briefly explain the following terms: a) Spectral Reflectance b) Spatial resolution c) SLAR d) Image enhancement e) Radiometric calibration f) Normalization of hyperspectral imagery	10	
2	a) What is a high-pass filter used for? b) What is a principal component analysis (PCA) used for? c) Explain the main differences between the TM sensor on the LANDSAT and the HRV sensor onboard the SPOT satellite.	10	
3	a) What are the major steps for the thematic classification of satellite imagery? b) What is the meaning of <i>training the classifier</i> ? c) What are the major differences between <i>supervised and unsupervised training of the classifiers</i> ? d) What is the main difference between parametric and nonparametric thematic classification of remote sensing data?	15	
4	a) Briefly explain the following terms: • Registration • Rectification • Geocoding • Orthorectification  b) Briefly describe the necessary steps and needed information for rectifying a SPOT image?	10	
5	What are the uses of: a) Spectral band ratios b) The tassled-cap transform	5	

6	<p>Briefly explain the following terms:</p> <ul style="list-style-type: none"> <li>• Principal point</li> <li>• Base-height ratio</li> <li>• Collinearity condition</li> <li>• Coplanarity condition</li> </ul>	10	
7	<p>The average elevation of a vertical photograph is 300 m above mean sea level and its scale is 1 mm = 15 m. How high above mean sea level was the aircraft flying when taking the photograph with a 210-mm focal length camera?</p>	5	
8	<p>A tower was identified on a "perfectly" vertical photograph and the distance between its top and its bottom was measured to be 14.3 mm and the distance from the photo center to the top of the tower was measured to be 85.6 mm. If the scale of the photograph is 1:10,000 and the focal length used to take this photograph is 152.4 mm, how tall is the tower?</p>	5	
9	<p>For the following rotation matrix (M):</p> $M = \begin{bmatrix} m_{11} & m_{12} & m_{13} \\ m_{21} & m_{22} & m_{23} \\ m_{31} & m_{32} & m_{33} \end{bmatrix}$ $= \begin{bmatrix} \cos f \cos k + \sin f \sin w \sin k & \cos w \sin k & -\sin f \cos k + \cos f \sin w \sin k \\ -\cos f \sin k + \sin f \sin w \cos k & \cos w \cos k & \sin f \sin k + \cos f \sin w \cos k \\ \sin f \cos w & -\sin w & \cos f \cos w \end{bmatrix}$ <p>What will be the form of the collinearity equations if the rotation angles <math>\omega</math> and <math>\phi</math> are very small angles (i.e. <math>&lt; 3^\circ</math>)?</p> $\left. \begin{aligned} x_a &= -f \cdot \frac{(m_{11}(X_A - X_c) + m_{12}(Y_A - Y_c) + m_{13}(Z_A - Z_c))}{(m_{31}(X_A - X_c) + m_{32}(Y_A - Y_c) + m_{33}(Z_A - Z_c))} \\ y_a &= -f \cdot \frac{(m_{21}(X_A - X_c) + m_{22}(Y_A - Y_c) + m_{23}(Z_A - Z_c))}{(m_{31}(X_A - X_c) + m_{32}(Y_A - Y_c) + m_{33}(Z_A - Z_c))} \end{aligned} \right\}$	5	
10	<p>What are the main differences between the 2-D affine and 2-D similarity transformations in terms of transformation parameters, quantities needed to estimate these parameters? Tabulate your answer and clearly indicate any assumptions.</p>	5	

11	The airbase of a stereo-pair of vertical photos is 1000 m, and the flying height above average ground is 2000 m. The camera has a focal length of 152.5 mm and a 23-cm format. What is the percent over lap? If the aircraft has a ground speed of 250 km/hr, what is the time between exposures along the flight line? Assume that the spacing between adjacent flight strips is 2400 m. What is the percent side lap?	10	
12	<p>a) What is the main goal of aerial-triangulation? Briefly describe the principle of the analytical aerial-triangulation using the Bundle method (i.e. what is the mathematical model being used, known and unknown quantities, etc.)</p> <p>b) Briefly describe the benefits of the Global Positioning System (GPS) to aerial-triangulation.</p>	10	
	<b>Total Marks:</b>	100	