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SCHEDULE I / ITEM 4   **March 2006**
REMOTE SENSING & APPLIED PHOTOGRAMMETRY

Note: This examination consists of 11 questions on 3 pages.   **Marks**

Q. No	Time: 3 hours	Value	Earned
1	Briefly explain the following terms: a) Spectral resolution b) Spatial resolution c) False-color composite d) Image enhancement e) Radiometric calibration	10	
2	For each of the following, choose one or more of the Landsat Thematic Mapper (TM) bands and explain why you think it or they should be used for the following feature discrimination: (a) Vegetation moisture content (b) Soil moisture content (c) Water body penetration	6	
3	(a) What is a low pass filter used for? (b) What is a principal component analysis (PCA) used for? (c) How can the normalized difference vegetation index (NDVI) be used to monitor the evolution of a growing crop from soil reflectance to vegetation reflectance?	3 3 4	
4	Briefly explain the following terms: (a) Registration (b) Rectification (c) Geocoding (d) Orthorectification	4	
5	a) What are the major steps for the thematic classification of satellite imagery? b) What is the meaning of *training the classifier*? c) What are the major differences between *supervised and unsupervised training of the classifiers*? d) What is the main difference between parametric and nonparametric thematic classification of remote sensing data?	5 2 4 3	

6	The following is a sample of a remote sensing image:
	
	    170 170 100
	
	    150 170 160
	
	    140 140 150
	
	What is the smoothed value at the central point using the following filters:
	a) Mean
	b) Median
	c) The following smoothing mask
	    1 1 1
	    1 2 1
	    1 1 1
		6	

7	A pushbroom (linear) digital camera has 2000 array of CCD elements at a pixel size of 10 μm x 10 μm. The nominal focal length of the camera is 25 mm. What is the field of view for this camera? What will be the pixel size on the ground if the flying height is 1000 m?	5	
8	(a) Draw a sketch of a vertical photograph over a variable terrain and demonstrate the formula used to compute the scale at a point P whose elevation above the datum is h. (b) For a camera with a focal length of 152.4 mm and the standard 23 cm format size, what height above ground is necessary for a vertical photograph to cover and area of 9 km^2? (c) Two points, a and b, are 6.35 cm apart on photo-1 and 8.32 cm on photo-2. Photo-2 was taken with a 152.4 mm focal length camera from 4260 m above MSL. If a is 820 m and b is 680 m above MSL, what is the average scale of photo-1?	5 5 5	
9	There are two ways to calculate the 3D coordinates out of stereo photos, namely relative orientation followed by absolute orientation, and space resection followed by space intersection. Compare these two methods in terms of: (a) the number of photos and parameters (being estimated) at each stage, (b) necessary information and number of ground control points needed to estimate these parameters. Tabulate your answer.	10	
10	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 of overlap between the stereo-pair? If the aircraft has a ground speed of 250 km/hr, what is the time between exposures of the stereo-pair along the flight line? Assume that the spacing between adjacent flight strips is 2400 m. What is the percent of side overlap?	10	

11	a) Nowadays, nearly all organizations involved in photogrammetric applications make use of aerial triangulation techniques. Bundle adjustment is one of the most commonly used techniques used in this regard. Explain clearly what is the mathematical model used in bundle adjustment aerial triangulation (i.e. what is the mathematical model being used, parameters being estimated, known and unknown quantities, etc.).	5	
	b) Briefly describe the benefits of the Global Positioning System (GPS) and Inertial Navigation Systems (INS) to aerial-triangulation.	5	
	Total Marks:	**100**	