

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 10 questions on 2 pages.

Marks

Q. No

Time: 3 hours

Value **Earned**

1.	a) Do we need Fiducial marks for metric digital cameras? Why? b) Briefly explain the following terms and how they are evaluated for a digital imaging system : 1) Geometric resolution, 2) Radiometric resolution, 3) Spectral resolution, and 3) Temporal resolution. c) Where in the image is there no Radial Lens Distortion ? Why?	2 4 2	
2.	The Figure below shows a 3D schematic diagram of a building and the associated ground coordinate system (in black – upper case XYZ) as well as the image/camera coordinate systems for two images (in grey – lower case xyz) that have been captured around the building. What will be the approximate values you would use for the rotation angles (ω , ϕ , and κ) for these images in a bundle adjustment procedure? Why? Would you expect any problem in the estimation of these rotation angles in the bundle adjustment procedure? Why?	10	
3.	What is the rotation matrix that relates the coordinate systems in the figure below – given that $r_{o_2a}^{x_1y_1x_1} = [-6 \ 8 \ 10]^T$ and $r_{o_2b}^{x_1y_1x_1} = [6 \ -8 \ 10]^T$? Briefly explain how you derived such a rotation matrix. Note: <ul style="list-style-type: none"> $r_{o_2a}^{x_1y_1x_1}$ denotes the components of the vector o_2a with regard to the $x_1y_1x_1$ coordinate system $r_{o_2b}^{x_1y_1x_1}$ denotes the components of the vector o_2b with regard to the $x_1y_1x_1$ coordinate system 	14	

9.	a) How is the perspective center defined for the lens assembly for a digital camera system? Would that be different for an analog camera?	3	
	b) Give a brief definition of the following entities: Nadir point, nodal points, principal point, principal distance, focal point, focal length, principal planes , as well as optical axis of a lens system.	3	
	c) What is the objective of establishing the interior orientation for a given camera? List the interior orientation parameters that we usually solve for. What are the alternative methodologies for deriving the interior orientation parameters of a photogrammetric camera? Which one would you prefer to adopt? Why?	4	
	d) What is the objective of establishing the exterior orientation for a given image? List the exterior orientation parameters that we usually solve for. What are the alternative methodologies for deriving the exterior orientation parameters of an imaging system? Which one would you prefer to adopt? Why?	4	
10.	a) What is the EM radiation waveband used in LiDAR remote sensing systems? Are they active or passive systems?	1	
	b) What are the advantages of RADAR remote sensing systems?	2	
	c) Could the following matrix be considered a rotation matrix? Why? $\begin{bmatrix} 0.7071 & -0.7071 & 0 \\ 0.7071 & 0.7071 & 0 \\ 0 & 0 & 1 \end{bmatrix}$	3	
Total Marks:		100	