Semester 2 2004 Final Examination

University of South Australia Imaging Technology N (GEOE 1010)

DIVISION OF INFORMATION TECHNOLOGY, ENGINEERING AND THE ENVIRONMENT

School of Natural and Built Environments

Subject Area:	GEOE	Catalogue Number:	1010

Imaging Technology N

Examination Day:	Wednesday	Examination Date:	24th November, 2004
Examination Time:	1800 hrs	Length of Exam:	2 hours + 10 minutes reading

Examination Venue:	Ridley Centre/Duncan Hall/Other :	Ras/RidCen

Student ID:		Student Name:	

Instructions to Candidates

Attempt ALL questions.

Marks for each question are shown thus **[marks]**.

Answer questions from Section A in a **separate book** to Section B

This is an open book examination.

Programmable calculators are permissible.

Please ensure the front of your answer books are completed with your name, student I.D. number, course and section of the examination.

SECTION A

Answer SECTION A in a separate book to SECTION B

QUESTION 1 [25 marks]

A project area of 12 km by 4 km is to be mapped stereoscopically using the normal pattern of parallel flight lines and overlapping near vertical photography. The photography is to have an average scale of 1:12,000 and will be flown with 60% forward overlap and 30% side overlap. The camera is a typical wide angle mapping camera with a format of 230 mm by 230 mm and a focal length of 152.92 mm. The ground elevations (above datum) vary throughout the project area such that the minimum and maximum elevations (above datum) are103 m and 197 m respectively. To ensure complete coverage of the project area the stereoscopic coverage should extend beyond the project area by a margin of at least 10% of the coverage of a single photograph at average scale.

i.) Briefly describe the distortions that will exist in this photography and show by way of annotated diagrams how the major distortions will make it difficult to join together neighbouring images to form a mosaic.

ii.) Calculate the maximum and minimum photographic scales within the project area.

iii.) Determine the ground dimensions of the coverage of a typical “neat” stereo-model based on the average scale.

iv.) Determine the total number of photographs required to achieve this stereoscopic mapping coverage by calculating the required number of flight lines and photographs along each flight line.

v.) Prepare TWO annotated sketches; ONE of the “flight plan” showing the flight lines and stating the required flying height above ground level; and ANOTHER showing the arrangement of overlap including at least one stereo neat model.

Note that your sketches do not need to be to scale.

QUESTION 2 [25 marks]

a) Discuss "geo-referencing" of aerial photography being sure to include comments on the following

- the aim of the process
- the mathematical models we might use for the geometric transformation
- the control point requirements
- the actual operational procedures involved in such an operation
- the considerations which enable us to assess the success of the process.

[15 marks]

b) Discuss the use of the collinearity equations to produce a "virtual" photograph of an object such as a building. In your answer be sure to include comments on the object space coordinate system and the exterior orientation elements of the "camera".

[10 marks]

SECTION B

Answer SECTION B in a separate book to SECTION A

QUESTION 3 [17 marks]

Using examples of space and air borne sensors, discuss how image size (measured in bytes) is related to the resolution(s) of an image.

QUESTION 4 [15 marks]

a) Explain how piece-wise linear contrast stretching can be used to improve the way in which an image is displayed on a computer screen.

[8 marks]

b) What is ***histogram matching*** and how is it used when multiple images are joined together to create an image mosaic?

[7 marks]

QUESTION 5 [18 marks – 3 marks per answer]

Select the most appropriate answer of the four supplied

5.1 Spectral reflectance is:
- a) The division of the electromagnetic spectrum into different zones
- b) The ratio of reflected energy to incident energy
- c) The spectral bandwidth of a sensor
- d) The dispersion of incident electromagnetic energy by a diffraction grating

5.2 Rank the following sensors in terms of their spectral resolution, starting at the lowest and finishing with the highest:
- a) MODIS
- b) Hyperion
- c) Landsat ETM+
- d) Spot 5 MS

5.3 Pseudo colorization is:
- a) The creation of a false colour display via the use of three non-visible image bands
- b) The creation of a false colour display by manipulation of the three colour lookup tables for three different input image bands
- c) The inversion of the Colour Lookup Tables for a three banded image display
- d) The modification of the Colour Lookup Tables for a single image band

5.4 Plank's law describes the relationship between:
- a) Spectral radiant exitance, temperature and wavelength
- b) Radiant exitance and temperature
- c) Maximum wavelength and temperature
- d) Emissivity and spectral radiant exitance.

5.5 The detectivity of a sensor affects:
- a) The number of spectral bands a sensor can use
- b) The radiometric resolution of the sensor
- c) The swath width of the sensor.
- d) The revisit time of the sensor.

5.6 Lossy compression of image data:
- a) Enables the original data to be recovered from the compressed image
- b) Permits a user to more easily see detail in the image
- c) Causes certain parts of the image data to be removed from the image
- d) Requires the compression algorithm to be fully stated so the original image can be recovered.