University of South Australia

2006 End of Year Examination

School	NBE	Subject Area & Catalogue number	GEOE 1010
Course Name		Imaging Technology N	

Instructions to Candidates:

Attempt ALL questions.

Marks for each question are shown thus [marks].

Question 5 is 'multi-choice' and is on a separate detachable sheet on which you can provide your answers. Please carefully detach the sheet and enter you name and student ID number in the spaces provided and then insert the completed sheet inside the front cover of your examination answer book.

Also, please ensure the front of your answer books are completed with your name, student ID number and course.

Permitted Materials

This is an open book examination.

Programmable calculators are permissible.

Conduct in examinations

Examination procedures

- Students will be allowed a designated reading time prior to the published starting time for the examination.
- No writing in the examination booklets is permitted during the reading time. However, during this period students may complete attendance slips, make notes on loose-leaf paper provided, and fill in details required on the front cover of examination booklets.
- Every student shall fill in the attendance slip where provided. Students will display their student identification card, or an alternative form of photographic identification acceptable to the invigilator. Students who are unable to provide such proof of identity will be permitted to proceed with the examination but will be required subsequently to provide proof of identity. Students holding an ENTEXT card or Access Plan should display the ENTEXT card or Access Plan in addition to their identification card.
- No student shall commence writing answers until authorised by the chief invigilator. All students shall cease writing when instructed by the chief invigilator. At the conclusion of the examination all students shall remain seated until all examination booklets have been collected.
- No student will be permitted to enter the examination room more than 30 minutes after the published starting time.
- No student shall leave the examination room before 30 minutes have elapsed from the published starting time or during the last 30 minutes of any examination.
- After the published starting time a student may leave the examination room temporarily only with the consent of the chief invigilator, and shall be adequately supervised during this period.
- Any student who wishes to leave the examination room, except temporarily, must hand to the invigilator all examination booklets. The invigilator must endorse the booklets as correctly identifying the student.
- A student must not take into the examination room any books, dictionaries, calculators, mobile telephones, personal digital assistants, notes, or other documents, devices or personal items except those specified in the Course Information Booklet (see clause 5.4 c) and authorised by the examiner.
- During an examination no student shall speak to or communicate with any other student.
- During the examination no student will give to or receive from any other person any form of assistance, academic or otherwise.
- No student shall bring into, or remove from, an examination room any examination answer booklet or examination attendance slip.
- Where a student is disrupting the examination, the student may be summarily dismissed from the examination room at the discretion of the chief invigilator.
- Exceptions to the above procedures may be made only with the prior approval of the Director: Student and Academic Services.

Breaches of examination procedures

- Any student who breaches these examination procedures will be guilty of misconduct.
- If misconduct is detected, the invigilator will inform the student at the completion of the examination that the misconduct will be reported.

- The invigilator will document the incident using the Incident Report proforma, and will provide a copy of this report to the Head of School/Dean: Whyalla responsible for the course, within 5 working days of the incident. The Head of School/Dean: Whyalla will investigate the incident.
- Where the Head of School/Dean: Whyalla concludes that no misconduct was involved, no further action will be taken and no record of the investigation will be placed in the student's file.
- Where the Head of School/Dean: Whyalla concludes that the action of the student was an example of inadvertent misconduct, the student will be counselled by the Head of School/Dean: Whyalla, and a note to that effect will be placed in the student's file.
- Where the Head of School/Dean: Whyalla concludes that the action of the student constitutes deliberate misconduct, the Head of School/Dean: Whyalla may determine that the appropriate penalty is the first penalty specified in clause 9.28 below.
  If the Head of School/Dean: Whyalla makes such determination and if the student admits to misconduct and agrees to imposition of the first penalty specified in clause 9.28 then:

a the Head of School/Dean: Whyalla will prepare a written statement using the proforma (Investigation Report - PDF staff access only) setting out the findings on the facts, referring to the evidence or other material on which the findings were based, noting the student's admission of misconduct and setting out the penalty imposed, the reasons for its imposition, and the student's agreement to its imposition.
b the Head of School/Dean: Whyalla will, within 10 working days, provide a copy of the Investigation Report to the student, the relevant Pro Vice Chancellor, the Head of School/Dean: Whyalla, the Division Manager and the Director: Student and Academic Services; and
c a copy of the Investigation Report will be retained in the student's file and the Head of School/Dean: Whyalla will issue a reprimand to the student.

- Where the Head of School**/**Dean: Whyalla concludes that the case involves deliberate misconduct and either:

a the student does not admit to misconduct; or
b the student does not agree to accept the first penalty prescribed in clause 9.28 below; or
c the Head of School**/**Dean: Whyalla or the student believes that the first penalty prescribed in clause 9.28 below is not appropriate; then the Head of School**/**Dean: Whyalla shall establish a formal inquiry.

QUESTION 1 [24 marks]

a) Briefly describe the two principal distortions that typically exist in aerial photography. *[Include sketches in your answer]* [8 marks]

b) Explain how we can use the 'relief displacement formula' to estimate the likely error associated with a geo-referenced image product. [8 marks]

c) Briefly discuss the use of *residuals* and *root mean square errors* to evaluate the success of photogrammetric operations. [8 marks]

QUESTION 2 [30 marks]

A project area measuring 15km by 15km is to be mapped stereoscopically using the normal pattern of parallel flight lines and overlapping near vertical photography. The photography will be obtained from an altitude of 3050m above datum using a wide angle camera (focal length = 153.13mm and format = 230mm by 230mm) and flown with 60% forward overlap and 25% side overlap. The ground elevations vary throughout the project area with the minimum and maximum terrain elevation above datum being 125m and 205m respectively.

a) Determine the average photographic scale within the project. [6 marks]

b) Calculate the ground dimensions and area of coverage of a typical "neat" stereo-model? [6 marks]

c) What are the photo-base and strip interval for this photography? [6 marks]

d) Calculate the maximum amount of relief displacement that could be expected at the extremity of any neat stereo-model. [6 marks]

e) Calculate the number of photographs required to cover the project area stereoscopically. [6 marks]

QUESTION 3 [15 marks]

a) Explain how histogram equalization can be used to improve the way in which an image is displayed on a computer screen. [6 marks]

b) What are the disadvantages of histogram equalization? [4 marks]

c) What is histogram matching and how is it used when multiple images are joined together to create an image mosaic? [5 marks]

QUESTION 4 [7 marks]

Consider that you are working with imagery from a new satellite borne sensor. Each image has 4 spectral bands, each of which are quantised at 8 bits. There are 7,500 lines in every scene and each line has 12,500 pixels. The images files do not contain any header information.

Calculate the storage size of each image file in Mb. [7 marks]

DETACH THIS SHEET AND ENTER YOUR NAME AND ID NUMBER IN THE SPACES PROVIDED THEN INSERT IT IN YOUR EXAM BOOK			
STUDENT NAME		ID NUMBER	

QUESTION 5 [24 marks – 3 marks per answer]

Select the best answer for each question and indicate your choice by CIRCLING the appropriate letter.

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 Wavelet compression is based upon:
- a) Mathematical modelling of the spectral structure of an image
- b) Mathematical averaging of the DN values of blocks of pixels
- c) Fitting of piece-wise polynomial equations to image brightness values
- d) Mathematical modelling of the spatial frequency of an image

5.3 JPEG compression compresses image:
- a) Radiometric resolution
- b) Spatial resolution
- c) Spectral resolution
- d) Temporal resolution

5.4 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

5.5 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.

5.6 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.

5.7 Non-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) Uses the spatial frequency of the image to store image data..

5.8 ECW is an image file format that:
- a) Is lossy and uses wavelet transforms to compress image data
- b) Is non-lossy and uses wavelet transforms to compress image data
- c) Is lossy and uses a compression of image colours to achieve compression
- d) Is non- lossy, fits polynomial functions to rows and columns, and stores the coefficients and the power of the functions