UNIVERSITY OF SOUTH AUSTRALIA

DIVISION OF INFORMATION TECHNOLOGY, ENGINEERING AND THE ENVIRONMENT

School of Geoinformatics, Planning and Building

Semester 2, 2002

Imaging Technology N : GEOE 1010 / 10221

Time Allowed **:** 2 hours + 10 minutes reading time

General Instructions to Candidates

Attempt ALL questions.

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

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

This is an open book examination.

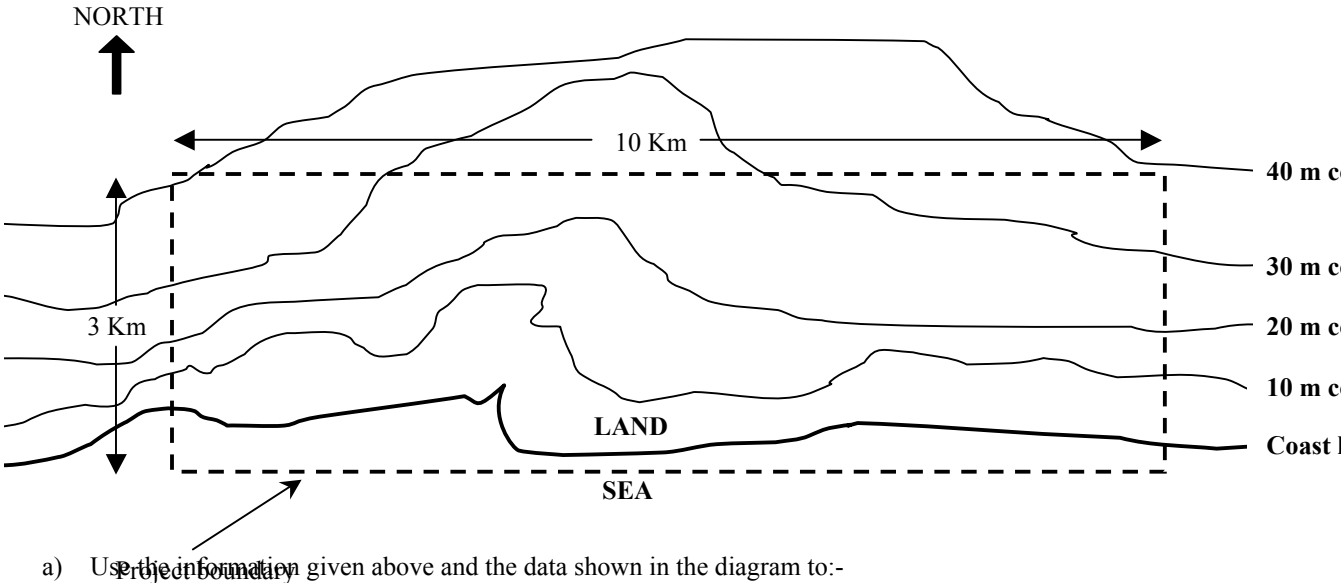
Programmable calculators are permissible.

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

SECTION A

QUESTION 1 [25 Marks]

Standard aerial photography is flown of a coastal project area measuring 10Km x 3Km which is shown in the diagram below [*note that the diagram is not to scale*]. The photography is at an average scale of 1:6,000 and is obtained from east/west flight lines which have 60% forward overlap between successive photographs and 30% sidelap between strips. The camera used has a calibrated focal length of 152.85mm and an image format measuring 230mm x 230mm.



a) Use the information given above and the data shown in the diagram to:-

i) determine the flying height of the camera/aircraft
ii) determine the maximum and minimum scales of the photography
iii) compute the dimensions of the ground coverage of a single photograph at each of the average, maximum and minimum scales
iv) compute the dimensions of a typical neat stereo-model based on the average scale
v) determine the total number of photographs required to obtain complete stereo coverage of the project area including the normal factor of safety (ie. 10% of a single photo coverage).

[15 marks]

b) Consider that the photography described above is to be used for the preparation of a photo-mosaic of the project area and that for the sake of economy only every second photograph along each strip is to be used.

i) determine the dimensions of the ground coverage of a typical mosaic neat model based on the average scale
ii) given that a tall building (32m in height) might exist anywhere within the project area compute the maximum amount that such a building would appear to "lean over" on a photograph within a typical neat model area.

[10 marks]

QUESTION 2 [25 Marks]

a) Often when we want to use aerial photography for basic mapping purposes we "geo-reference" the imagery rather than perform a more sophisticated rectification. Briefly discuss this process in general being sure to include comment on the following

- the mathematical models we might use
- the steps involved in such an operation
- the manner in which we may assess the success of the process.

[12 marks]

b) Show (using diagrams and a few comments) how we might use the collinearity equations to compute a "virtual photograph" of an object (eg. a car) provided that we have a complete three dimensional model of the object and all the required information relating to the "virtual" camera.

[7 marks]

c) Briefly discuss ANY <u>ONE</u> of the following topics

- the use of stereo-viewing in image data extraction
- the use of resampling and interpolation in image product generation
- the precision scanning of film based images to obtain digital images

[6 marks]

Section B questions on next page.

Remember to answer Section B questions in a separate book to Section A questions.

SECTION B

QUESTION 3 [25 marks]

a) Using examples from sensors that you are familiar with, explain the following resolutions:
Spectral
Spatial
Temporal
Radiometric
[12 marks]

b) What sections of the electromagnetic spectrum are most useful for remote sensing and why? Which areas are utilised by active sensors and which are utilised by passive sensors? Why?

[4 marks]

c) Image Data is stored (uncompressed) in three formats. Explain these formats and the benefits of each.
[6 marks]

d) Explain a method of image compression, and the circumstances in which you would utilise this compression. Include advantages and disadvantages of compression. [3 marks]

QUESTION 4 [25 marks]

You have been asked to monitor the growth phase of a winter wheat crop (seeding to reaping is 5 months). You need to rectify and classify scenes from the available satellite imagery whenever possible throughout this period. Satellite imagery is available with a spatial resolution of 25m, consisting of 12 multispectral, one panchromatic and a thermal band of information. This sensor has unsigned 16 bit radiometric resolution and a temporal resolution of 8 days (no off nadir viewing is possible). Scene size is 100km x 100km's. (Round up in all cases).

a) What is the size of an individual scene (in MB)? [2 marks]
b) What storage capacity is required for the project if only 30% of possible acquisitions are cloud free?
[4 marks]
c) Which method of classification would you apply to the imagery and why? [4 marks]
d) What Geometric and Radiometric considerations are there? [3 marks]
e) Assuming a 20:1 compression ratio, what would the disk space requirement be for your final products?
[3 marks]
f) Explain (with the aid of diagrams) why you would contrast stretch the image before visual interpretation?
[6 marks]
g) Explain storage options for the final product. How would you choose to store the final product?

[3 marks]