

**The University of Melbourne**

**Semester 2 Assessment 2006**

**Department:** Geomatics  
**Subject Number:** 451-337  
**Subject Title:** Satellite Positioning and Geodesy  
**Reading Time :** 15 minutes  
**Writing Time :** 3 hours

**This paper has 3 pages including this cover page**

**Authorised Materials:**

Electronic calculators are permitted

**Instructions to Invigilators:**

Students require script books

**Instructions to Students:**

All five (5) questions are to be attempted  
All answers are to be written in the script books provided  
All questions carry equal marks

**Baillieu Library:**

Paper is to be archived in the Baillieu Library

1. (a) Discuss the distinctions between coordinate conversion and coordinate transformation. (5 marks)

(b) Dilution of Precision (DOP) values are used to indicate the instantaneous quality of GPS positioning based on the C/A code. Describe how the various DOP factors are computed and how they can be interpreted. (5 marks)

(c) Describe the problem of GPS antenna phase centre offset and variation and elaborate on how this error can be modelled and/or eliminated. (10 marks)

2. The observation equation for the GPS carrier phase observable (in units of metres) is given below. Derive this equation, giving a full description of each term and illustrating the derivation with diagrams where appropriate.

$$\Phi = c(dt - dT) + R - d_{\text{ion}} + d_{\text{trop}} - \lambda N(t_0) + n$$

(20 marks)

3. (a) Give a definition for the *geoid* and explain its role in geodesy as a reference surface for height. (5 marks)

(b) Explain the importance of accounting for the geoid when carrying out precise GPS positioning. (5 marks)

(c) Define the term *integer ambiguity*. What is *ambiguity resolution* and why is it important in GPS data processing? (5 marks)

(d) When it comes to dealing with GPS errors, what is meant by the term *spatial correlation*? What benefit does spatial correlation bring to the problem of GPS error mitigation? Provide a list of the spatially correlated errors that affect GPS positioning and a second list of those errors which are not spatially correlated? (5 marks)

4. (a) Provide details of the GPS signal structure including codes, carriers and satellite message. Describe the use of each component of the signal in terms of positioning applications. (10 marks)
- (b) Describe the function and operation of the GPS Control Segment. (10 marks)
5. (a) Explain why *measurement differencing* is used to aid the processing of GPS carrier phase data. Include a discussion of the advantages and disadvantages of measurement differencing. Develop the double difference carrier phase equation to demonstrate the key points of your explanation. (10 marks)
- (b) As an employee of a large surveying company, you have been given four GPS receivers and have been told that you should compute six baselines from every observation session. Obviously the issue of *trivial baselines* has never been explained to your employer. You must prepare a written report explaining the concept of trivial baselines and justifying why they should not be used in the adjustment of GPS networks. (10 marks)