

## 2005 Paper 7 Question 16

### Additional Topics

- (a) The Global Positioning System (GPS) is often described in terms of three Segments: Space, Control and User. Give brief descriptions of the components involved in each of these segments, and how they work together. [5 marks]
- (b) Explain what is meant by the term *pseudo-range*. If a single pseudo-range is measured from a pair of satellites well above the horizon, the possible receiver positions will all lie close to an imaginary surface. Illustrate with a simple (2-D) diagram what a slice through this surface in the plane of the receiver and the satellites might look like. Show how errors in the pseudo-range will expand the possible receiver positions. Explain why this geometry might lead to large errors if a position is calculated from four satellites well above the horizon. [6 marks]
- (c) Differential GPS is a technique for removing some of the errors inherent in the GPS. Explain how the errors might arise, how they are measured at a single base station, and how they can be distributed to users of the system. [5 marks]
- (d) After Differential GPS has been used to remove errors, explain what error sources might be left, and how, if at all, they could be reduced. [4 marks]