

National Exams May 2016

04-Geom-B2
Satellite Navigation

3 Hours duration

NOTES:

1. If doubt exists as to the interpretation of any question, the candidate is urged to submit with the answer paper, a clear statement of any assumptions made.
2. This is a CLOSED BOOK EXAM.
3. Candidate may use one of the calculators, the Casio or Sharp non-programmable models.
4. Each question is specified for its maximum marks in bracket.
5. Clarity and organization of the answer are important

15 Marks QUESTION ONE

- 1). Name the fully operational GNSSs and also the other GNSSs being developed worldwide (5 Marks).
- 2). What are the respective tasks of the three segments of the Global Positioning System? (10 Marks)

15 Marks QUESTION TWO

Analytically describe how to calculate the DOPs in single point positioning based on L1 C/A pseudorange measurements. (Include the measurement model, the clear definition of the individual DOPs, and an explanation of your notation in your answer).

10 Marks QUESTION THREE

Conceptually summarize the different GPS positioning modes inclusive of static, kinematic, single point and relative positioning methods. (Use diagrams, figures, etc. where helpful.)

15 Marks QUESTION FOUR

Describe how to establish a control network for an engineering project through static GNSS baseline observations in terms of network design, baseline observations, baseline processing, and baseline network adjustment.

10 Marks QUESTION FIVE

Describe the cycle slip phenomenon with GPS carrier phase measurements and its consequence in GPS data processing.

15 Marks QUESTION SIX

Mathematically construct the double-differenced GPS measurements from (L1 C/A-code) pseudoranges $\rho_A^j(t)$, $\rho_B^j(t)$, $\rho_A^k(t)$, $\rho_B^k(t)$ between stations A and B , and between satellites j and k at an instant t , and briefly discuss how the systematic and random errors in GPS measurements are reduced, cancelled or increased in the double-differencing process. (Include the measurement equations, the error terms and the explanation of your notation in your answer).

CHOOSE ONE OUT OF QUESTIONS SEVEN AND EIGHT

20 Marks QUESTION SEVEN

Conceptually describe the PPP technique and the Network RTK technique, respectively.

20 Marks QUESTION EIGHT

Describe three different integration architectures (loosely-coupled, tightly-coupled and deeply-coupled) that are used in the GNSS-aided inertial integrated navigation in terms of the data processing. Include the sensors used and their characteristics for each integration architecture in your answer.

Question No	Marks	Comment
1	15	mandatory
2	15	mandatory
3	10	mandatory
4	15	mandatory
5	10	mandatory
6	15	mandatory
7	20	Select one out of 7 & 8
8	20	
sum	100	