KATHMANDU UNIVERSITY
End Semester Examination
February/March, 2018

Marks Scored:

Level : B.E.
Year : IV

Course : GEOM 417
Semester: I

Examination Roll No.: Time: 30 mins. F.M. : 10

Registration No.: Date MAR 15 2018

SECTION "A"
[20 Q.×0.5=10 marks]

1. The fundamental frequency of GNSS observations is:
   a. 1.023 MHz b. 10.23 MHz c. 102.3 MHz d. 1023 MHz

2. Which of the following is frequency independent source of error?
   a. Phase centre variation c. Phase wind-up
   b. Troposphere d. Ionosphere

3. The Kalman Gain is used to:
   a. maximize the gain.
   b. minimise the difference between observed and modelled values
   c. minimise the observation
   d. minimize the noise

4. The weightage of measurements is inherited in .....
   a. Confusion matrix c. Innovation Matrix
   b. Covariance matrix d. Kalman Gain

5. The distance dependent terms in DD measurements are:
   a. Eliminated b. reduced c. neglected d. omitted

6. The time required for GPS satellites to complete a cycle around the earth is known as .....
   a. One sidereal day c. 12 hours
   b. Half Sidereal day d. None of the above.

7. Multipath for satellites from GLONASS exhibit .....pattern over days.
   a. strange b. time-shifted c. non-uniform d. repeated

8. A white noise means .....
   a. zero mean, zero standard deviation c. zero mean, certain standard deviation
   b. certain mean and standard deviation d. certain mean and variance.

9. Which one of the following is the odd?
   a. White noise c. Process noise
   b. Random noise d. Thermal noise

10. The line of sight vector in GNSS observation is directed from:
    a. Receiver to receiver c. receiver to satellite
    b. Satellite to receiver d. satellite to satellite

11. In satellite-to-satellite single differencing, ... are eliminated.
    a. Receiver dependent errors
    b. Receiver and satellite dependent errors
    c. satellite dependent errors
    d. noises

12. The precise position of satellite at the time of signal broadcast is obtained from:
    a. catalogue b. almanac c. ephemeris d. code

13. The noise in triple differencing is..... times the original measurement.
    a. Equal to b. two c. three d. four

14. The multipath effect can be:
    a. eliminated by single differencing
    b. eliminated by triple differencing
    c. eliminated by double differencing
    d. cannot be eliminated.

15. Cycle slips can be of half integers due to:
    a. multipath effect
    b. integer ambiguity
    c. missed satellite message
    d. satellite position error

16. For mid-latitude regions, the ionospheric activity is maximum around:
    a. Noon b. 1 pm c. 2 pm d. 3 pm

17. According to US Standard Atmosphere model, the tropospheric zenith delay is about:
    a. 2.37 mm b. 2.37 cm c. 2.37 m d. 37 cm

18. The slant tropospheric delay at 30° elevation is about ..... greater than that at zenith.
    a. 2 times b. 3 times c. 4 times d. 5 times

19. The electron density is maximum at the ..... in ionosphere.
    a. D-layer b. E-layer c. F1-layer d. F2-layer

20. For short baseline with significant height differences:
    a. troposphere and ionosphere delays are negligible.
    b. only ionospheric delay is negligible.
    c. only tropospheric delay is negligible.
    d. multipath effect is eliminated.

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F.M. : 50

SECTION "B"
(Short answer questions)

Answer *ANY EIGHT* questions. **Question no. 9 is COMPULSORY.**

1. Consider the single frequency GNSS observation, Express the observation equation for carrier phase observation. Mention the sources of errors included. [2+2=4]

2. Consider the multi-frequency GNSS observations, Express the observation equation for pseudorange observation. Mention the sources of errors included. [2+2=4]

3. Discuss the factors effecting the ionospheric delay. [4]

4. Can a Continuously Operating Reference Station be used to obtain information for Seismological study? Justify with appropriate example. [4]

5. What is Kalman Filter? Discuss its potential application in the field of surveying and mapping. [2+2=4]

6. Describe error budget and mapping function. [2+2=4]

7. Why is integer ambiguity an issue of challenge for accuracy of carrier phase measurements? Express the mathematical relation that provides the least squares of solution of integer ambiguity. [2+2=4]

8. Describe multipath effect. Explain how a sidereal filtering can be applied in multipath estimation. [2+2=4]

9. Write short notes on: [2+2+2=6]
   a. Single Differencing of GNSS measurements
   b. Double Differencing of GNSS measurements
   c. Triple Differencing of GNSS measurements

SECTION "C"
(Long answer questions)
[2 Q.×8=16 marks]

Answer *ANY TWO* questions.

10. Consider a multi-frequency GNSS observation for GPS and Galileo over a short baseline that has effect of troposphere, multipath effect and the remaining sources of errors accumulated as noise. Express the complete observation model in matrix-vector notation. [8]

11. Discuss the various techniques of ionospheric delay estimation for precise positioning using GNSS technology. [8]

12. What is the purpose of linear combination of multi-GNSS observations of multiple frequencies? Discuss geometry-free, ionosphere-free and Melbourne-Wübbenna linear combinations. [2+2+2+2 =8]