GNSS Bank Question

Q 1:

1. Which of the GPS and GNSS receiver has a higher cost? Justify.
2. One of the Galileo's levels of service can reach meter level of accuracy, what is this? Specify the frequencies that provide such service.
3. State the role of control segment in the satellite positioning.
4. With the aid graphically, explain an ideal condition of DOP.

Q 2:

1. The elevation of stations A and B are 531.728 m are 482.014 m respectively. The undulations for stations are -13.016 m and 11.533 respectively. Calculate the ellipsoidal height of both points with the graphical representation.
2. The ITRF2008 of ISER has been changed to ITRF2014, Justify. Give your recommendation for necessity of updating HARN points.
3. State the parameters required for conversion from Satellite to geocentric reference system.
4. Compute the geocentric coordinates of a point whose latitude, longitude, ellipsoidal height are 36°18'14.81641"N, 316°51'02.13102"W, 229.089 respectively? Consider a=6378137.0 and b=6356752.3.

Q 3:

1. With the aid graphically, explain the phase delay measurement.
2. Referred to the satellite and receiver time frame, how much would the synchronism error?
3. How the time displacement can be computed in the receiver?

Q 4

5. Compare between NAVSTAR and GLONASS.
6. Describe navigation message, and then state the frequencies that can carry, calculate the wavelength of their frequencies.
7. Compute the uncertainty of the coordinates of points A and B, whose coordinates observed by C/A code and P-code receivers respectively. Consider ideal condition of GDOP and PDOP

Q 5

5. With the aid graphically explain why the geoid cannot be the same as the mean sea level? Enumerate the methods for finding undulation. Which one is more practical?
6. Geocentric coordinates are not preferred by geomatics engineers, justify.
7. With a graphical representation explain the Satellite reference coordinate system.

Q 6

4. Prove that tracking four satellites are necessary for geodetic coordinate determination using ground station receiver.
5. With the aid graphically compare between pseudo- range and carrier phase measurement in terms of single and dual frequency receiver.
6. Explain how the initial cycle ambiguity plays a role in satellite positioning?

Q 7

1. Differentiate between ionospheric and atmospheric errors.
2. Satellite clock error causes several meters of positional error, justify.
3. With the aid graphically explain multipath error.

Q 8

Two ground distances of 103.763m and 53.767m are measured from A to B and A to C, respectively. Consider Ellipsoidal height is 428.001 m and scale factor as 0.9996946073.

1. Calculate with sketch the ellipsoidal distance and grid factor.
2. How much will change the grid distance? Why?

Q 9

8. What did we mean by GPS and GNSS? Differentiate between them in terms of number and altitude of satellites.
9. Calculate the wave length of each L1, L2, E1, and E5.
10. With the aid graphically explain the ideal condition of DOP.

Q 10

8. Calculate the elevation of point A and B whose heights above the ellipsoid are 489.725 m and 532.269 m respectively. The geoid separation of A and B are 17.571 m (geoid under ellipsoid) and 8.423 m (geoid above ellipsoid) respectively.
9. Justify that continuously operating reference stations should be updated periodically.
10. State the parameters required to convert from satellite reference system to geocentric system. Where they will be available?

Q 11

7. How a 3D coordinate can be computed using pseudo- range measurement? What will be the expected accuracy?
8. Define the cycle slip, where will be occur? How can be detected?
9. State the similarities between carrier phase measurement and EDM.

Q 12

4. State the impact of Einstein's relativity theories on satellite positioning.
5. With the aid graphically explain multipath error.
6. How can gas molecules effects on the satellite positioning?

Q 13

Two ground distances of 103.663m and 53.667m are measured on the equator from A to B and A to C, respectively. Calculate with sketch the ellipsoidal distance and grid factor. Consider Ellipsoidal height is 428.101 m.

Q 14

1. What are factors that selection of satellite positioning techniques depends on?
2. Define RINEX.
3. Compare between single and dual differencing.

Q 15

The geodetic distance from CP26 to ISER and ER7 (HARN) are 90 km and 34 respectively. ISER is in operation. Prepare an observation plan for establishing a network of control points with millimeter level of accuracy using dual frequency GNSS receiver in 16th April 2022. Consider the following data:

PID	Easting (m)	Northing (m)	Ellip.Height (m)
CP02	487548.00	4012359.00	598.00
CP22	511838.00	4005919.00	636.00
CP29	525671.00	3991112.00	829.00
CP15	473887.00	4016660.00	663.00
CP26	499377.00	4007641.00	513.00
CP12	480980.00	4009818.00	570.00
CP05	489439.00	4009096.00	540.00
CP06	491731.00	4011884.00	569.00

Q 16

11. With the aid graphically explain how the integer ambiguity can be eliminated.
12. State the functionality of the WRS, WMS, and GUS.
13. Explain the IMU? State the functionality of each their components.
14. Specify the coverage of the WAAS, EGNOS, and MTSAT

Q 17

In order to establish a number of ground control points (GCPs) for aerial surveying, a static observation technique are proposed to achieve millimeter level of accuracy for data shown in table below. Prepare an observation plan for all baseline; showings start and end time for each baselines. Consider CP4 as a site reference point, figure 1.

PID	Easting (m)	Northing (m)	Ellip.Height (m)	Receiver type
ISER	411035.0	4002122.0	404.0	dual frequency
ZAXO	293029.0	4110016.0	544.0	dual frequency
CP1	360357.0	4066812.0	433.0	dual frequency
CP2	359827.0	4069516.0	513.0	dual frequency
CP3	359665.0	4071120.0	711.0	single frequency
CP4	360115.0	4076442.0	629.0	dual frequency
CP5	358595.0	4078407.0	789.0	single frequency
CP6	357436.0	4080546.0	955.0	single frequency
CP7	359109.0	4084321.0	1529.0	dual frequency

Q 18

Real Time Kinematic technique is proposed to be use for gaining centimeter level of accuracy of the GCPs mentioned in Q2. Compute the followings:

1. True coordinates of the CP1, CP2, CP3, CP6, and CP7 based on CP4 shown in table below.
2. True coordinates of the CP1, CP2, CP3, CP6, and CP7; consider CP4 is updated from SBAS.

PID	Easting (m)	Northing (m)	Ellip.Height (m)
CP4	360115.756	4076440.910	632.076

Q 19

Summarize the necessary steps for checking a topographic survey of an area of 500mx 500m, considering a grid spacing of 20m as and dual frequency receivers of Leica GS16.

Q 20

1. Explain the procedure of pot-processing static data utilizing online services from the figure 2.
2. Summarize the expectations of different solutions that could be achieved through post-processing with online services.

Q 21

1. Compare between standalone and relative positioning.
2. Explain each of single, double, and triple differencing.
3. Two receivers are required for static observation, justify.

Q 22

1. Define RTCM and RINEX. When they should be utilized? State the source of them
2. Compare between SBAS and GBAS.
3. How UAV photogrammetry can get benefit from GPS-INS integration.

Q 23

In order to establish a number of ground control points (GCPs), the following positions are proposed, as shown in table below. The observation should start for CP23 on 1/7/2022 at 8:00 AM. OPUS is planned to be use for post-processing of CP23. Prepare an observation plan for all CPs.

	Initial coordinate		
PID	Easting	Northing	Ellip.height
CP22	511837.977	4005921.295	654.441
CP23	514138.634	4003268.290	741.044
CP24	511142.004	4001908.267	648.533
CP27	522784.504	4007174.678	1106.923
CP28	524963.605	3998044.188	1400.796
CP29	525672.447	3991108.891	879.952
CP30	503947.686	3991391.117	615.740

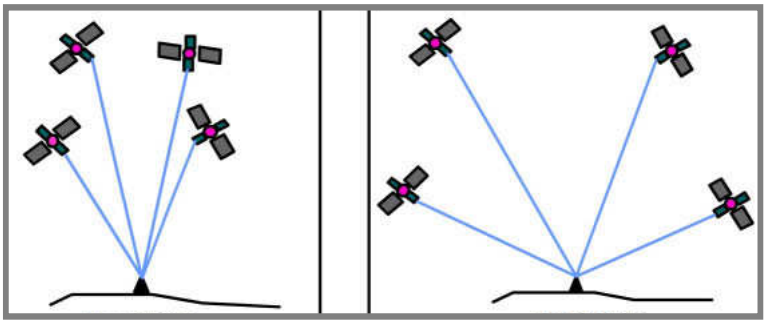
Q 24

Calculate the corrected 3D-coordinates of the ground control points shown in table below. Consider findings in Q 3.

	Final corrected coordinate		
PID	Easting	Northing	Ellip.height
CP22	---	---	---
CP23	514139.837	4003267.029	743.453
CP24	---	---	---
CP27	---	---	---
CP28	---	---	---
CP29	---	---	---
CP30	---	---	---

Q 25

4. Differentiate between global coverage satellite constellations in the tabulate form.
5. Express the expected accuracy in terms of wavelength for pseudorange and carrier phase measurement.
6. Calculate the uncertainty of an observation of stations A and B whose coordinates to be measure using Garmin hand-held GPS, consider ideal condition for PDOP factor.



A B

Q 26

11. The ellipsoidal height points R and S are 467.923 m are 498.645 m respectively. The undulations for stations are -12.320 m and 10.198m respectively. Calculate the elevation of both points with the graphical representation.
12. Why geocentric coordinates not preferable by geomatics engineers?
13. Compute the geocentric coordinates of a point whose latitude, longitude, ellipsoidal height are 36°18’14.81641”N, 316°51’02.13102”W, 229.089 respectively? Consider a=6378137.0 and b=6356752.3.

Q 27

10. With the aid graphically, explain the phase delay measurement.
11. Four satellites are necessary for coordinate determination? Justify
12. How the time displacement can be computed in the receiver?

Q 28

7. Mention the services of Galileo system; describe the current frequencies available for public.
8. Explain why the geoid cannot be the same as MSL? What are the possible ways to compute it?
9. Calculate the uncertainty of an observation of stations A, in which measured from 8:00 to 14:00 consider PDOP and GDOP factor; figure 1. The accuracy of station before and after processing was 3.789m and 0.009m respectively.

Q 29

14. State the parameters required for conversion from satellite to geocentric reference system.
15. Why the satellite and receiver clocks are not synchronized? Compute the synchronization error considering both satellite and receiver fundamental scale.
16. Explain how the errors can be resolved during satellite positioning.

Q 30

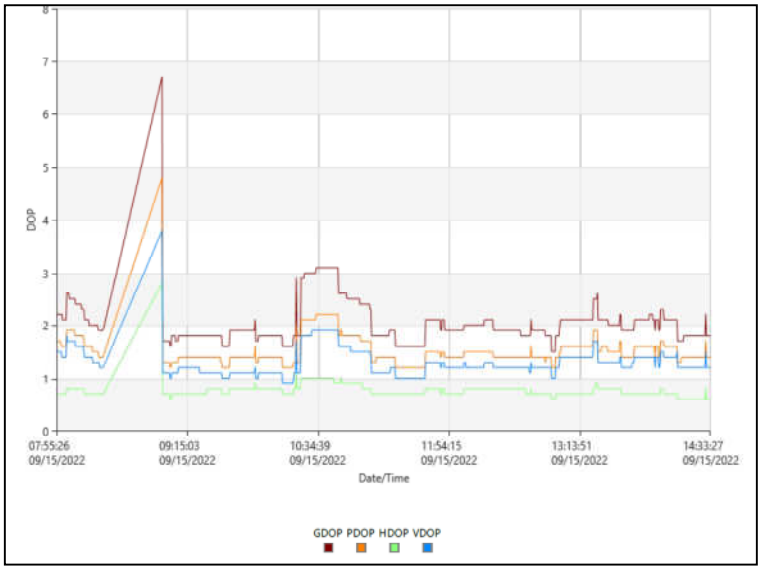
13. Explain how the satellite and receiver clock errors effects on satellite positions accuracy.
14. What are the significant of VRS in satellite positioning?
15. How the satellite signals can distort during its jury from satellite to receiver?

Q 31

In order to establish a geodetic network for a project in Soran Independent Administration using Leica Infinity Software, following initial coordinates were proposed.

1. Prepare an observation plan using dual frequency receiver and Figure 1, considering HARN point FP02 as reference; CP01 is a primary CP within the network.
2. Compute the corrected coordinate of CP02, CP03, CP04, and CP05 if corrected coordinate of CP01 is 447204.015m, 4051689.972, 682.759m.

PID	Easting	Northing	Ellip.Height	N
FP 02	412485.32	4018319.74	450.00	+ 12.39
CP01	447203.00	4051689.00	680.00	+ 15.43
CP02	447841.00	4055483.00	840.00	+ 15.70
CP03	454991.00	4054728.00	838.00	+ 15.84
CP04	459378.00	4053270.00	600.00	+ 15.91
CP05	456685.00	4052335.00	800.00	+ 15.80



Q 32

Two ground distances of 103.663m and 53.667m are measured on the equator from A to B and A to C, respectively. Calculate with sketch the ellipsoidal distance and grid factor. Consider Ellipsoidal height is 428.101m

Q 33

10. Differentiate between GPS and GNSS, which of them has higher cost effective, why?
11. Compute the wavelength of currently available frequencies of GALILEO and BeiDou?
12. What are the significant of different grid spacing in geoid calculators for Kurdistan and globe?
13. Compare between multipath and cycle slip.

Q 34

17. What are the functionalities of WRS, WMS, and GUS?
18. Differentiate between RTCM and RINEX.
19. The coordinates of astronomical bodies are necessary for satellite positioning? Justify.
20. It's the fact that pseudo-range and carrier phase measurement needs four satellite for coordinate computation. But carrier phase can obtain mm level of accuracy, while other not. Justify

Q 35

An observation was carried out for crustal motion study, Figure 3. Propose your expectation for achieving different solutions and accuracies.

Q 36

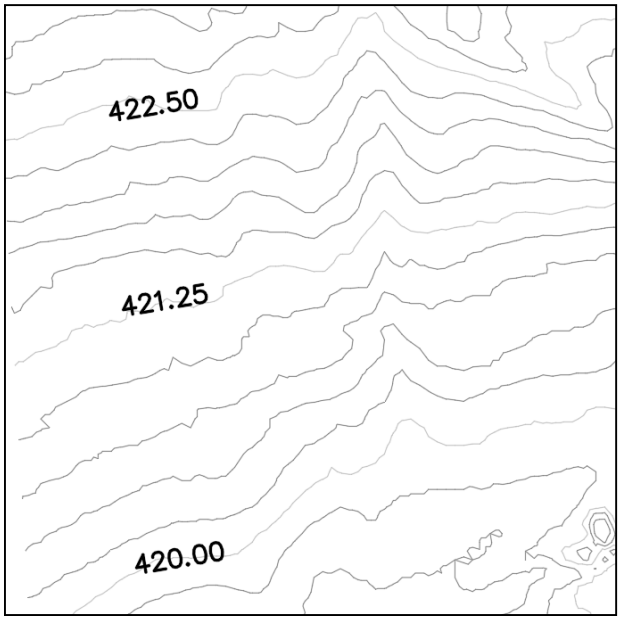
A contour map was produced from GNSS-based topographic survey, Figure 2. Propose a methodology for checking the topography utilizing Leica GNSS GS16.

Q 37

Write the methodology of performing a topographic survey in college of engineering using RTK technique utilizing Leica GNSS GS16.

Q 38

Explain the methodology about how the geomatics engineer can perform static observation at 10:00AM and post- process if the software not available, Figure 1




```
     3.02           OBSERVATION DATA    G: GPS              RINEX VERSION / TYPE
GS15 V8.00                               20230512 103932 UTC PGM / RUN BY / DATE
SNR is mapped to RINEX snr flag value [1-9]                  COMMENT
LX:     < 12dBHz -> 1; 12-17dBHz -> 2; 18-23dBHz -> 3        COMMENT
       24-29dBHz -> 4; 30-35dBHz -> 5; 36-41dBHz -> 6        COMMENT
       42-47dBHz -> 7; 48-53dBHz -> 8; >= 54dBHz -> 9        COMMENT
S200                                                         MARKER NAME
9801                                                         MARKER NUMBER
                                                             OBSERVER / AGENCY
1509801             LEICA GS15          8.00.654/6.524       REC # / TYPE / VERS
                    LEIGS15         NONE                     ANT # / TYPE
  3743865.0012  3586499.1732  3703183.9767                   APPROX POSITION XYZ
        1.5395        0.0000        0.0000                   ANTENNA: DELTA H/E/N
G   16 C1C L1C D1C S1C C2S L2S D2S S2S C2W L2W D2W S2W C5Q   SYS / # / OBS TYPES
       L5Q D5Q S5Q                                           SYS / # / OBS TYPES
DBHZ                                                         SIGNAL STRENGTH UNIT
     5.000                                                   INTERVAL
  2023    12    12    10    39   50.0000000     GPS         TIME OF FIRST OBS
  2023    12    12    15    10   10.0000000     GPS         TIME OF LAST OBS
     0                                                       RCV CLOCK OFFS APPL
G L2S -0.25000                                               SYS / PHASE SHIFT
G L2X -0.25000                                               SYS / PHASE SHIFT
R L2P  0.25000                                               SYS / PHASE SHIFT
E L8Q -0.25000                                               SYS / PHASE SHIFT
    18    18  1929     7                                     LEAP SECONDS
                                                             END OF HEADER
```