Explain your answers with neat sketches whenever possible. If not clearly stated, assume that the mean radius of the earth is R = 6371 km if not mentioned.

Assignment 3 – Coordinate Systems

1. Express your views about the following statements.
   a. The reason for numerous coordinate systems in geodesy.
   b. Deflection of the vertical can be used to convert from natural to geodetic coordinates.
   c. There are essential elements to define a coordinate system.
   d. Orthometric height is measured along the ellipsoidal normal at the point.
   e. The quantities Φ, Λ, and H define the position of the observer with respect to the geoid & the mean rotational axis of the earth.
   f. When rectangular system is called Average Terrestrial Coordinate System.
   g. Average Terrestrial Coordinate System and geodetic coordinate systems are the same.
   h. Observations which define the components of a horizon coordinate system.
2. Calculate the coordinates of a station C in a local coordinate system UVW if the change in rectangular coordinates from C to D is $\Delta X = 15\ km, \Delta Y = 10\ km,$ and $\Delta Z = 3\ km$ Also, compute the astronomic azimuth $A_{CD,}$ spatial distance $S_{CD,}$ and zenith angle Z_{CD} if the deflection components at C are $\xi = 5"$, and $\eta = 3"$ while the geodetic coordinates of C are $\varphi = 26°\ 15'27"\ N$, and $\lambda = 30°\ 25'12"\ E$.
3. Given that the deflection components ξ, η, N at an arbitrary station P are 15", 10", and 12.5 m, respectively. Calculate the rectangular coordinates of station P if its astronomic coordinates are $\Phi = 25°\ 18'\ 45"$, $\Lambda = 26°\ 22'32"$ and $H = 155.425\ m$.
4. If the astronomic coordinates at point 1 are (Φ_1=40° 40´ 10", Λ_1=41° 42´20"and H_1=160.50 m) and the measurements from point 1 to 2 not corrected for the gravity effect are (S_{12}=110.45m, A_{12}=20°, and $Z`_{12}$=45°). The deflection components at point 1 are (ξ_1=15", η_1=9"andN_1=15.50m). How can the geodetic coordinates (φ_1,λ_1,h_1) , Azimuth α_{12} and Zenith distance z_{12} can be calculated?
5. Given the geodetic coordinate of two point (φ_A =30°10`15", $\lambda_A$ =33°20`10", h_A =110.12m) and (φ_B =32°20`05", $\lambda_B$ =35°10`15", h_B =120.10m). The deflection components at point A are (ξ_A=5", η_A=15") calculate the astronomic azimuth AB?