**Explain your answers with neat sketches whenever possible. Assume any missing data.**

# ***Assignment 5 – Reduction to Ellipsoid***

1. Laplace's equation has a crucial role in the establishment of geodetic networks, why? OR: Why was Laplace's equation strictly required in the orientation of geodetic networks?
2. Geodetic observations should be reduced to ellipsoid. To what extent do you consider this statement is true.
3. Why reduction to ellipsoid is dependent on the angle of deflection of the vertical?
4. Let the astronomical azimuth from station A to B is 125° 18` 13", the astronomic coordinates of A are (25° 28` 17" N, 31° 20` 55" E), and their geodetic counterpart are (25° 28` 10" N, 31° 21` 05" E). Assuming first-order triangulation, compute the geodetic azimuth AB.
5. For any station P on the earth's surface, assume that its astronomical latitude Φ is $32° 40' 15"$ and astronomical longitude Λ is $75° 42' 18"$. Also, its geodetic coordinates are $\varphi = 31° 20'25"$, and $\lambda = 73° 44'27"$. Compute the components of the angle of deflection of the vertical $\theta(\xi, \eta)$. Also, calculate the deflection of the vertical components in direction $\alpha$ (computed geodetic latitude from former problem).
6. A chimney has been observed using a theodolite such that the vertical angle to its top was $12° 15'19"$. If the average deflection of the vertical at this site is $(00° 00'05"\text{N}, 00° 01'05"\text{ E})$, compute the geodetic zenith angle of the top of the chimney if its geodetic azimuth is $25° 15'25"$.
7. The geodetic coordinates of stations Q are (25° 28` 27" N, 33° 20` 55" E), and the deflection of the vertical is $(\ 00° 00'15"N, 00° 00'55"E\ )$. The local coordinates of Q to S are U = 23423 m, V = 6345 m, and W = 7896 m. Compute the geodetic azimuth QS and the geodetic zenith from Q to S.