MCL 732, Minor I (15 Marks)

1. An urban receptor site measured the concentration of $PM_{2.5}$ as 140 $\mu g/m^3$. The site measures two species (A, B) and their concentrations were 1.4 $\mu g/m^3$ and 3.4 $\mu g/m^3$ respectively. Species A is reactive, and looses (α)% per km while it is transported downstream. Analysis on two major sources (X, Y) suggest that species A contributes 1.11% to source X and 2% to source Y, whereas species B contributes 3% to source X and 4.5% to source Y. The receptor site is located very close to source Y and 10km away from source X.

I. Calculate the source contributions in $\mu g/m^3$, assuming $\alpha = 1$ **(5)**

II. Describe how the sensitivity of source apportionment with respect to α can be quantitatively evaluated **(2)**

III. Is the source apportionment complete, as conducted in part I. If yes, explain how. If no, explain how it could be made complete **(1)**

2. I. What possible physical factors can cause source contributions to change from sample to sample? **(2)**

II. Can we do sample by sample source apportionment in PCA? If so, how and if not, why not? Repeat your answers in case of CMB. **(2)**

3. I. Give possible physical reasons or scenarios behind negative values in the PCA correlation matrix for an air pollution dataset **(2)**

II. Reason why trace amount of CO will always be present in the atmosphere even if there were no CO emissions **(1)**

fg

1 km.

$\frac{100-\alpha}{100} \times fg$.

$2\left(\frac{101-\alpha}{100}\right)^2 fg$.