The covariance matrix is always semi positive and symmetric.

Proof:

Denote by X the matrix of observations, it consists of n (number random variables) columns, each one of length N (the number of observations). Assume that each random variable has mean zero (or otherwise that we already deducted the mean from the observations).

Then the covariance matrix C is a simple matrix product of X transposed and X (and is obviously symmetric of size n by n). $C = \frac{1}{N} X'X$.

It is positively definite as any product $X'X$, since for any vector a of length n we have $a'X'Xa \geq 0$.

To show that in a specific case the covariance is semi positive it is enough to find a non-zero vector a , such that $a'X'Xa = 0$.

Assume that N<n, then one can always find an n dimensional vector a that will be orthogonal to all N observations (for example, having 2 observations and 3 random variables one can always find a 3 dimensional vector that is orthogonal to any two given vectors - observations)
Let's choose a orthogonal to each observation, then $a'X' = 0$ and this completes the proof that in this case C is only semi positive definite.