Which of the following equations specify a linear Gaussian POMP model for which the observable variable $Y_{1:N}$ is an ARMA(1,1) model? Here, ϵ_n and η_n are Gaussian white noise. X_n is 1-dimensional in (1) and 2-dimensional in (2) and (3).

(A) (1), (2) and (3)
(B) (1) and (2) but not (3)
(C) (2) and (3) but not (1)
(D) (1) and (3) but not (2)

$$\left.\begin{array}{rcl} X_n &=& aX_{n-1}+\epsilon_n \\ Y_n &=& X_n+\eta_n \end{array}\right\} \tag{1}$$

$$\left.\begin{array}{rcl} X_n &=& \begin{pmatrix} a & 1 \\ 0 & 0 \end{pmatrix} X_{n-1} + \begin{pmatrix} 0 \\ 1 \end{pmatrix} \epsilon_n \\ Y_n &=& (1,0)\, X_n + \eta_n \end{array}\right\} \tag{2}$$

$$\left.\begin{array}{rcl} X_n &=& \begin{pmatrix} a & 1 \\ 0 & 0 \end{pmatrix} X_{n-1} + \begin{pmatrix} 1 \\ b \end{pmatrix} \epsilon_n \\ Y_n &=& (1,0)\, X_n \end{array}\right\} \tag{3}$$