Step-1

Let

$$\mathbf{F} = \begin{bmatrix} 1 & 1 \\ 1 & -1 \end{bmatrix}$$

The Fourier matrix in 2D is given by,

$$\begin{aligned} F_{2D} &= F \otimes F \\ &= \begin{bmatrix} F & F \\ F & -F \end{bmatrix} \\ &= \begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & -1 & 1 & -1 \\ 1 & 1 & -1 & -1 \\ 1 & -1 & -1 & 1 \end{bmatrix} \end{aligned}$$

Step-2

Thus, The Fourier matrix in 2D is $\boxed{F_{2D} = \begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & -1 & 1 & -1 \\ 1 & 1 & -1 & -1 \\ 1 & -1 & -1 & 1 \end{bmatrix}}$.