Hamiltonian matrix

$$\begin{bmatrix}
\langle\psi_{1,1}|H|\psi_{1,1}\rangle & \langle\psi_{1,1}|H|\psi_{1,2}\rangle & \cdots & \langle\psi_{1,1}|H|\psi_{2,1}\rangle & \langle\psi_{1,1}|H|\psi_{2,2}\rangle & \cdots & \langle\psi_{1,1}|H|\psi_{M,N}\rangle \\
\langle\psi_{1,2}|H|\psi_{1,1}\rangle & \langle\psi_{1,2}|H|\psi_{1,2}\rangle & & \langle\psi_{1,2}|H|\psi_{2,1}\rangle & \langle\psi_{1,2}|H|\psi_{2,2}\rangle & & \langle\psi_{1,2}|H|\psi_{M,N}\rangle \\
\vdots & & \ddots & & & & \vdots \\
\langle\psi_{2,1}|H|\psi_{1,1}\rangle & \langle\psi_{2,1}|H|\psi_{1,2}\rangle & & \langle\psi_{2,1}|H|\psi_{2,1}\rangle & \langle\psi_{2,1}|H|\psi_{2,2}\rangle & & \langle\psi_{2,1}|H|\psi_{M,N}\rangle \\
\langle\psi_{2,2}|H|\psi_{1,1}\rangle & \langle\psi_{2,2}|H|\psi_{1,2}\rangle & & \langle\psi_{2,2}|H|\psi_{2,1}\rangle & \langle\psi_{2,2}|H|\psi_{2,2}\rangle & & \langle\psi_{2,2}|H|\psi_{M,N}\rangle \\
\vdots & & & & & \ddots & \vdots \\
\langle\psi_{M,N}|H|\psi_{1,1}\rangle & \langle\psi_{M,N}|H|\psi_{1,2}\rangle & \cdots & \langle\psi_{M,N}|H|\psi_{2,1}\rangle & \langle\psi_{M,N}|H|\psi_{2,2}\rangle & \cdots & \langle\psi_{M,N}|H|\psi_{M,N}\rangle
\end{bmatrix}$$

$$\langle\psi_{1,2}|H|\psi_{3,4}\rangle = \langle\psi_{1,2}|-\frac{\hbar}{2m}\nabla^2 + V(\vec{r})|\psi_{3,4}\rangle$$