.. Show that $E(\lambda) = \langle \Phi | \lambda V_c | \Psi(\lambda) \rangle$

$$H(\lambda) \equiv H_0 + \lambda V_c$$

$$H(\lambda)\Psi(\lambda) = E(\lambda)\Psi(\lambda) \Rightarrow H_0 \Psi(\lambda) + \lambda V_c \Psi(\lambda) = E(\lambda)\Psi(\lambda)$$

$$\Rightarrow \langle \Phi | H_0 | \Psi(\lambda) \rangle + \langle \Phi | \lambda V_c | \Psi(\lambda) \rangle = \langle \Phi | E(\lambda) | \Psi(\lambda) \rangle$$

$$\Rightarrow \langle \Psi(\lambda) | H_0 | \Phi \rangle^* + \langle \Phi | {}^{*\lambda} V_c | \Psi(\lambda) \rangle = E(\lambda) \langle \Phi | \Psi(\lambda) \rangle$$

$$\Rightarrow 0 + \langle \Phi | {}^{*\lambda} V_c | \Psi(\lambda) \rangle = E(\lambda)$$

$$\Rightarrow E(\lambda) = \langle \Phi | \lambda V_c | \Psi(\lambda) \rangle \quad QED$$