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解答

1.

$$\begin{aligned} |00\rangle &= \frac{1}{\sqrt{2}}(|\Phi^+\rangle + |\Phi^-\rangle), \\ |11\rangle &= \frac{1}{\sqrt{2}}(|\Phi^+\rangle - |\Phi^-\rangle), \\ |01\rangle &= \frac{1}{\sqrt{2}}(|\Psi^+\rangle + |\Psi^-\rangle), \\ |10\rangle &= \frac{1}{\sqrt{2}}(|\Psi^+\rangle - |\Psi^-\rangle) \end{aligned} \quad (1)$$

2.

$$\begin{aligned} |\psi\rangle &= \frac{1}{\sqrt{2}}[\alpha(|\Phi^+\rangle + |\Phi^-\rangle) + \beta(|\Psi^+\rangle + |\Psi^-\rangle) \\ &\quad + \gamma(|\Psi^+\rangle - |\Psi^-\rangle) + \delta(|\Phi^+\rangle - |\Phi^-\rangle)] \\ &= \frac{1}{\sqrt{2}}[(\alpha + \delta)|\Phi^+\rangle + (\alpha - \delta)|\Phi^-\rangle + (\beta + \gamma)|\Psi^+\rangle + (\beta - \gamma)|\Psi^-\rangle] \end{aligned} \quad (2)$$