(1) (16)

iii) If A_1 and A_2 satisfy $A_1K + KA_1^{+} = 0$
$A_2K + KA_2^{+} = 0$

then $(A_1 + A_2)K + K(A_1^{+} + A_2^{+}) = 0$

$\therefore A_1 + A_2 \in T_{SU(m,n)}$

$AK + KA^{+} = 0 \Rightarrow r(AK + KA^{+}) = (rA)K + K(rA^{+}) = 0$
$\Rightarrow rA \in T_{SU(m,n)}$

$r \in \mathbb{R}$

$\therefore$ The tangent space is a real vector space.

$AK + KA^{+} = 0 \Rightarrow AK = -KA^{+}$

Write $A = \left[\begin{array}{c|c} A_{m,m} & A_{m,n} \\ \hline A_{n,m} & A_{n,n} \end{array}\right]$, where $A_{r,s}$ is an $r \times s$ submatrix

$$\left[\begin{array}{c|c} A_{m,m} & A_{m,n} \\ \hline A_{n,m} & A_{n,n} \end{array}\right]\left[\begin{array}{c|c} I_m & 0 \\ \hline 0 & -I_n \end{array}\right] = -\left[\begin{array}{c|c} I_m & 0 \\ \hline 0 & -I_n \end{array}\right]\begin{bmatrix} A^{+}_{mm} & A^{+}_{n,m} \\ A^{+}_{mn} & -A^{+}_{nn} \end{bmatrix}$$

$$\left[\begin{array}{c|c} A_{m,m} & -A_{m,n} \\ \hline A_{n,m} & -A_{n,n} \end{array}\right] = -\begin{bmatrix} A^{+}_{mm} & A^{+}_{n,m} \\ -A^{+}_{m,n} & -A^{+}_{nn} \end{bmatrix} = \begin{bmatrix} -A^{+}_{mm} & -A^{+}_{n,m} \\ A^{+}_{m,n} & A^{+}_{nn} \end{bmatrix}$$

$A_{mm} = -A^{+}_{mm}$, $-A_{nn} = A^{+}_{nn} \Rightarrow A_{mm}, A_{nn}$ skew Hermitian

$-A_{mn} = -A^{+}_{nm}$, $A_{n,m} = A^{+}_{m,n}$

$\therefore -A_{mn} = -(A^{+}_{mn})^{+} = -A_{m,n}$

$A_{nm} = (A^{+}_{nm})^{+} = A_{n,m}$ $\therefore$ There are no restrictions on the off diagonal block except $A_{nm} = A^{+}_{m,n}$