

$$V_B = R_4 I_7 \quad (9)$$

Matrix soln:

$$\begin{bmatrix} -1 & 0 & 1 & 1 & 1 & 1 & 0 & 0 & 0 \\ R_1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -1 & 0 & 0 & \frac{1}{C_2 S} & 0 & 0 & 0 & 0 \\ 0 & -1 & 0 & R_2 & 0 & 0 & 1 & 0 & 0 \\ 0 & -1 & 0 & 0 & 0 & \frac{1}{C_5} + R_2 & 0 & 0 & 0 \\ 0 & -1 & R_3 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & -1 & 0 & R_4 + R_5 \\ 0 & -1 & 0 & 0 & 0 & \frac{1}{C_1 S} & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & -1 & R_4 \end{bmatrix} \begin{bmatrix} I_1 \\ V_A \\ I_3 \\ I_4 \\ I_5 \\ I_6 \\ V_0 \\ V_B \\ I_7 \end{bmatrix} = \begin{bmatrix} 0 \\ 1 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{bmatrix}$$

OR see Maple Worksheet

Result:

$$G(s) = \frac{99.619s}{0.99619s^2 + 95.88s + 1 \times 10^6}$$

$$\begin{aligned} \text{b) i) } G(500j) &= \frac{(100)(500j)}{(500j)^2 + 100(500j) + (1000)^2} \\ &= |0.0665| \angle 1.504 \end{aligned}$$

$$V_{\text{oss}} = 0.665 \cos(500t + 1.504)$$

$$\text{ii) } G(1000j) = |1| \angle 0$$

$$V_{\text{oss}} = 10 \cos(1000t)$$

$$\text{iii) } G(1500j) = |0.119| \angle -1.45$$

$$V_{\text{oss}} = 1.19 \cos(1500t - 1.45)$$