2. a)

Mode 1

$$i_1^l + n i_2 \overset{0}{\cancel{}} = 0$$
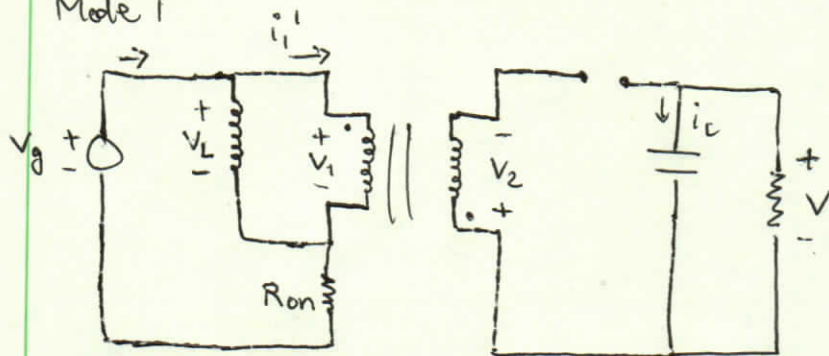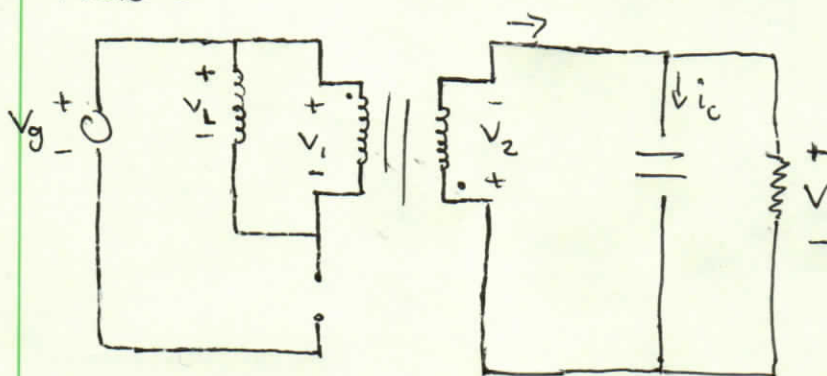
$$i_i^{ll} = i_2 = 0$$

$$V_1 = \frac{V_2}{n} \rightarrow V_2 = n V_1 = n V_g$$

Mode 2

$$x(t) = \begin{bmatrix} f_1(x(t), u(t)) \\ f_2(x(t), u(t)) \end{bmatrix} = \begin{bmatrix} \frac{d}{dt} \langle i(t) \rangle_{T_s} \\ \frac{d}{dt} \langle v(t) \rangle_{T_s} \end{bmatrix}$$

$$x(t) = \begin{bmatrix} \frac{1}{L}\left[\langle V_g(t) \rangle_{T_s} - R_{on} \langle i(t) \rangle_{T_s} \right] d(t) + \frac{1}{L}\left[-\frac{\langle v(t) \rangle_{T_s}}{n} \right] d'(t) \\ \frac{1}{C}\left[-\frac{\langle v(t) \rangle_{T_s}}{R} \right] d(t) \quad + \quad \frac{1}{C}\left[\frac{\langle i(t) \rangle_{T_s}}{n} - \frac{\langle v(t) \rangle_{T_s}}{R} \right] d'(t) \end{bmatrix}$$