Chapter **28** (Benson)

E03 $8.4 = \mathcal{E} - 6\,r$ & $7.2 = \mathcal{E} - 8\,r$ give $\mathcal{E} = 12\,\mathrm{V}$ & $r = 0.6\,\Omega$.

E10 $R_{eq} = 4R/3 = 16\,\Omega$, thus $R = 12\,\Omega$.

E15 $I = P/V$: 0.5 A, 0.083 A, 8.33 A; 12.5 A .

E21 $I_7 = 0$; $I_3 = 3.33\,\mathrm{A}$; $I_4 = 2.5\,\mathrm{A}$.

E25 $\mathcal{E}_1 = 26\,\mathrm{V}$ & $\mathcal{E}_2 = 25\,\mathrm{V}$: Left Loop: $-\mathcal{E}_1 + 2I_1 - 5I_3 = 0$; Right Loop: $\mathcal{E}_2 + 5I_2 + 5I_3 = 0$; $I_2 = I_1 + I_3$. (**a**) $I_1 = 3\,\mathrm{A}$, $V_1 = 6\,\mathrm{V}$; $I_2 = -1\,\mathrm{A}$, $V_2 = 5\,\mathrm{V}$; $I_3 = -4\,\mathrm{A}$, $V_3 = 20\,\mathrm{V}$; (**b**) $V_A - V_B = -I_2R_2 - \mathcal{E}_2 = -20\,\mathrm{V}$.

E28 Left Loop: $-5I_1 + 12 - 5I_3 - 7 = 0$; Right Loop: $7 + 5I_3 - 5I_2 + 13 = 0$; $I_1 = I_2 + I_3$. $I_1 = 2\,\mathrm{A}$, $I_2 = 3\,\mathrm{A}$, $I_3 = -1\,\mathrm{A}$. $V_A - V_B = -2I_1 + 12 = 8\,\mathrm{V}$.

E36 $\tau = (2R)(4C/3) = 8RC/3$.

E40 (**a**) $dQ/dt = (Q_0/RC)\exp(-t/RC) = \mathcal{E}/R$ (at $t = 0$);

(**b**) $Q_0 = (\mathcal{E}/R)\,t$, so $t = Q_0R/\mathcal{E} = RC$.

E67 $R_1 = 2\times10^5\,\Omega$, $C_1 = 60\,\mu F$ & $C_2 = 20\,\mu F$. $R_1C_1 = R_{eq}C_{eq}$, where $C_{eq} = C_1 + C_2$ & $R_{eq} = R_1R_2/(R_1 + R_2)$ gives $R_2 = 6\times10^5\,\Omega$.

E69 (**a**) $V_5 = (24/8)(5) = 15\,(\mathrm{V})$, $V_c = V_5 = 15\,\mathrm{V}$, $Q_0 = 900\,\mu\mathrm{C}$;

(**b**) $Q = Q_0\exp(-t/RC)$, where $RC = 42\,\mathrm{ms}$. Find $t = 58.2\,\mathrm{ms}$.

P02 $2R + RR_e/(R + R_e) = R_e$; $R_e^2 - 2RR_e - 2R^2 = 0$. Find $R_e = (1 + \sqrt{3})R$.

P09 (**a**) $V_5 = (5/6)(24) = 20\,(\mathrm{V})$, $V_b = 4\,\mathrm{V}$; $V_a = 12\,\mathrm{V}$, $V_a - V_b = 8\,\mathrm{V}$; (**b**) Same as (a); (**c**) $R_{eq} = 8/3\,\Omega$, $C = 10\,\mu\mathrm{F}$, $\tau = 26.7\,\mu\mathrm{s}$.

P12 (**a**) $V_c = 0$, $I_1 = \mathcal{E}/R_1$, $I_2 = \mathcal{E}/R_2$; (**b**) $V_c = \mathcal{E}$, $I_1 = \mathcal{E}/R_1$, $I_2 = 0$; (**c**) $U = C\mathcal{E}^2/2$; (**d**) $\tau = (R_1 + R_2)C$. (Teacher: Jyh-Shinn Yang, 90.05.21)

P13 (**a**) $I_1 = \mathcal{E}/R_1$, $I_2 = 0$, $I_c = I_1$; (**b**) $I_1 = I_2 = \mathcal{E}/(R_1 + R_2)$, $I_c = 0$; (**c**) $\mathcal{E} - I_1R_1 - Q/C = 0$, $Q/C = I_2R_2$, $I_1 = I_c + I_2$; $\mathcal{E} - (I_c + Q/R_2C)R_1 - Q/C = 0$, or $\mathcal{E}/R - I_c - Q/C(1/R_1 + 1/R_2) = 0$. Using $I_c = dQ/dt$, $dI_c/dt = -I_c/\tau$, then $I_c = (\mathcal{E}/R_1)\exp(-t/\tau)$.