⑪-11. $I = 9\angle 15° \, mA$ (45rad/s), $R = 18k\Omega$, $C = 1mF$
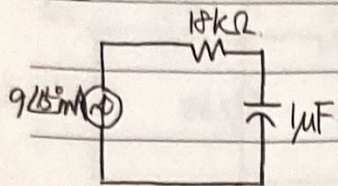
$$Z_{eq} = R + X_C$$

$$18k\Omega \to 18k\Omega, \quad 1\mu F \to X_C = \frac{1}{j\omega C} = -22.22k\Omega$$

$$\therefore Z_{eq} = 18k - j22.22k$$
$$= 28.6k \angle -51° \, \Omega$$

$$\Rightarrow V_{eq} = Z_{eq}I = (28.6k\angle -51°)(9m\angle 15°) = 257.4\angle -36° \, V$$

(a) 순간전력

$$P(t) = i(t)v(t) = (257.4\cos(45t - 36°)) \times (9\times10^{-3}\cos(45t + 15°))$$

$$= 2.316 \cos(45t - 36°)\cos(45t + 15°)$$

$$\boxed{\cos A \cos B = \frac{\cos(A+B) + \cos(A-B)}{2}}$$

$$= 2.316 \left(\frac{\cos(90t - 21°) + \cos(-51°)}{2}\right)$$

$$= 2.316 \left(\frac{\cos(90t - 21°) + 0.6294}{2}\right)$$
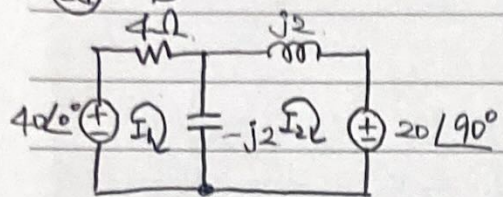
$$= \boxed{1.16\cos(90t - 21°) + 0.73} \, [W]$$

(b) 평균전력

$$P = \frac{1}{2}V_m I_m \cos(\theta - \phi)$$

$$= \frac{1}{2}(257.4)(9\times10^{-3})\cos(-36° - 15°)$$

$$= 0.73 W$$

⑪ - 15

각 소자에 대한 평균 전력

먼저, 2개의 리액턴스 소자들에 흡수되는 평균 전력은 0 이다.
(인덕터 , 캐패시터)　$\boxed{P_L = 0W}$, $\boxed{P_C = 0W}$

KVL에 의해,

Loop ① : $-40\angle0° + 4I_1 - j2(I_1 - I_2) = 0$

$\quad\quad (4-j2)I_1 + j2I_2 = 40\angle0° = 40$

Loop ② : $-j2(I_2 - I_1) + j2I_2 + 20\angle90° = 0$

$\quad\quad j2I_1 = -20\angle90° = -20j$

$\quad\quad \therefore I_1 = \dfrac{-20j}{2j} = 10$

$\quad\quad$ (대입) $\rightarrow$ $40 - j20 + j2I_2 = 40$

$\quad\quad\quad j2I_2 = j20 \quad I_2 = \dfrac{j20 \times j2}{j2 j2} = \dfrac{-40}{-4} = 10$

$\quad\quad\quad \therefore I_1 = 10\angle0° , \quad I_2 = 10\angle0°$

$P_{4\Omega} = \dfrac{1}{2}I_m^2 R = \dfrac{1}{2}(10)^2 4 = 200W$　$\boxed{P_{4\Omega} = 200W}$ (흡수)

〈흡부규약〉

$P_{left} = \dfrac{1}{2}(40)(10)\cos(0°-0°) = 200W$　$\boxed{P_{left} = 200W}$ (공급)

〈흡부규약〉

$P_{right} = \dfrac{1}{2}(20)(40)\cos(90°-0°) = 0$　$\boxed{P_{right} = 0W}$

⑪ - 17
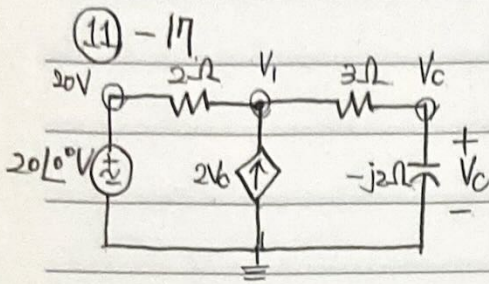
KCL을 이용하면,

$$\frac{20-V_1}{2} + 2V_c = \frac{V_1-V_c}{3}$$

$$60-3V_1+12V_c = 2V_1-2V_c$$

$$5V_1-14V_c = 60 \quad \cdots \quad ①$$

$$\frac{V_1-V_c}{3} = \frac{V_c}{-j2}$$

$$V_1-V_c = \frac{3V_c \times (j\cancel{2})}{\cancel{-j2}}$$

$$2V_1-2V_c-3jV_c = 0$$

$$2V_1-(2+3j)V_c = 0 \quad \cdots \quad ②$$

①, ② 연립

$$10V_1 - 28V_c = 120$$

$$10V_1 - (10+15j)V_c = 0$$

$$(-18+15j)V_c = 120 \quad , \quad \begin{cases} V_c = \dfrac{120}{(-18+15j)} = 5.122\underline{/-140.2°} \\[2mm] V_2 = 9.223 \underline{/83.88°} \end{cases}$$

$$P_{2V_c} = -\frac{1}{2}(9.223)(2\times5.122)\cos(-83.88°+140.2°) = -26.22W$$

$$\boxed{26.22W} \; 흡수$$