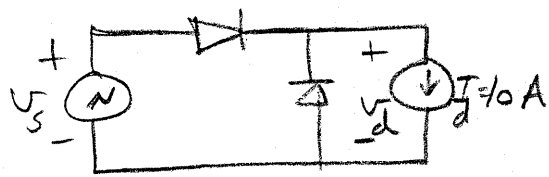
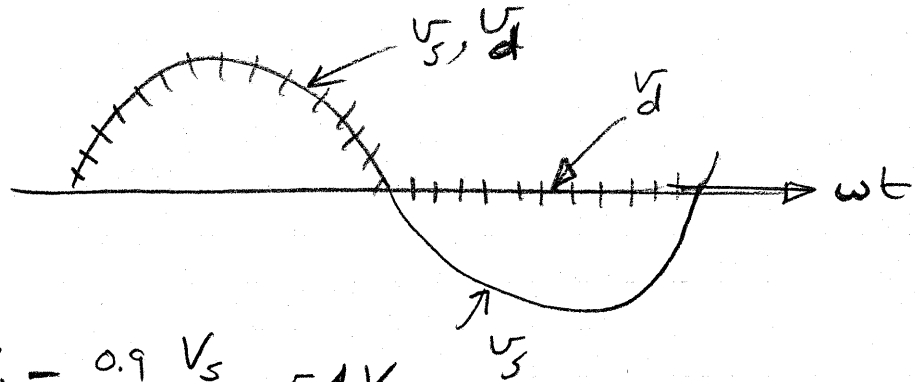
Problem 5-5

(a)



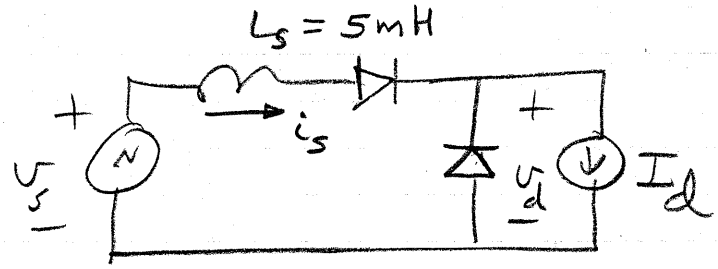
$V_s = 120\,V$



$$V_d = \frac{0.9}{2} V_s = 54\,V$$

$$P_d = V_d I_d = 540\,W$$

(b)



$u, V_d, P_d = ?$

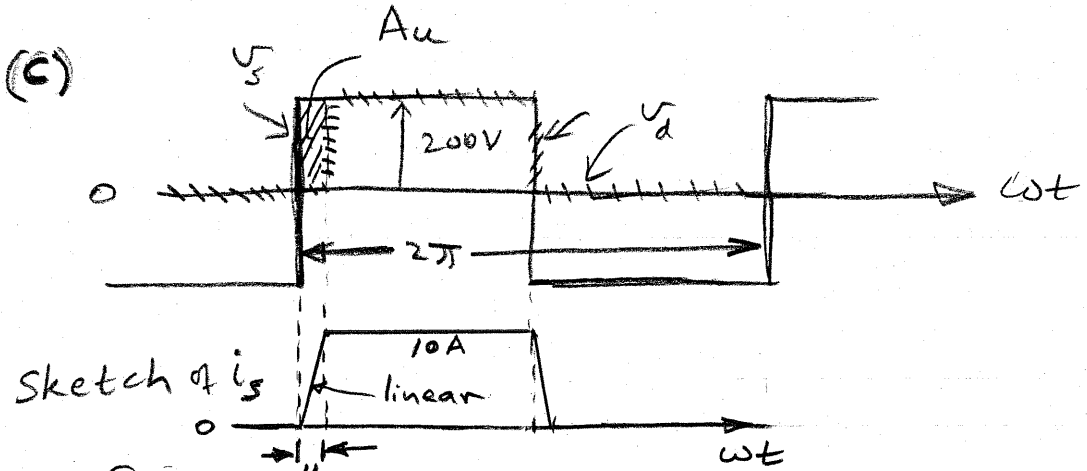
$$\cos u = 1 - \frac{\omega L_s I_d}{\sqrt{2}\, V_s} \qquad (5\text{-}22)$$

$$V_d = 0.45 V_s - \frac{\omega L_s}{2\pi} I_d \qquad (5\text{-}26)$$

$$P_d = V_d I_d$$

$\therefore\ u = 27.26^\circ,\ V_d = 51\ V,\ P_d = 510\ W$

(c)



$\omega = 2\pi \times 60$
$= 377 \frac{rad}{s}$
$L_s = 5mH$

Similar development leading up to Eq. (5-21) ---

$$\int_0^u 200 \cdot d(\omega t) = \omega L_s I_d$$

$$200\, u = 377 \times 5 \times 10^{-3} \times 10$$

$\therefore\ u = 0.094$ rad
$= 5.4^\circ$

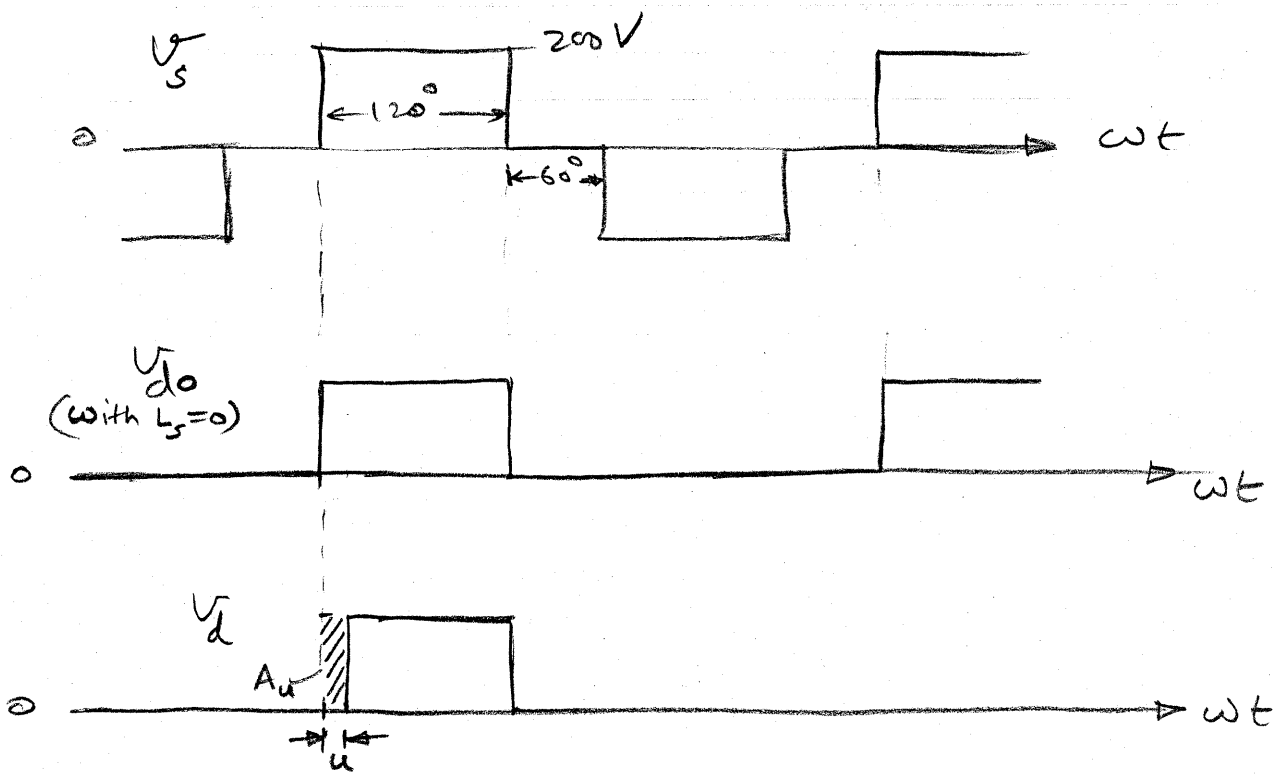
From Eq. 5-21

$$A_u = \omega L_s I_d = 18.85\ V \cdot rad$$

$$\therefore V_d = 100 - \frac{18.85}{2\pi} = 97\ V$$

$$P_d = V_d I_d = 970\ W$$

(d)



$$V_{do} = \frac{200 \times 120}{360} = 66.67\ V$$

$$A_u = \omega L_s I_d = 18.85\ V.rad \text{ (as in part c)}$$

$$\therefore V_d = V_{do} - \frac{A_u}{2\pi} = 63.67\ V$$

$$P_d = V_d I_d = 636.7\ W$$