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Simulim 22
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Electronics (ECE)

4) Buck Converter
$V_i = 60V$ $V_o = 25$
$\nu = 25KHz = f$

we know that
Duty cycle $D = \frac{V_o}{V_s}$

$\therefore D = \frac{25}{60} = \frac{5}{12} \approx 0.4167$

$D \approx 0.42$

We also know that

$L_{min} = \frac{(1-D)R}{2F}$

$\therefore L_{min} = \frac{(1-0.4167)R}{2 \times 25 \times 10^3}$

$\frac{0.5833}{50} \times 10^{-3} \times R$

$L_{min} = (11.66)R$

$\therefore$ for precaution we take L 25% greater than calculated

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$\therefore L = 1.25 \times 11.66 \times R$

$L = 14.58\ R$

& $C = \dfrac{1-D}{8L\left(\dfrac{\Delta V_o}{V_o}\right) f^2}$

let $\dfrac{\Delta V_o}{V_o} = x$

$C = \dfrac{0.5833}{8 \times 14.58 \times R \times x \times (25\times10^3)^2}$

$\dfrac{0.005}{R \times x \times 625 \times 10^6}$

$C = \dfrac{8\times10^{-6} \times 10^{-6}}{R \times x}$

Let $x = \dfrac{1}{1000}$ [Meaning 0.1% max deviation from required voltage acceptable]

Then $C = \dfrac{8\times10^{-9}}{R}$

Let $R = 8\times10^{-3}\ \Omega$ [just an example]

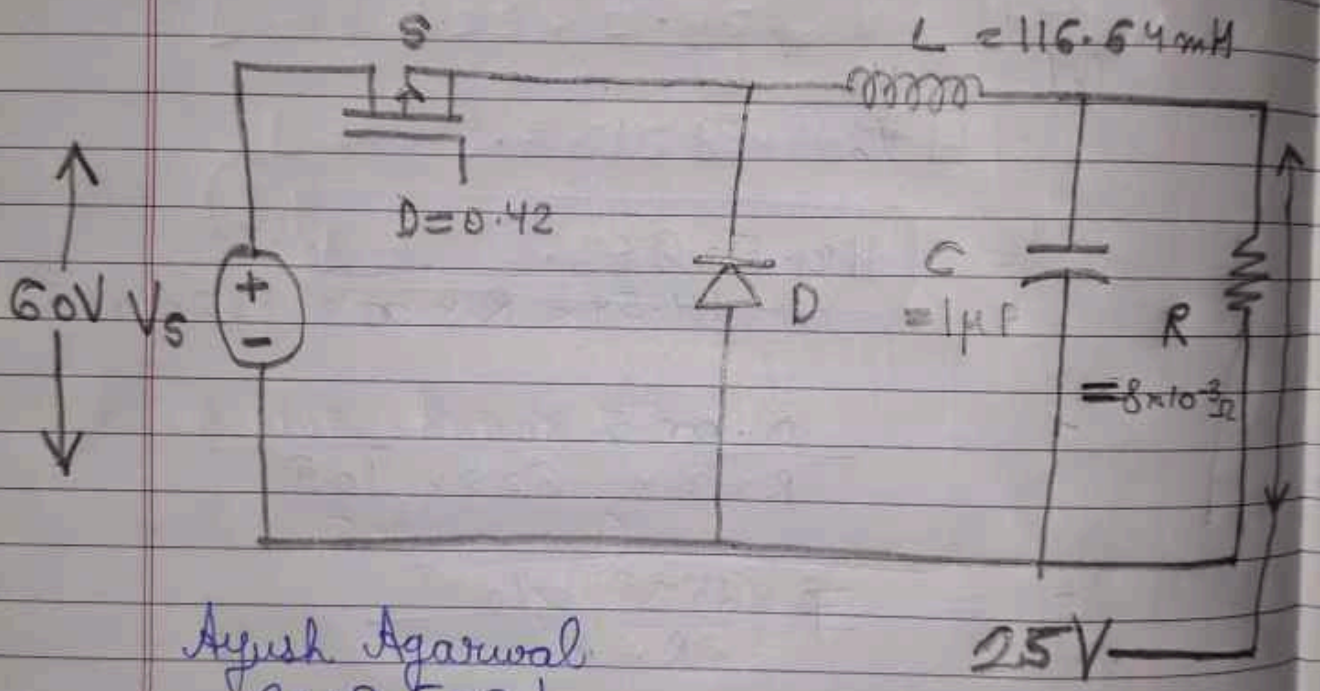
Then $L = 14.58 \times 8 \times 10^{-3}\ H$

$L = 116.64\ mH$

$$C = \frac{8 \times 10^{-9}}{8 \times 10^{-3}} = 10^{-6}$$

$$C = 1\,\mu F$$

∴ the circuit would be



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