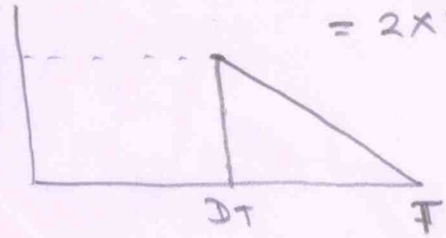
Q4. As the converter is on the boundary of continuous and disc mode of conduction

$L = 50 \times 10^{-6}$ H

$T = \frac{1}{50 \times 10^{3}}$ s $= 2 \times 10^{-5}$ s

$i_D = \bar{i}_o$



$$\frac{V_o}{V_d} = \frac{D}{1-D}$$

or, $V_d = \frac{1-D}{D} V_o$

$i_{D\,peak} = \frac{V_d}{L} DT$ $\therefore$ $\bar{i}_D = I_o = \frac{1}{2}(1-D)T \times \frac{V_d}{L} D\cancel{T} \times \frac{1}{\cancel{T}}$

$$= \frac{10}{R_L}$$

$$\frac{D(1-D)T}{100 \times 10^{-6}} \times V_d = \frac{10}{R}$$

$$\frac{D(1-D)T}{100 \times 10^{-6}} \times \frac{1-D}{D} V_o = \frac{10}{R}$$

or $$\frac{\cancel{D}(1-D) \times 2 \times 10^{-5}}{100 \times 10^{-6}} \times \frac{1-D}{\cancel{D}} \cancel{10} = \frac{\cancel{10}}{R_L}$$

or $(1-D)^2 = \frac{5}{R}$ or, $1 - D = \pm\sqrt{\frac{5}{R_L}}$ or $D = 1 \pm \sqrt{\frac{5}{R_L}}$

D cannot be more than 1.

$\therefore$ $D = 1 - \sqrt{\frac{5}{R_L}}$, $V_d = \frac{1 - 1 + \sqrt{5/R_L}}{1 - \sqrt{5/R_L}} \times 10 = \frac{\sqrt{5/R_L}}{1 - \sqrt{\frac{5}{R_L}}} \times 10$ V

$$I_{D(peak)} = \frac{V_d}{50 \times 10^{-6}} \left(1 - \sqrt{\frac{5}{R_L}}\right) \times 2 \times 10^{-5} \text{ A.}$$

$$= \frac{2 V_d}{5} \left(1 - \sqrt{\frac{5}{R_L}}\right)$$

$$= \frac{2}{5} \frac{\sqrt{5/R_L}}{\cancel{1 - \sqrt{\frac{5}{R_L}}}} \left(\cancel{1 - \sqrt{5/R_L}}\right) \times 10 \text{ A}$$

$$= 10 \times \frac{2}{5} \sqrt{\frac{5}{R_L}} \text{ A} = \frac{20}{\sqrt{5 R_L}} \text{ A.}$$