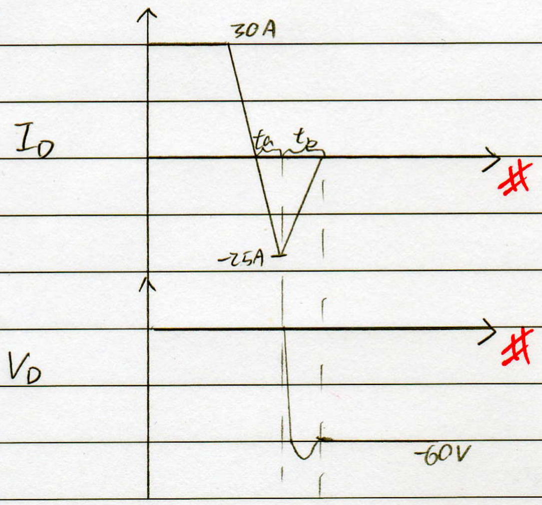
PYP EE4532 NOV/DEC 11 Megarine Tee

1ai)



ii) $SF = t_b/t_a$, $t_b + t_a = t_{rr}$, $I_{rr} = \frac{di}{dt} \times t_a$

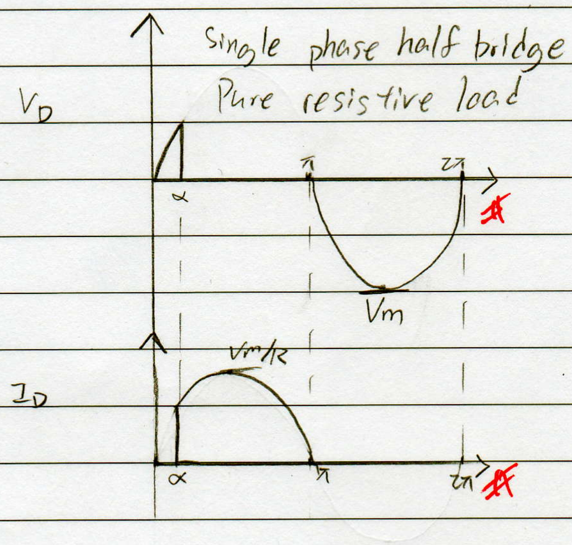
$t_a = I_{rr} / [\frac{di}{dt}] = 25/12 = 2.083\,\mu S$

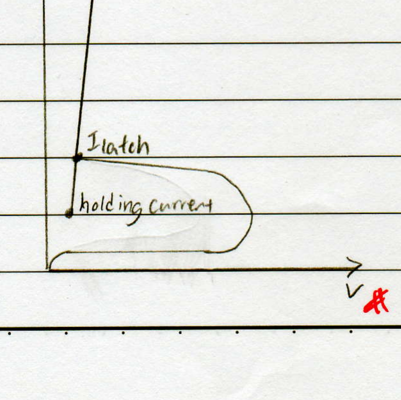
$t_b = SF \times t_a = 0.6 \times 2.083 = 1.25\,\mu S$

$t_{rr} = t_b + t_a = 3.333\,\mu S$ #

Since SF is < 1 ∴ use fast recovery diode. #

b)





2) Highly inductive, $V_{o\,avg} = 190\,V$, $R = 12\,\Omega$, $V_m = \sqrt{2} \times 220\,V$

a i) $I_{o\,rms} = I_{o\,peak} = I_{o\,avg} = V_{o\,avg}/R = 15.833\,A$

ii) $V_{o\,avg} = \frac{1}{2\pi}\int_0^{2\pi} V_o(\omega t)\,d\omega t = \frac{1}{\pi}\int_\alpha^{\pi+\alpha} V_m \sin\omega t\,d\omega t$

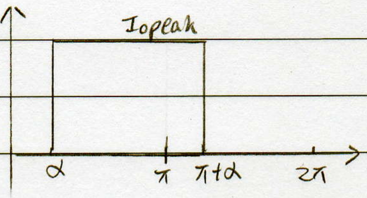
$= \frac{V_m}{\pi}\left[-\cos\omega t\right]_\alpha^{\pi+\alpha}$

$= \frac{2V_m}{\pi}\cos\alpha$

$\Rightarrow \frac{2V_m}{\pi}\cos\alpha = 190\,V \quad \Rightarrow \alpha = 16.4°$

iii)

I_{D1}



$PIV = V_m = 311\,V$

$I_{D1\,avg} = I_{o\,avg}/2 = 7.9165\,A$

$I_{D1\,rms} = I_{o\,rms} \times \sqrt{\frac{1}{2}} = 11.2\,A$

$I_{D1\,peak} = I_{o\,peak} = 15.833\,A$

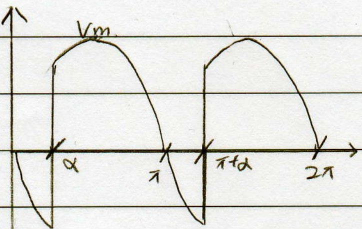
b) $V_{in\,rms} = 220\,V$

$I_{in\,rms} = I_{D1\,rms} \times \sqrt{\frac{2}{1}} = 15.833\,A$

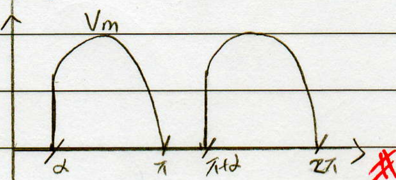
Transformer kVA $= V_{in\,rms} \times I_{in\,rms} = 3.483\,kVA$

c)

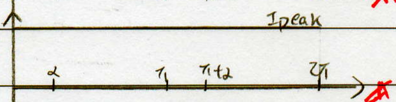
Vo W/O FHD



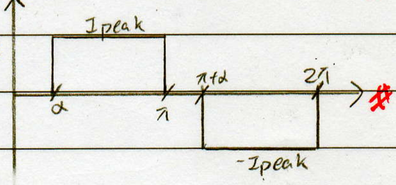
Vo with FHD, for resistive & inductive



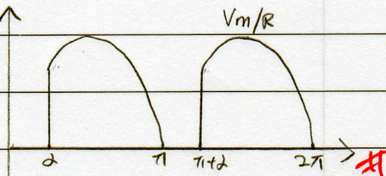
Io for inductive



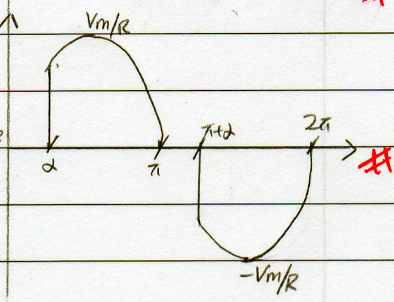
Is for inductive



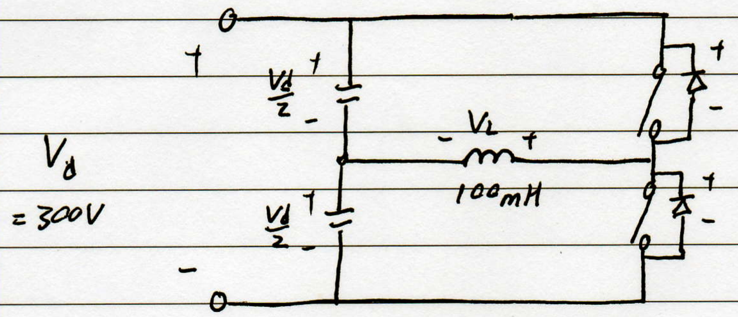
Io for resistive



Is for resistive



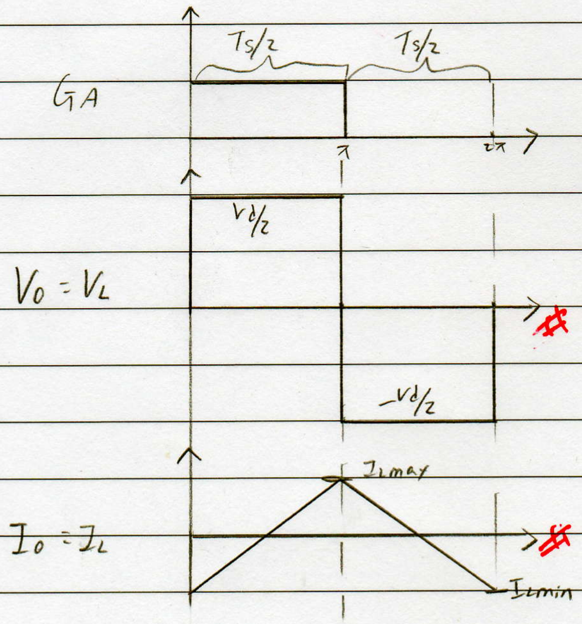
3)



$f = 50Hz$

$T_s = 0.02\,s$

a i)



$$\Delta I_L = \left(\left[\frac{V_d}{2}\right]/L\right) t_{on}$$

$$= \frac{V_d}{2L} \times T_s/2$$

$$= 15A$$

$$I_{Lmax} = \Delta I_L/2 = 7.5A$$

$$I_{Lmin} = -\Delta I_L/2 = -7.5A$$

ii) $V_{orms} = V_d/2 = 150V$

$Z = 2\pi f L = 31.42\,\Omega$

$I_{orms} = V_{orms}/Z = 4.775A$

b) V_o fundamental frequency $= 50Hz$

On state $V_{Load} = 0V$

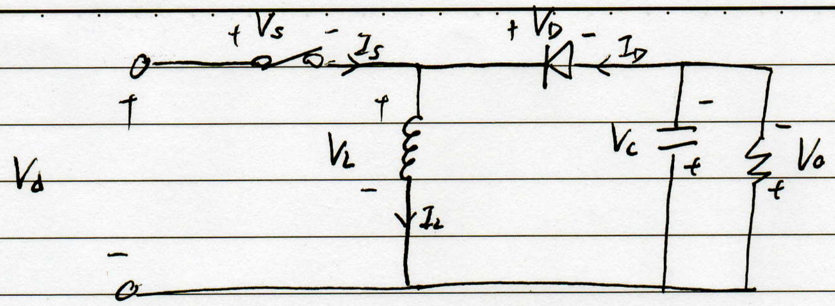
Off state $V_{Load} = 300V$

$$V_{Load} = \frac{300}{2} \times m_a \sin(100\omega t) + \frac{300}{2}$$

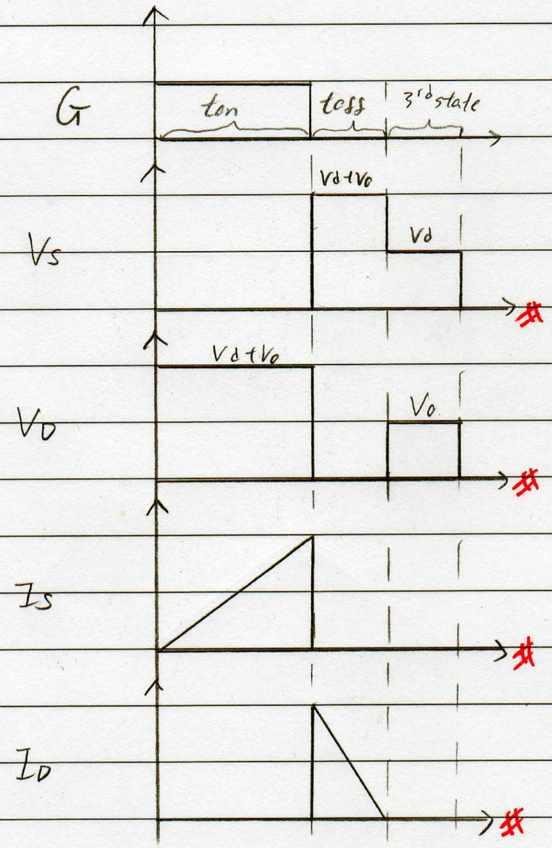
For max V_{Load}, $m_a = 1$

$\therefore V_{Load\,peak\,max} = \frac{300}{2}V + \text{Offset} = \frac{300}{2} + \frac{300}{2} = 300V.$

4)



a)



b) Large amount of Power is require to start an induction motor, if voltage remain, there will be large initial current which may damage the motor. Hence by using voltage boost, initial current will be reduced.

c) Varying stator frequency will reduce the magnetic flux generated, hence lowering the motor speed.