1-1 ENG011055
Electrical Electronics
Electrical Machines

Solution For number 1

Q) V = 415 V, 3-ϕ, 4-kline, f = 50Hz, P = 74.6
PF = 0.7. eff = 85%.

NO 1

1. unity = 1.

$$C = \frac{KVAR}{2\pi f V^2}$$

→ Kvar = P x (tan actual p.f − tan target Pf)

Actual p.f => cos θ = 0.7

θ = cos⁻¹ 0.7

= 45.57

tan (45.57) = 1.0201

target p.f => cos θ = 1

θ = cos⁻¹ 1 = 0

tan 0 = 0

KVAR = 74.6 x (1.0201 − 0)

= 76.0995

≈ 76.10

$$C = \frac{76.10}{2 \times \pi \times 50 \times 415^2}$$

= 0.0000014

≈ 1.4×10^{-6} C

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Contd of No 1

1.) 0.9 Lagging

actual P.f = 1.0201

target P.f = $\cos\theta$ = 0.9

$\theta = \cos^{-1}(0.9)$

$= 154.16$

$\tan\theta = -0.48$

$KVAR = 74.6 \times (1.0201 - (-0.48))$

$= 111.90$

$\simeq 112$

C. $\frac{KVAR}{2\pi f V}$

$= \frac{112}{2 \times \pi \times 50 \times 415^2}$

$= 0.00086$

$\simeq 8.6 \times 10^{-4}$ (

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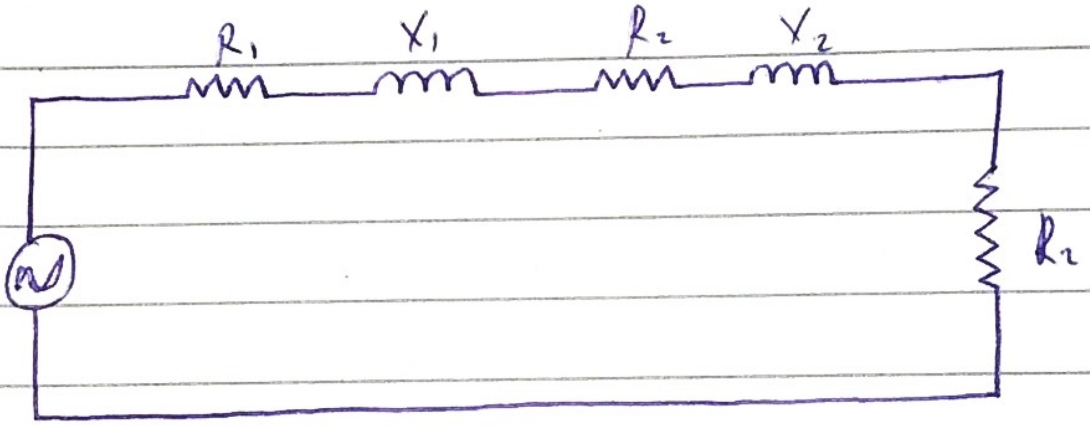
EEE 326 test - Electrical Machine II

2.) V = 415 V
No of Pole 6
f = 50Hz
$Z_1 = 0.25 + J\,0.75$ — stator
$Z_2 = 1.173 + J\,0.52$ — rotor



Supply Voltage Per Phase $V = \frac{415}{\sqrt{3}} = 239.50V$

Referring to rotor
$R_{O_1} = (R_2 + K^2 R_1)$
$= (1.173 + (5/5)^2 \times 0.25)$
$R_{O_2} = 1.3475\Omega$

$XO_2 = (X_2 + K^2 X_1)$

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2.) $= j(0.52 + (5/6)^2 \times 0.75)$

$= 1.041$

$Z_{02} = R_{02} + X_{02}$

$= 1.547 + j\ 1.041$

$Z_{02} = \sqrt{1.347^2 + 1.041^2}$

$= 1.7\ \Omega$

To Find Rotor Current

$I_2 = \frac{E_2}{Z_{02}}$

Recall that $E_2 = kV$.

$= 239.6 \times 0.85$

$= 199.67\ V$

$\therefore I_2 = \frac{199.67}{1.7} = 117.45\ A$

3.) G

F =

15

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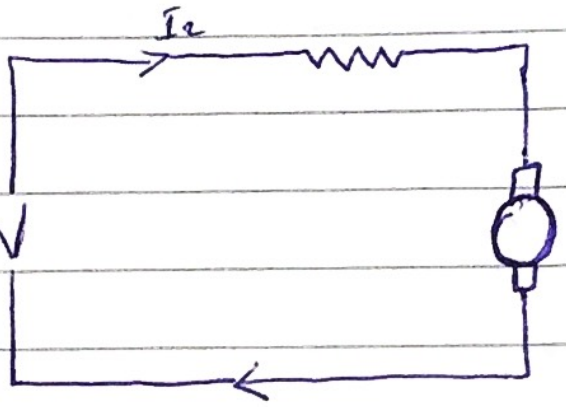
Question 3

3.) Given
$F = 50Hz$, $\frac{1}{4}hp$, $N = 2000.pm$, $V = 220$
15Ω and $0.25H$

On Dc Supply
Supply Voltage = 220V
Current draws $I = 0.7A$



$V = E_b + I_a * R$
$V - [I_a * R] = E_b$
$E_b = 220 - [0.7 * 15]$
$= 209.5V$
Speed on Dc
$N/L = 2000.pm$

On Ac Supply
supply Voltage = 220V
Current draw = $I_a X R = 0.7 X 15 = 10.5V$

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3.) Reactance drop = $I_2 X R = 0.7 \times 15 = 10.5\ V$

Reactance Voltage drop = $I_2 \times X_2$

$= 0.7 \times 2\pi fL$

Where $X_2 = JwL = 2\pi fi$

$= 0.7 \times 2 \times 50 \times 0.75$

$= 54.98\ V$

$\mathcal{E}bac = \sqrt{V^2 - [x_0]^2} - IR$

$= 220^2 - 54.98^2 - 10.5\ V$

$= 202.52 V$

Recall speed

$\frac{N_2}{N_1} = \frac{\mathcal{E}b_2}{\mathcal{E}b}$

$\therefore \frac{\mathcal{E}bac}{\mathcal{E}bdc} = \frac{Nac}{Ndk}$

$Nac = Ndc \times \frac{\mathcal{E}bac}{\mathcal{E}bdc}$

$= 2000 \times \frac{202.52 V}{209.5 V}$

$Nac = 1933.37 rpm$

ii.) Power Factor, $\cos\theta = \frac{\mathcal{E}bac + IR}{V}$

$= \frac{202.52 + 10.5}{220} = 0.968$ Lagging

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B) Torque develop $T_w = \varepsilon_{bac} * I$

$$T_{ac} = \frac{\varepsilon_{bac} \times I}{w}$$

w is Speed in rad/s

$w = 2\pi n$, where n is Speed

$$T_{ac} = \frac{\varepsilon_{bac} \times I}{2\pi \times \frac{N_{ac}}{60}}$$

$$= \frac{202.52 \times 0.7 \cdot 60}{2\pi \times 1933.37}$$

$$= 0.700 \text{ NM}$$