17/Eng04/041 Electrical/Electronics
EEE 326 300L

Question 2

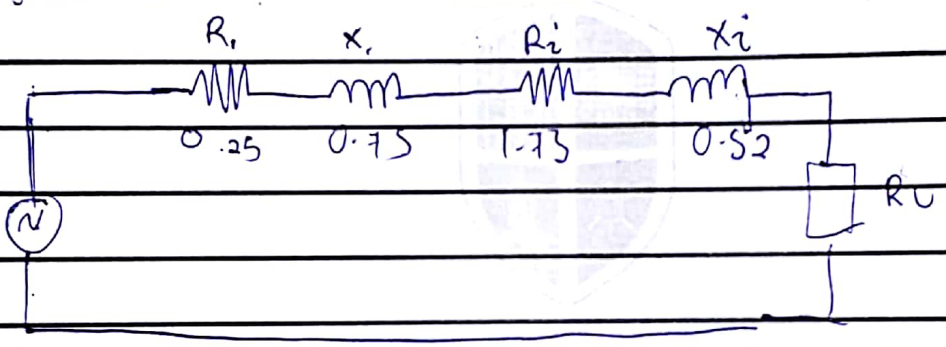
25hp 415V(l-l), 6-pole = 0.6

f = 50Hz K = 5/6

$Z_1 = 0.25 + j0.75$ $Z_2 = 1.73 + j0.52$

↓ ↓

Stator Rotor



Supply voltage $V = \frac{415}{\sqrt{3}} = 239.6$

$\Rightarrow 240V$

Relating to rotor

$R_{o1} = (R_2 + K^2 R_1)$

$= (1.73 + (5/6)^2 0.25) \Rightarrow 1.13 + 0.17361$

$= 1.3466\Omega$

$R_{o1} \simeq 1.347\Omega$

$X_{o2} = (X_2 + K^2 X_1)$

$= 0.52 + (5/6)^2 \times 0.75) \Rightarrow 0.52 + 0.521$

$X_{o2} = 1.0408$

$\simeq j1.041\Omega$

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

$= 1.347 + j1.041$

$Z_{02} = \frac{1.347 + j1.041}{\sqrt{1.347^2 + 1.041^2}}$

angle $= \tan^{-1}(1.041/1.347)$

angle $= \tan^{-1}(0.7728)$

$= 37.69$

$= \sqrt{1.814409 + 1.083681}$

$= \sqrt{2.89809}$

$= 1.7023$

$Z_{02} = 1.7023 < 37.69$

Rotor Current:

$I_2 = \frac{\mathcal{E}_2}{Z_{02}}$

$\mathcal{E}_2 = kV_1$

$= 240 \times 0.833$

$\mathcal{E}_2 = 199.92V$

$I_2 = \frac{199.92}{1.7023} = 117.44A$

Question 2

17/Eng04/041 Electrical/Electronics
EEE 300L
No 3 (3)

f = 50Hz 1/4 p motor N = 2000rpm
V = 220V DC Source
R = 15Ω
L = 0.25H
On DC supply
V = 220V
I = 0.7A

$V - E_b = I_2 * R$
$V - [I_2 * R] = E_b$
$E_b = 220 - [0.7 * 15]$
$= 220 - 10.5$
$= 209.5V$
Speed on DC
N = 2000rpm

On AC supply $= X_L = 2\pi fL$
Supply V = 220V
I = 0.7A
Reactance drop = $I_L \times R = 0.7 \times 15 = 10.5V$
Reactance Voltage drop = $I_L \times X_L = 0.7 \times 2$
$X_L = 2 \times 3.142 \times 50 \times 0.25$
$= 78.55$
$\Rightarrow I \times 78 = 0.7 \times 78.55 = 54.985V$

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300L
No 3

(3)

$E_{bac} = \sqrt{V^2 - [X_s]^2} - I_R$

$= \sqrt{(220)^2 - (54.96)^2} - 10.5V$

$= \sqrt{45377.1996} - 10.5$

$= 213.01 - 10.5$

$= 202.519V$

Speed relation:

$\frac{N_2}{N_1} = \frac{E_{s2}}{E_{s1}}$

$\therefore E_{bac} = \frac{N_{ac}}{N_{dc}}$

E_{sdc}

make speed of AC subject

$N_{ac} = \frac{E_{bac} \times N_{dc}}{E_{sdc}}$

$= \frac{202.519}{209.5} \times 2000$

$= 0.966678 \times 2000$

i) $= 1933.36$ rpm

Power factor =>

ii) Power factor: $\cos\theta = \frac{E_{bac} + I_R}{V}$

$= \frac{202.52 + 0.7 \times 15}{220}$

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300L

No 3 (3)

(i) $\frac{202.52 + 10}{220}$

$= \frac{213.02}{220}$

$\cos\phi = 0.968$ = power factor

(ii) Torque developed

$T = \frac{E_{bc} \times I_c}{\frac{2\pi \times N_{ac}}{60}}$

$= \frac{202.52 \times 0.7 \times 3}{\frac{2 \times 3.142 \times 1933.37}{60}}$

$= \frac{141.764}{262.488}$

Torque $= 0.700$ Nm

(iv) The type of motor is Universal motor

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300L Question 1

V = 415 V, 3-Ø 4 wire f = 50Hz
P = 74.6 KW p.f = 0.7 eff = 85%

1

C = KVAR
2πfV

KVAR = P x
actual pf = Cos θ = 0.7
θ = Cos⁻¹ 0.7
θ = 45.57
tan⁻¹(45.57) = 1.020
Target p.f = Cos θ = 1
θ = Cos⁻¹(1) = 0
tan 0 = 0
KVAR = 74.6 x (1.020 - 0).
= 76.099
= 76.1
C = 76.10 = 1.4 x 10⁰ c
2π x 50 x 415²

ii) 0.9 laggin
actual p.f = 1.020
target p.f = Cos θ = Cos⁻¹(.09)
θ = 154.16
tan θ = tan(154.16)
= -0.46
KVAR = 74.6 x (1.020 - (0.46)
= 111.95
KVAR = 112

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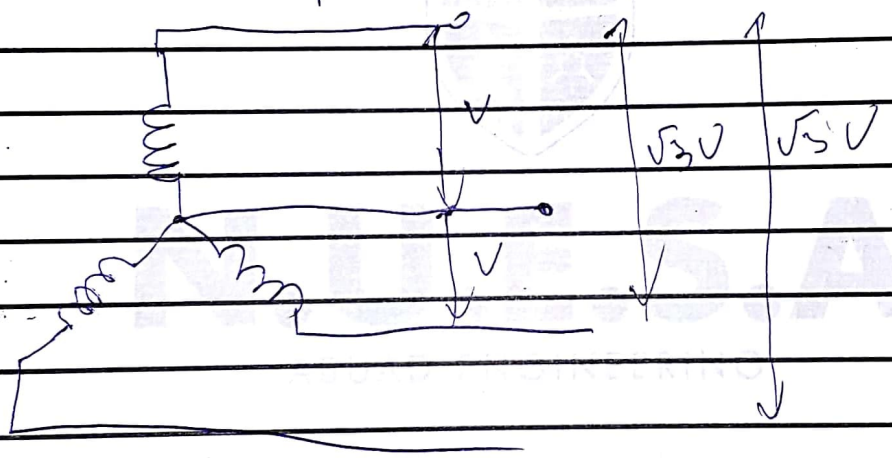
300C 1 1

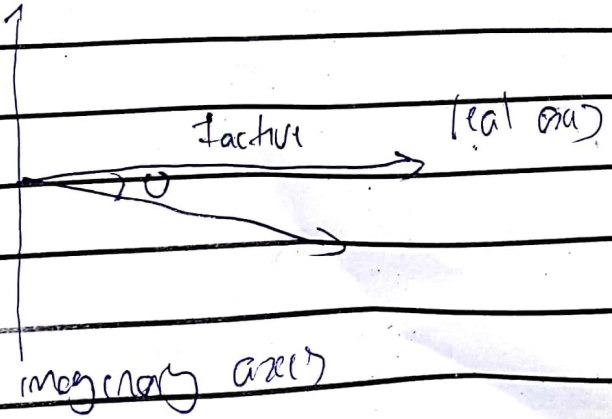
C = kVAR : Question 1
2πfV
= 111.9 (1)
2 × 3.142 × 50 × 415/√3

= 1.4 6.2 × 10⁻⁶C

1) It is a Three phase induction motor



Phasor diagram



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