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# MATRIC NUMBER: 17/ENG06/085

# DEPARTMENT: MECHANICAL ENGINEERING

# COURSE TITLE: ELECTRICAL MACHINES II

# COURSE CODE: EEE326

# ASSIGNMENT ON HARMONICS

1. $S\_{r}=25KVA$

$$V\_{p}=415v$$

$$A 3-φ 4poles$$

$$Frequency=60H\_{z}$$

$$X\_{2}=1.5$$

$$R\_{2}=0$$

$$\cos(θ),P\_{f}=0.8$$

* 1. $E\_{a}=V\_{p}+jX\_{2}+R\_{2}I\_{a}=V\_{p}+jX\_{2}$

$$\cos(θ)=0.8$$

$$cos^{-1}0.8=36.87$$

$$V\_{R\left〈Line Voltage\right〉}=415v$$

$$V\_{p\left〈Phase Voltage\right〉}=\frac{415}{\sqrt{3}}=239.6v$$

$$I\_{a}=\frac{S\_{r}}{\sqrt{3}×V\_{R}}=\frac{25×10^{3}}{\sqrt{3}×415}=34.78$$

$$≅34.78<-36.87$$

$$then;$$

$$E\_{a}=V\_{p}+jX\_{2}I\_{a}$$

$$E\_{a}=239.6<0+1.5<90°×34.78<-36.87$$

 $=270.9+J41.74$

$$=274.1<8.76V\_{p}$$

* 1. $If I\_{f} is increased by 20\%$

$$I\_{a}=\frac{E\_{a}-V\_{R}}{JX\_{2}}=\frac{E\_{a2}-V\_{2}}{JX\_{2}}$$

$$E\_{a2}=1.2×E\_{a}=1.2×274.1=328.92$$

$$E\_{1}\sin(S\_{1}=E\_{2}\sin(S\_{2}))$$

$$\sin(S\_{2}=\frac{E\_{1}\sin(S\_{1})}{E\_{2}})=\frac{274.1\sin(8.76)}{328.92}=0.127$$

$$S\_{2}=sin^{-1}0.127=7.47$$

$$∴ I\_{a}=\frac{328.92<7.47°-239.6<0}{1.5<90°}=28.51-J57.69$$

$$I\_{a}=64.35<-63.7A$$

$$P\_{f}=\cos(θ)$$

 $=\cos(\left〈-63.7\right〉)$

 $= 0.4 Lagging$

$$Q=\sqrt{3}×V\_{L}×I\_{L}×\sin(θ)$$

 $=\sqrt{3}×415×64.35×\sin(63.7)$

$$ =41466.85$$

$$ =41.5KVA$$

* 1. $I\_{a}=\frac{E\_{a2}-V}{JX\_{2}}=\frac{274.1<90°-239.6<0}{1.5<90°}=164.73+j159.73$

$$I\_{a}=229.46<44.12$$

$$P\_{f}=\cos(θ)$$

 $ =\cos(\left〈44.12\right〉)$

$$ =0.7 lagging$$

$$Q=\sqrt{3}×V\_{L}×I\_{L}×\sin(θ)$$

 $=\sqrt{3}×415×229.46×\sin(44.12)$

$$ =114822.48=115KVA$$