**OLAYIDE ARIYO ALEX**

**17/ENG06/064**

**ELECTRICAL MACHINES EEE326**

**ASSIGNMENT III**

**SOLUTIONS**

1. (a) Determine the excitation voltage. Ea when the machine is delivering

rated Kva of 0.8 pf lagging

Ea = Vt – j IaXs ; Vr=415, S=25Kva=25000va

Vt = (Vl/(3^0.5))=239.6v

X3 =1.5Ohms ; Pf= 0.8 lagging; angle=cos^-1(0.8) = 143.13degrees

Ia=S/(Vr\*0.5) = 25000/415.(3^0.5) =34.78A < 143.13degrees

Ea=239.6 – j[(34.78<143.13)(1.5)]

Ea = 270.90 + j41.74

Ea = 274.098v<8.76 degrees

 (b) The field excitation current If is increased by 20% without changing the power

Input from the prime mover. Find the stator current Ia ,power factor and the reactive power applied by the machines

20% increases = 1 + 0.2 =1.2

S = 8.76 degrees

Ea` = 1.2 \* 274.098 = 328.92V

 (Vt\*Ea/Xs)\*sinS = (Vt\*Ea`sins)/Xs sin(S) = Ea/Ea`(sinS)

 = 274.098/328.92\*(sin(8.76))

Sin S` = 0.1269 ; S’ = sin(0.1209) S`= 7.29 degrees

1. Ia` = (Ea`-Vt)/jjXs = [(328.922<7.29 deg) –(239.6<0)]/j1.5 = 27.82- j57.77

Ia` = 64.13A<-64.28 deg

1. Power factor = cos(-64.28deg) = 0.454 lagging
2. Q = 3VtIasin(angle) = 3\* 239.6 \*64.13 \* sin(64.28) = 41529.65 vAR

(C) with the fluid excitation current i.e as in part (a) the input power from the prime mover is increased very slowly. What is the steady state limit? Determine stator current . I.e power factor ad reactive power Q

At max power S = 90 degrees

Pmax = 3EaVt/Xs = 3\*274.098\*239.6/1.5 = 131347.76kw = 131.347kw

Imax = ea-Vt/j Xs = (274.098<90 – 239.60<0)/1.5j = 242.71A<41.16 deg

Power factor = cos(41.16 deg) = 0.7529 leading

Qmax = 3VtI2 maxsin(41.16 deg)

 >>>3\*239.6\*242,71\*0.6582 = 114.829 kvAR