Assiut University
Faculty of Eng.
May , 2015

Term Examination
Electrical Machines(1)

Elect. Eng. Dept.
2 nd Year Elect.
Time : 3 Hours

Answer all questions   **The solution must be include the curves , the connection diagrams and the necessary equations.**   (Max. Marks = 50)

1) **A- Compare** between 3-ph transformers and 3-ph induction motors ? State the reasons.

   B- A 1200 kva , 11000/423 V , $Y_{d\,11}$, 50 c/s , 3-ph transformer has the following parameters in ohms per phase as :

   $Z_{HV} = 1.2 + j\,12$, $Z_{LV} = 0.005 + j\,0.05$
   $R_0 = 5288$, $X_m = 2100$ (referred to HV side)

   i) **Draw** the transformer winding connection Y_{d11} and its vector connection. State the angle between the line voltages of the primary and the secondary ?

   ii) **Obtain** and draw the equivalent circuit of the transformer referred to the primary and its vector diagram at a lead power factor ?

   iii) **When** the LV side is **opened** , and the HV side is connected to 11000 V line voltage , find the line current and the total power drawn .

   iv) **When** the LV side is **short-circuited** , the supply HV side is adjusted to flow the rated current .Find the values of the supply line voltage, line current and the total power drawn ?

   v) **At 0.6** power factor lead , calculate the **maximum efficiency** and its load ? Find also the corresponding approximate regulation ?

   vi) **Find** the power factor at **zero** regulation?   (18 Marks)

----

2) **A- Compare** between two methods used for starting a 3-ph **Y connected** squirrel-cage induction motor ?

   B- A 48 BHP , 6-pole , 440 V ,delta connection , 50 s/c ,3-phase induction motor has the following full-load values as :

   Efficiency = 0.895 , power factor = 0.9 , input power to rotor = 37.8 kw . Total mechanical power losses =1108 W . The ac resistance between two stator lines = 0.1867 Ω .

P T O

Draw the complete power flow diagram . **At full-load , calculate and find :**

i) **The input power** , the stator copper loss and iron loss . The rotor copper loss, the speed and the slip ?

ii) **The speed** , the rotor frequency , the developed torque , the shaft torque in kg.m.) and the mechanical torque loss ? **(11 Marks)**

---

3) **A-** **Draw** the T-N curve of a 3-ph induction-motor indicating the starting and pull-out torques and range of operation. Assume and draw on the above curve any T-N load torque and indicate the operating point ?

B- A 4-pole , 380V, Y connected , 50 c/s , 1462 rpm induction motor has a dc resistance **between two stator lines = 0.9 Ω** . The skin effect = 1.15 . The test readings give the following results as :

	Line voltage/V	Line current/A	Total power/W
Running light	380	5.77	560
Blocked rotor	60	17.32	790

At rated values , find:

i) **The parameters** of the equivalent circuit . Draw it and its vector diagram?

ii) **Using the approximate circuit to find :**

$\overrightarrow{I'_2} , \overrightarrow{I_1}$, input power , out power , developed torque and the efficiency ? Given that : The total mechanical losses = 4 % of the mechanical developed power . **(11 Marks)**

---

4) **A-** **State** the differences between the two types of 3-ph induction motor ?

B- A 12-pole ,440 V, delta connection , 50 c/s ,3-ph induction motor , the rotor emf speed = 15 rpm , has the following data in ohms per phase as : $R_1 = 2.95$, $X_1 = 6.82$, $R_2 = 0.5$, $X_2 = 1.03$. The effective reduction factor from the secondary to the primary = 2 .

The total mechanical losses = 332 W . **At rated voltage** , the no –load current = 3 A and the total drawn power = 270 W .

Draw the approximate equivalent circuit at rated values and draw also its vector diagram. **Then calculate ,using the above circuit , the following :**

i) **The rotor** speed and the rotor emf frequency?

ii) $\overrightarrow{I_2'}$, $\overrightarrow{I_1}$,the stator current , the air-gap power , the input power , the out torque , BHP and efficiency ? **(10 Marks)**

Prof.Dr. H.I. Abou-Faddan   End of questions