ID: 15276

NAME: SALMAN FAROOQ

Pg#1

ASSIGNMENT 2

Q1(a) Write a short note on power stages of an induction motor and torque developed by induction motor? Discuss the relation of torque, mechanical power and rotor output? (6)

(b) The power input to the rotor of 440V, 50Hz, 6 pole, 3-phase, induction motor is 80kW. The rotor electromotive force is observed to make 100 complete alteration per minutes. Calculate (1) the slip, (2) the rotor speed. (3) rotor copper loss per phase? (4)

Q2) Short question answers? (5)

(1) How changes in supply voltages and frequency do affects the perfomances of induction motor?

(2) What factors determine the direction of rotation of the motors?

3) What is meant by single phasing and what are its causes?

Pg# 2

(4) How can motors be protected against single phasing?

(5) What are the indications of winding faults in an induction motors?

Q3) Make 15 slides presentation on assigned topic of AC machines? (5)

Q1)(a) Write a short note on power stages of an induction motor and torque developed by induction motor? Discuss the relation of torque, mechanical power and rotor output.

Ans:

POWER STAGES IN AN INDUCTION MOTOR:

Different stages of power development in an induction motor.

- Stator iron loss (consisting of eddy and hysteresis losses) depen on the supply frequency and the flux density in the iron core. It is practically constant.
- The iron loss of the rotor is, however, negligible because frequency of rotor current under normal running conditions

is always small. Total rotor CU loss = 3I2 2R2.

• An induction motor develops gross torque Tg due to gross rotor out.

Torque produced:

An induction motor develops torque by inducing current to the rotor, which is proportional to the differential speed of the rotor and the rotating magnetic field in the stator.

Torque in a 3-phase induction motor is created by the interaction between the rotating magnetic field produced by the alterning current in the stator windings and the magnetic field produced by the induced current in the rotor assembly..... The two field interact, producing torque.

RELATIONSHIP OF TORQUE.

The developed torque or induced Torque Equation in a machine is defined as the torque generated by the electrical to mechanical power conversion. The torque is also known as electromagnetic torque this develop torque in the motor differs from the actual torque available at the terminal of the motor, which is almost equal to the friction and wind age torque on the machine.

QUES 1(b):

(b) The power input of the rotor of 440V, 50Hz, 6 pole, 3-phase, induction motor is 80KW. The rotor electromotive force is observed to make 100 complete alteration per minute. Calculate (1) the slip, (2) the rotor speed, (3) rotor copper loss per phase? (4)

Solution:

(i)

100 alterations/minute = $\frac{100}{60}$ cycles/sec

1.6667Hz = sf

Hence, the Slip, $s = \frac{1.6667}{50} = 0.3333$ P.U. or 3.33%

(ii) rotor speed, $N = (1-s)N_s = (1-0.0333) \times 1000$

Since $N_s = \frac{120}{6} \times 50 = 1000$ rpm, $N_s = 966.67$ rpm

(iii) rotor copper losses/phase = $\frac{1}{3}$ (s. rotor input)

total rotor power input = 80KW

rotor power input per phase = 80/3 KW

rotor copper losses per phase = $\frac{0.0333}{3} \times 80 = 0.8888$ KW

QUES 2 Sharks notes:

(1) How changes in supply voltage and frequency do effects the performance of induction motor?

ANS: High voltage decreases both power factor and slip, but increas torque, Low voltage does just opposite. Increased in frequency increases power factor but decrease the torque. However every

Pg#6

Per cent slip remains unchanged Decrease in frequency decreases ~~the torque~~ power factor but. Increases torque leaving per cent slip unaffected as before.

(2) What factors determine the direction of rotation of motor?

ANS:

The phase sequence of the supply lines and the order in which these lines are connected to the stator winding.

(3) What is meant by single-phasing and what are its causes?

ANS: Single-phasing is a Power supply-related electrical faults in case of an induction motor. It occurs when one of the 3 phase circuits in a three-phase motor is opened; hence the remaining circuits carry excess current.

Pg #7

CAUSES:

Single phasing is a power supply Related electrical fault in case of an induction motor. It occurs when one of the 3 phase circuits in a three-phase motor is opened; hence the remaing circuits carry excess current. The condition of single phasing is usually caused when:-

* One or more out of the three back up fuse blows (or fuse wir. melts if the fuse is of wire type.

* The motor circuits has contactor which supply the current. One of the contactors is open circuited.

(4)

How can motors be protected against single phasing?

ANS: Such a conditions requi that the motors is provided with Protection that will disconnect

pt from the system before the motor is permenently damaged. All motors above 500KW are to be provided with protection devices or equipment to prevent any damage due to single phasing.

(5) What are the inductions of winding fault in an induction motor?

ANS:

INDUCTIONS:

- excessive current drawn by motor.
- over heating of stator frame at particular spot
- Smell of burning.
- Jerky operation motor.
- motor may not start.
- Motor not able to provide full load torque
- imbalance current drawn by motor.

Fault can be observed with the help of digital millimeter.