Answer 1(a):

Power stages in an Induction Motor:-

Different stages of Power development in a Induction motor.

* Stator Iron loss depends on the supply frequency and the flux density in the Iron Core it is Praticaly Constant.
* The Iron loss of the rotor is however negligible because frequency of rotor Currents under normal running Conditions is always Small. Total rotor Cu loss = 3I2 2R2.
* An Induction motor develops gross torque Tg due to gross rotor output Pm

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 alternating Current in the Stator windings and the magnetic field Produced by the Induced

Current in the rotor assembly .... The two fields Interact Producting torque.

## Relationship of torque:-

The developed torque or Induced Torque Equation in a machine is defined as the torque generated by the electric of mechanical Power Conversion The torque is also known as electromagnetic torque This developed torque in the motor differs from the actual torque available at the terminals of the motor which is almost equal to the friction and wind age torques on the machine

## Answer 1(b):.

Solution:- (I) 100 alterations/minute = $\frac{100}{60}$ Cycles/sec.

1.6667 Hz = sf

Hence the slip $S = \frac{1.6667}{50} = 0.3333$ Pu or 3.333%.

ii) Rotor Speed $N = (1-s)Ns = (1-0.03333) \times 1000$

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

III) Rotor Copper lasses/Phase = 1/3 (s. rotor Input)

total rotor Power Input = 80kw

Rotor Power Input Per Phase = 80/3 kw

Rotor Copper Losses Per Phase =

$$\frac{0.0333}{3} \times 80 = 0.8888 kw$$

**Answer 2 (i):** High voltage decreases both Power factor and Slip but Increases torque Low voltage does just the oppasite Increase in Frequency Increases Power factor but decreases the torque However Per Cent Slip remains unchanged Decrease in Frequency decrease Power factor but Increases torque leaving Per Cent Slip unaffected a before

II) The phase sequence of the Supply lines and the order in which these lines are Connected to the stator winding.

III) Single Phasing is a Power Supply related 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 remaining Circuits Carry excess Current

**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 remaining Circuits Carry excess Current This Condition of Single Phasing is usually Caused when

* one or more out of the three back up fuse blows
* The motor Circuit has Contactors which Supply the Current one of the Contactors is open Circuited.

iv) Such a Condition requires that the motor is Provided with Protection that will disconnect it from the System before the motor is Permanently damaged. All motors above 5oolw are to be Provided with Protection devices or equipment to Prevent any damage due to Single Phasing.

v) INDICATION:

- excessive Current drawn by motor
- Over heating of Stator frame at Particular Spot
- Smell of burning
- Jerky operation motor
- motor may not start
- Imbalance Current drawn by motor.

Fault Can be observed with the help of digital millimeter.