# Sheet (4)

## Electrical Machines IV – 2016/2017

[1] The Power input To a 3-phase induction motor is 60 kW. The Stator Losses Total 1 kW. Find The mechanical Power developed and The rotor Copper Loss per phase if The motor is running with a slip of 3%. [ans.: $P_{mech} = 57.23$ kWatt – $P_{(cu\,rotor)/ph} = 0.59$ kWatt]

[2] The Power input To The rotor of a 400 V, 50 Hz, 6-Pole, 3-phase induction motor is 20 kW. The slip is 3%. Calculate:
(i) The frequency of The rotor Currents.
(ii) rotor speed.
(iii) rotor Copper Losses.
(iv) rotor resistance/ph if rotor Current is 60 A.
[ans: (i) 1.5 Hz (ii) 970 rpm (iii) 600 Watt (iv) 0.055 Ω]

[3] A 3-phase, 6-Pole, 50-Hz induction motor develops 3.73 kWatt at 960 rpm. What will be The stator input if The stator loss is 280 Watt?
[ans.: $P_{in} = 4156$ Watt]

[4] The Power input To The rotor of a 400 V, 50-Hz, 6-Pole, 3-φ IM is 75 kW. The rotor Electromotive force is observed To make 100 Complete alternation per minute. Calculate:
(i) slip.
(ii) rotor speed.
(iii) rotor Copper losses per phase.
(iv) mechanical Power developed.
[ans: (i) 0.0334
(ii) 967 rpm
(iii) 835 rpm
(iv) 72495 rpm ]

[5] The Power input To a 500 V, 50 Hz, 6-pole, 3-φ induction motor running at 975 rpm is 40 kW. The stator losses are 1 kW and The friction and Windage losses Total 2 kW. Calculate:
(i) The slip.
(ii) Rotor Copper losses.
(iii) shaft Power.
(iv) The efficiency.
[ans.: (i) 0.025
(ii) 0.975 kW
(iii) 36.025 kW
(iv) 90% ]

(Good Luck Dr. Eng. Emad Sami)

6 A 100 kW (output), 3300V, 50 Hz, 3-φ Y-Connected induction motor has a synchronous speed of 500 rpm. The full-Load slip is 1.8% and full-load input power factor is 0.85. Stator Copper loss = 2440 W. Iron loss of stator = 3500 W. Rotational Losses = 1200 W. Calculate:

(i) The rotor Copper loss.
(ii) The Stator Line Current.
(iii) The full-load motor Efficiency.

[Ans.: (i) 1855 Watt
(ii) 22.4 A
(iii) 91.75% ]

7 A 400 V, 50-Hz, 6-pole, Δ-Connected, 3-φ induction motor Consumes 45kW with a Line Current of 75A and runs at a slip of 3%. If Stator iron loss is 1200 Watt. The Windage and friction Losses is 900 W and The resistance of the stator per phase is 0.18Ω.

Calculate: (i) Power supplied To The rotor.
(ii) rotor Cu. Losses.
(iii) output power.
(iv) efficiency.
(v) Shaft Torque developed.

[Ans.: (i) 42788 Watt
(ii) 1284 Watt
(iii) 40604 Watt
(iv) 90.23%
(v) 400 N.m ]

[Hint : Motor Consumes 45kW.... means $P_{in}$ = 45kW]

8 A 400V, 3-φ, 50Hz, 4-Pole, Y-Connected induction-motor takes a Line Current of 10 A with 0.86 pf lag. Its Total Stator losses are 5% of The input power. Rotor Copper Losses are 4% of The input To The rotor, and mechanical Losses are 3% of The input To The rotor.

Calculate: (i) slip and rotor speed.
(ii) Torque developed in The rotor.
(iii) Shaft Torque

[Ans.:
(i) 4%
(ii) 36 Nm
(iii) 34.9 Nm ]

9 An 18.65 kWatt, 4-Pole, 50 Hz, 3-phase induction motor has friction and windage losses of 2.5% of The output. The full-load slip is 4%. Compute for full-load
(i) Rotor input Power (ii) Rotor Cu. Losses
(iii) Shaft Torque (iv) gross electromagnetic Torque

[Ans.:
(i) 19913 Watt
(ii) 796.5 Watt
(iii) 123.7 Nm
(iv) 126.8 Nm ]

10 Draw The power Flow diagram of induction motor.