# INDUCTION MOTOR-I (ASYNCHRONOUS MOTOR)

## UNIT-III

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# CONTENTS

**Torque and power equations**

**Lecture No. 5**

# TORQUE-EQUATION

- Torque, can be derived from power equation in term of mechanical power or electrical power.

$$Power, P = \omega T, where\ \omega = \frac{2\pi n}{60}(rad/s)$$

$$Hence, T = \frac{60P}{2\pi n}$$

*Thus,*

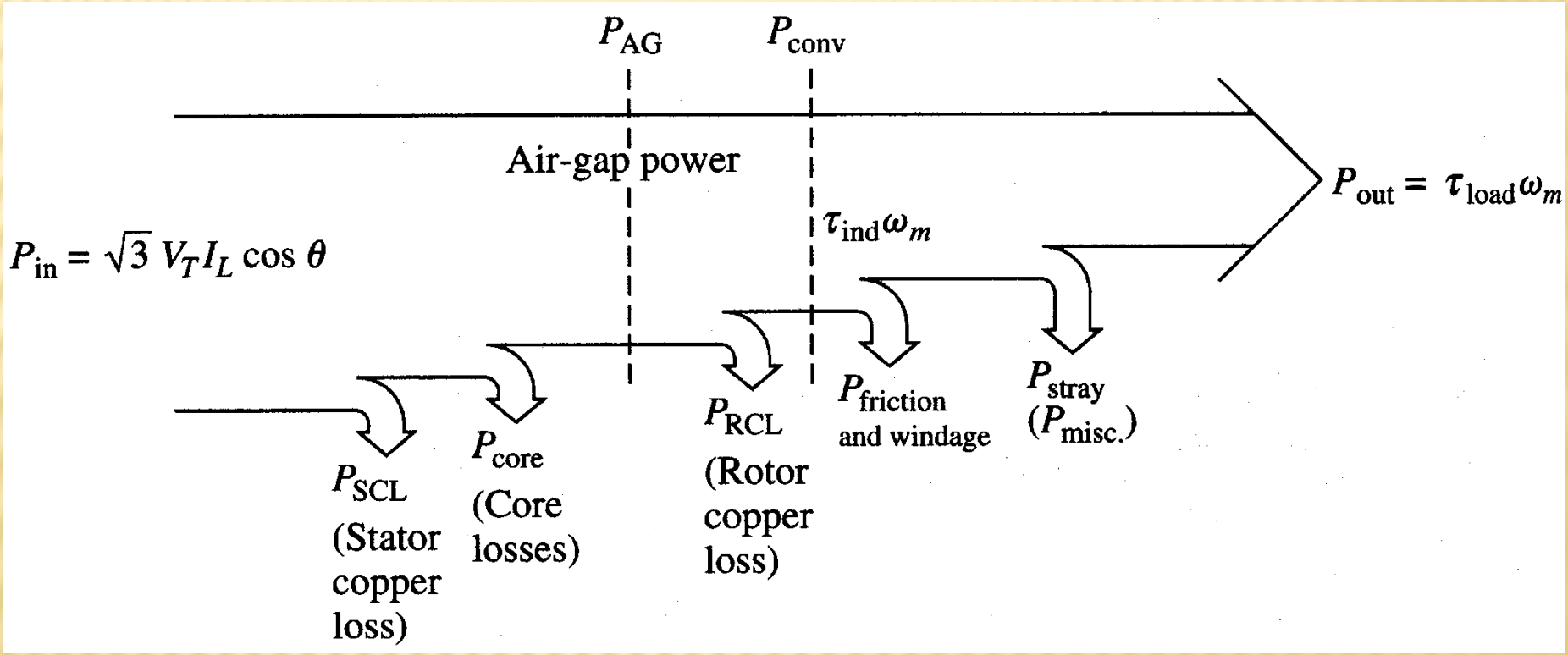
$$Mechanical\ Torque, T_m = \frac{60P_m}{2\pi n_r}$$

$$Output\ Torque, T_o = \frac{60P_o}{2\pi n_r}$$

# POWER LOSSES IN INDUCTION MACHINES

- Copper losses
  - Copper loss in the stator ($P_{SCL}$) = $I_1^2 R_1$
  - Copper loss in the rotor ($P_{RCL}$) = $I_2^2 R_2$
- Core loss ($P_{core}$)
- Mechanical power loss due to friction and windage
- How this power flow in the motor?

# POWER FLOW IN IM



# POWER RELATIONS

$$P_{in} = \sqrt{3}\, V_L I_L \cos\theta = 3 V_{ph} I_{ph} \cos\theta$$

$$P_{SCL} = 3\, I_1^2 R_1$$

$$P_{AG} = P_{in} - (P_{SCL} + P_{core})$$

$$P_{RCL} = 3 I_2^2 R_2$$

$$P_{conv} = P_{AG} - P_{RCL}$$

$$P_{out} = P_{conv} - (P_{f+w} + P_{stray})$$