

# **3- $\phi$ INDUCTION MACHINE-II (ASYNCHRONOUS MOTOR)**

## **UNIT-IV**

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# CONTENTS

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- Starting Methods
- Deep bar and double cage rotors
- Cogging & Crawling
- Speed Control (with and without emf injection in rotor circuit.)

# STARTING METHODS

- Direct on Line starting
- Stator resistor, reactor starting method
- Auto transformer starting
- Star Delta starting
- Rotor resistor starting method (for WRIM only)

**Note:** First four methods can be used for both squirrel cage as well as Wound Rotor type of Induction Motor (WRIM), but last method is used only for WRIM.

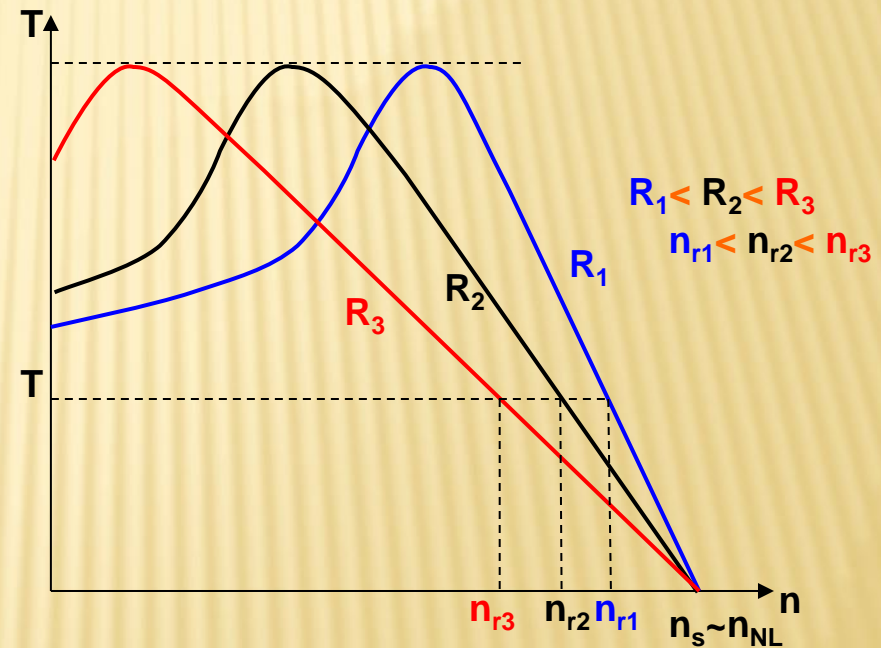
# SPEED CONTROL

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- ✘ There are 3 types of speed control of 3 phase induction machines
  - i. **Varying rotor resistance**
  - ii. **Varying supply voltage**
  - iii. **Varying supply voltage and supply frequency**

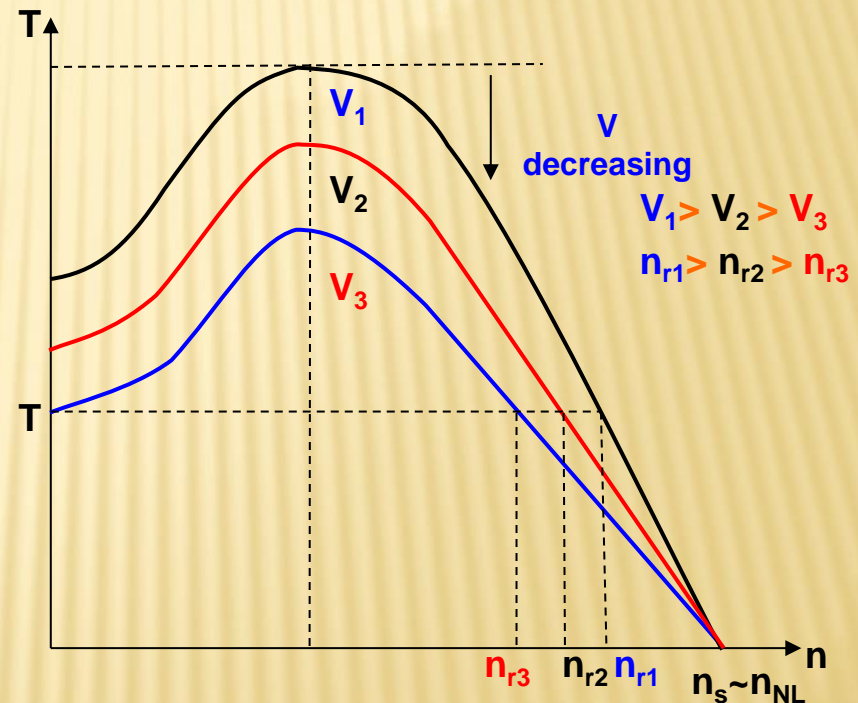
# VARYING ROTOR RESISTANCE

- ✘ For wound rotor only
- ✘ Speed is decreasing
- ✘ Constant maximum torque
- ✘ The speed at which max torque occurs changes
- ✘ Disadvantages:
  - + large speed regulation
  - + Power loss in  $R_{ext}$  – reduce the efficiency



# VARYING SUPPLY VOLTAGE

- ✘ Maximum torque changes
- ✘ The speed which at max torque occurs is constant (at max torque,  $X_R = R_R/s$ )
- ✘ Relatively simple method – uses power electronics circuit for voltage controller
- ✘ Suitable for fan type load
- ✘ Disadvantages :
  - + Large speed regulation since  $\sim n_s$



# VARYING SUPPLY VOLTAGE AND SUPPLY FREQUENCY

- ✘ The **best method** since supply voltage and supply frequency is varied to keep  $V/f$  constant
- ✘ **Maintain speed regulation**
- ✘ **uses power electronics** circuit for frequency and voltage controller
- ✘ Constant **maximum torque**

