SNS COLLEGE OF TECHNOLOGY

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Coimbatore-641035

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

19EET301 / POWER ELECTRONICS AND DRIVES

III YEAR / V SEMESTER

UNIT – IV : PART B - DC DRIVES

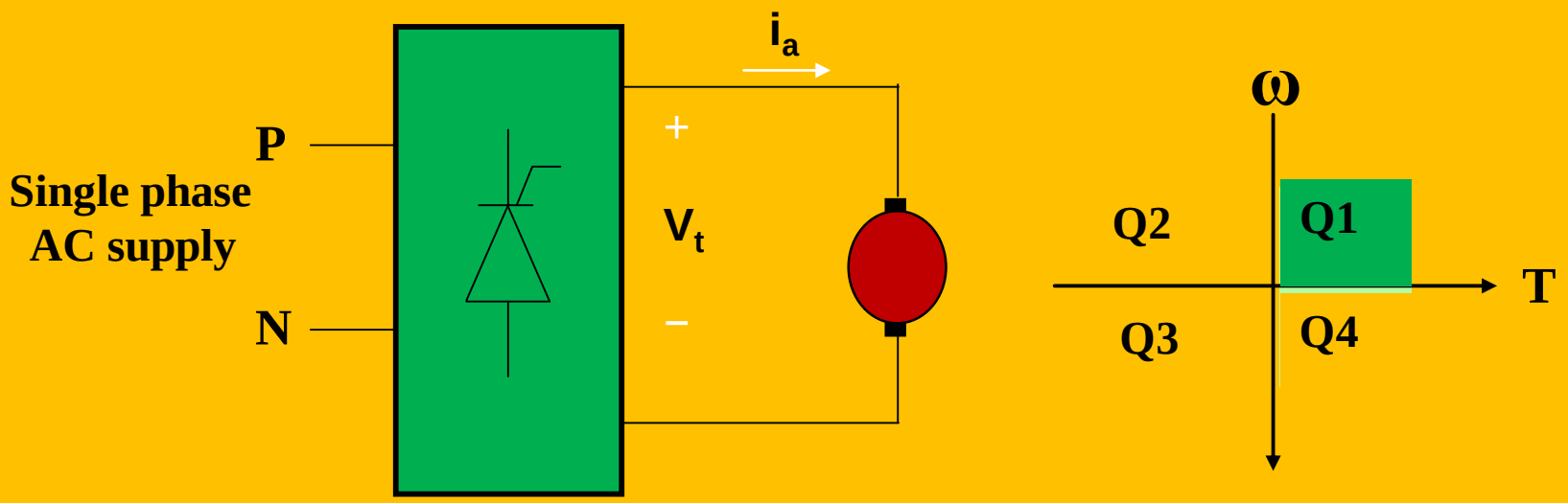
THYRISTOR CONVERTER FED DC DRIVE – 1Q, 2Q OPERATION

TOPIC OUTLINE

What we'll discuss?

- Single phase 1Q drive
- Single phase 2Q drive
- Three phase 2 Q drive
  - A case study video

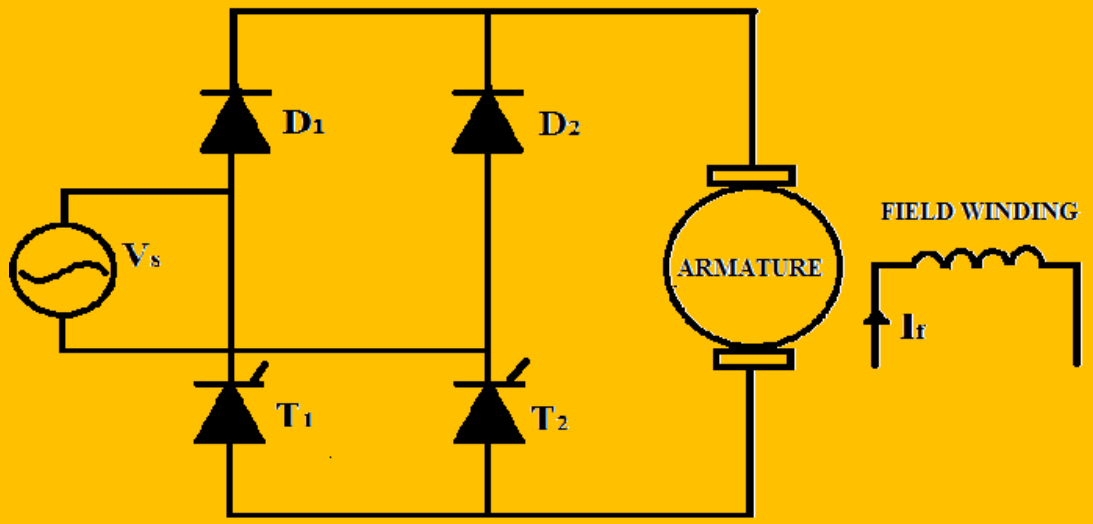
SINGLE PHASE 1 Q DRIVE



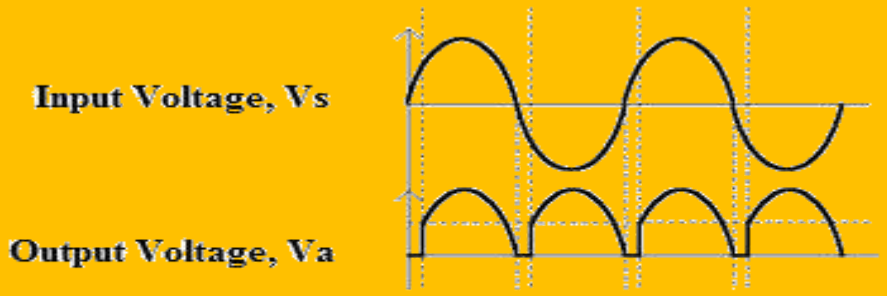
BLOCK DIAGRAM & QUADRANT OF OPERATION

SINGLE PHASE 1 Q DRIVE

CIRCUIT DIAGRAM



WAVEFORM



SINGLE PHASE 1 Q DRIVE

A CASE STUDY VIDEO
OF
FAN DRIVE

SINGLE PHASE 1 Q DRIVE

CALCULATION OF OUTPUT VOLTAGE

The circuit – single phase half controlled converter fed DC drive– 1 Quadrant drive

INPUT VOLTAGE: 230 V AC is RMS value.

OUTPUT VOLTAGE: $V_a =$ $(1+ \cos \alpha)$ is Average value.

Switch position is Low : Assume $\alpha = 170^0$, then $V_a = [(230 \sqrt{2}) / \pi](1+ \cos 170)$

$V_a = 61$ V

Switch position is Med : Assume $\alpha = 75^0$, then $V_a = [(230 \sqrt{2}) / \pi] (1+ \cos 75)$

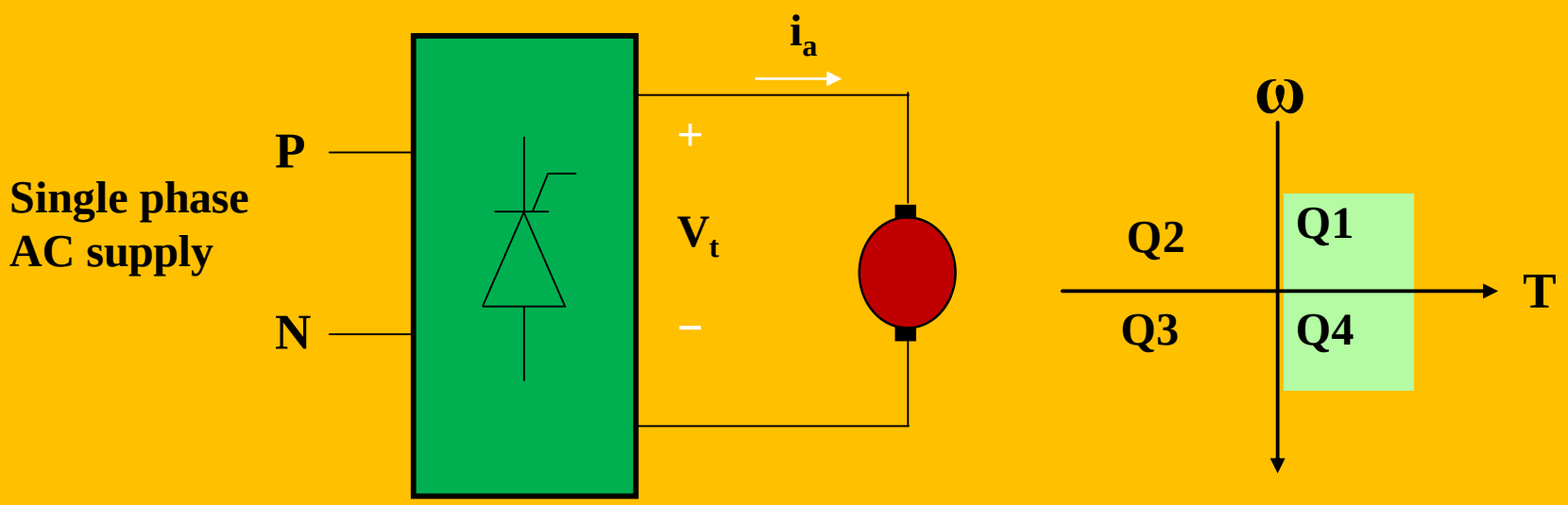
$V_a = 129$ V

Switch position is High : Assume $\alpha = 10^0$, then $V_a = [(230 \sqrt{2}) / \pi] (1+ \cos 10)$

$V_a = 204$ V

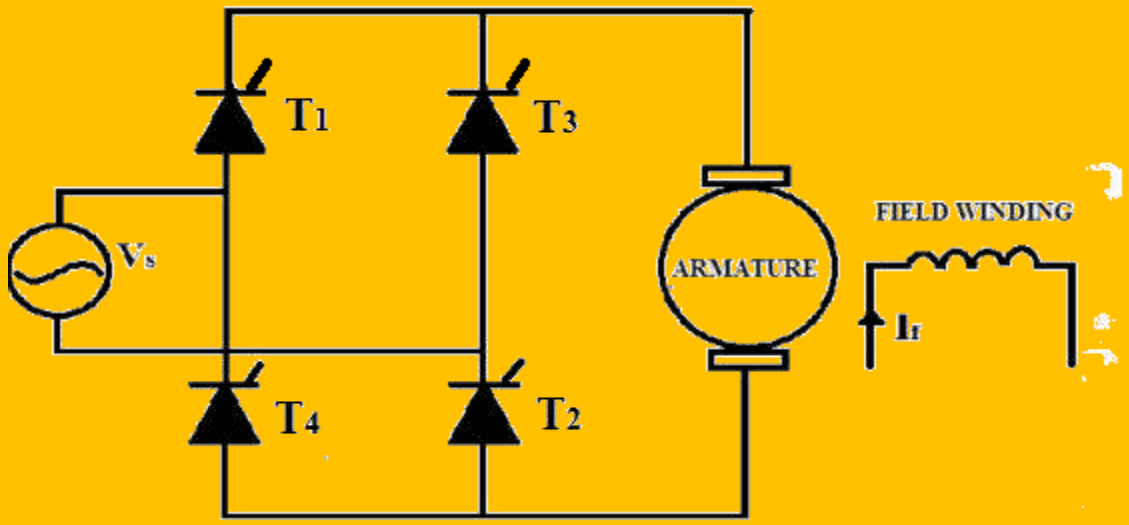
Greater the voltage, higher the speed of motor.

SINGLE PHASE 2 Q DRIVE



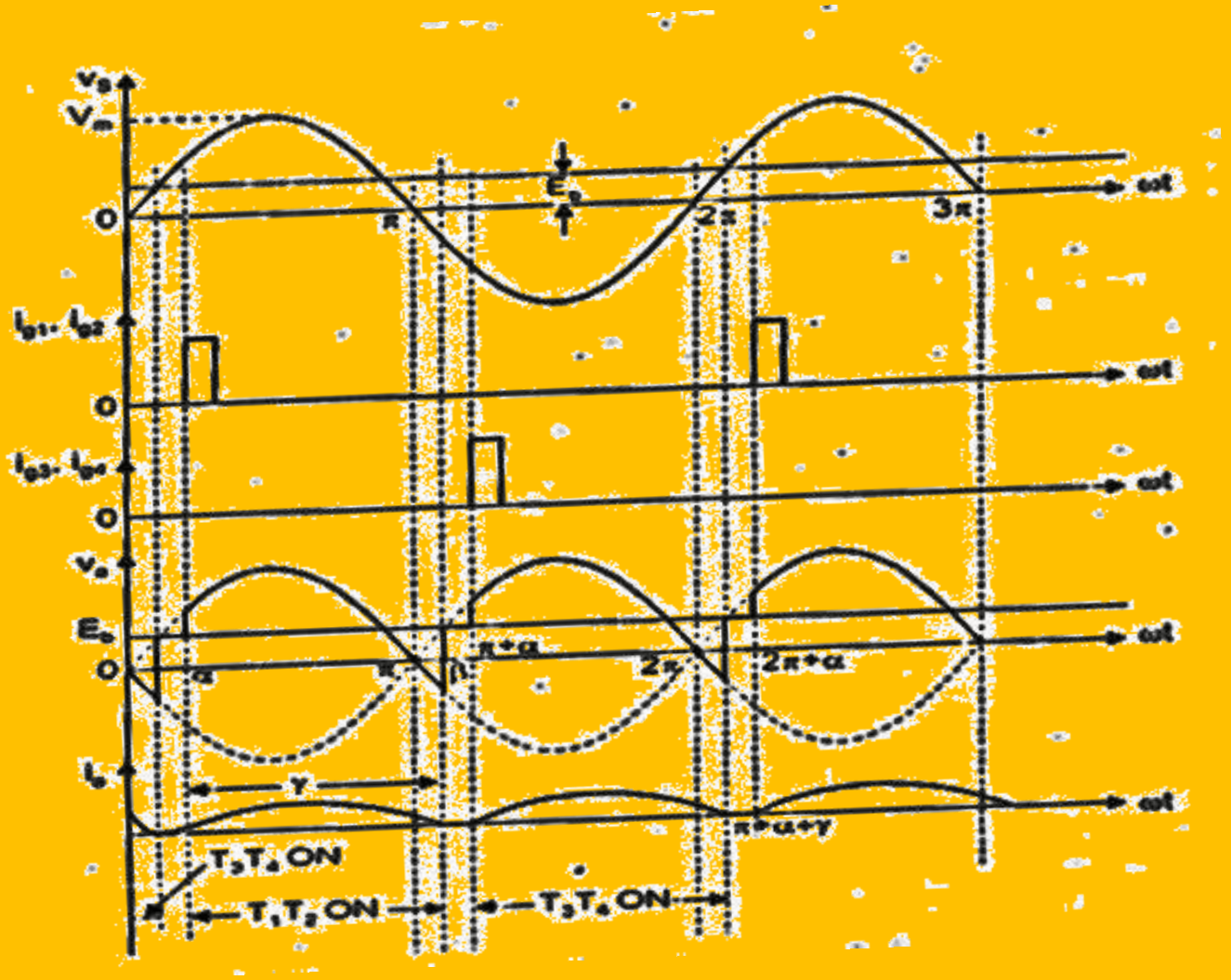
BLOCK DIAGRAM & QUADRANT OF OPERATION

SINGLE PHASE 2 Q DRIVE



CIRCUIT DIAGRAM

SINGLE PHASE 2 Q DRIVE



INPUT / OUTPUT WAVEFORMS

SINGLE PHASE 2 Q DRIVE

Back EMF , E_b : $V_a - I_a R_a$

Speed, N : E_b / Φ

Let,

Vi, Input Voltage (AC) = 220 V (RMS value), Ia = 150A, Ra = 0.06 Ω, Φ = 0.2 (K)

Va, Output Voltage (DC) $= \frac{2Vm}{\pi} \cos\alpha$

(i) If α = 30, then Va = { [2 * 220 √2] / π } cos 30 = 172 V

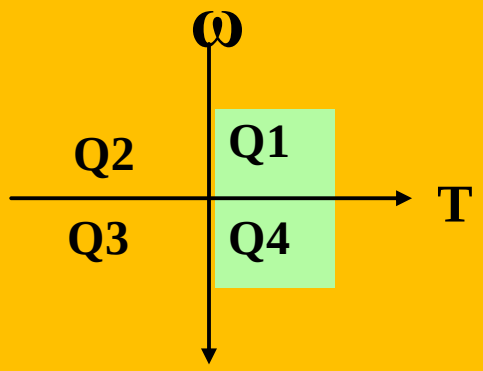
Eb = 163 V

Therefore speed, N = 163 / 0.2 = **815 RPM**

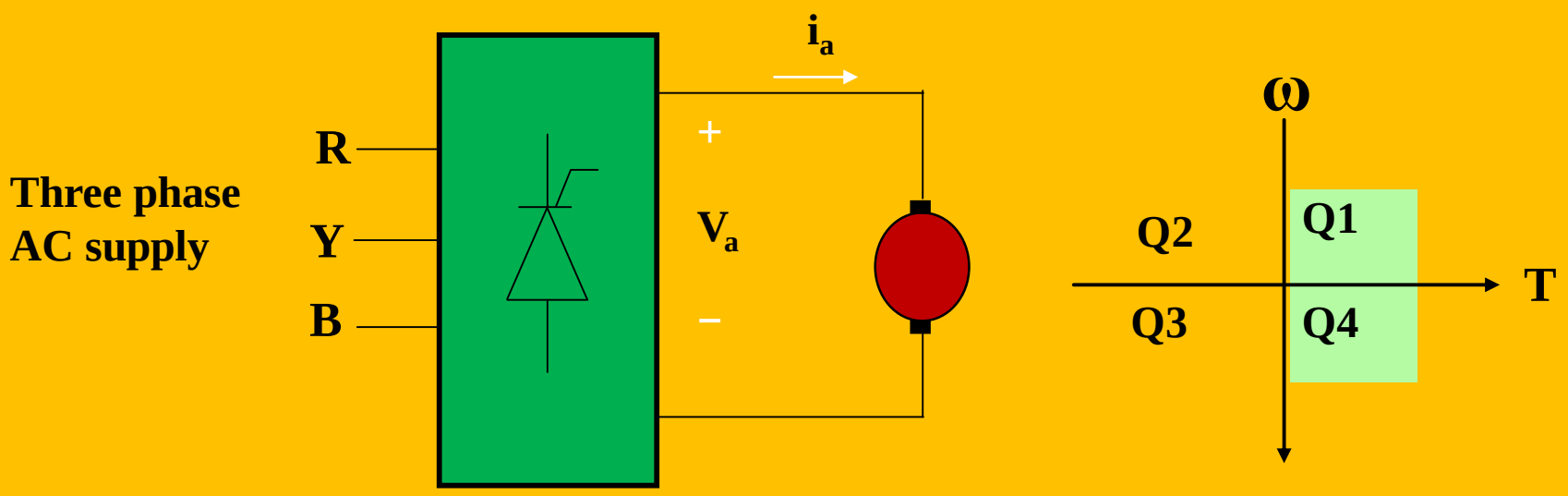
(ii) If α = 160, then Va = - 186 V

Eb = - 195 V

Therefore speed, N = -195 / 0.2 = **- 975 RPM**

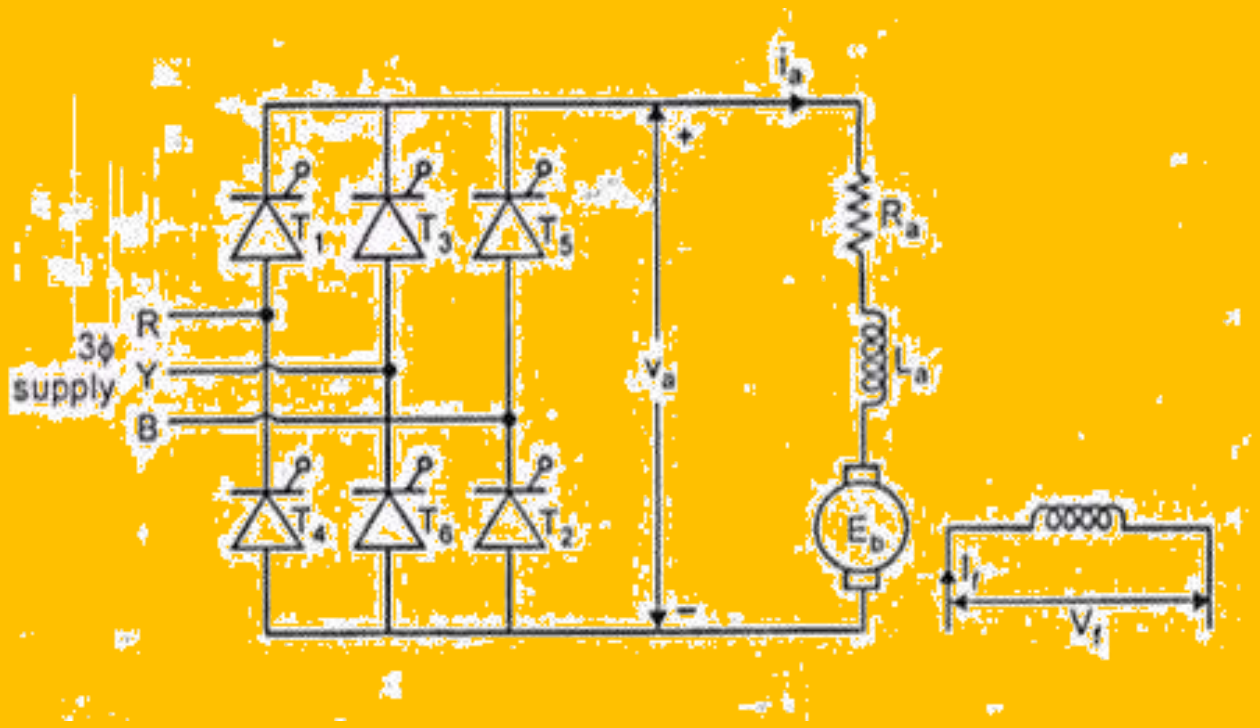


THREE PHASE 2 Q DRIVE



BLOCK DIAGRAM & QUADRANT OF OPERATION

THREE PHASE 2 Q DRIVE



CIRCUIT DIAGRAM OF SEPARATELY EXCITED DC MOTOR DRIVE

Evaluation Time

Summarize the content…

Assignment:

Draw the thyristor fed circuit diagram for DC Series Motor

Thanking You.