**SNS COLLEGE OF ENGINEERING**
**Coimbatore-35**
**An Autonomous Institution**

Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A' Grade
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai
**DEPARTMENT OF CSE (IoT)**

# 23ECT102- ELECTRONIC DEVICES AND CIRCUITS

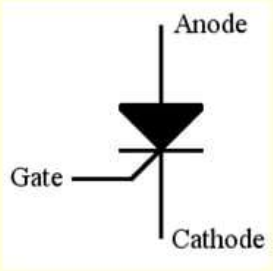
**I YEAR/ II SEMESTER**

UNIT 2– **P-N Junction Diode**

## Silicon Controlled Rectifiers

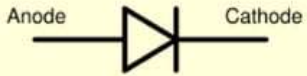
# Silicon Controlled Rectifier

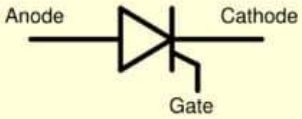
- A **S**ilicon **C**ontrolled **R**ectifier (or **S**emiconductor **C**ontrolled **R**ectifier) is a four layer solid state device that controls current flow
- The name "silicon controlled rectifier" is a trade name for the type of **thyristor** commercialized at General Electric in 1957



# Silicon Controlled Rectifier

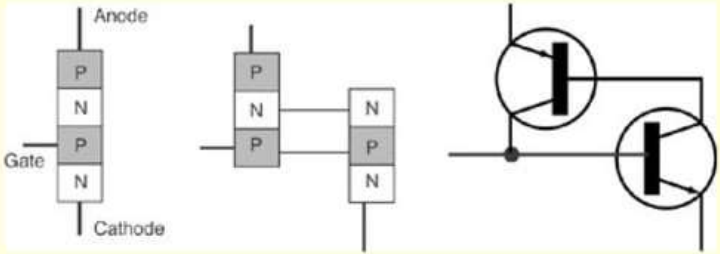
- An SCR can be seen as a conventional rectifier controlled by a gate signal
- It is a 4-layered 3-terminal device
- When the gate to cathode voltage exceeds a certain threshold, the device turns 'on' and conducts current

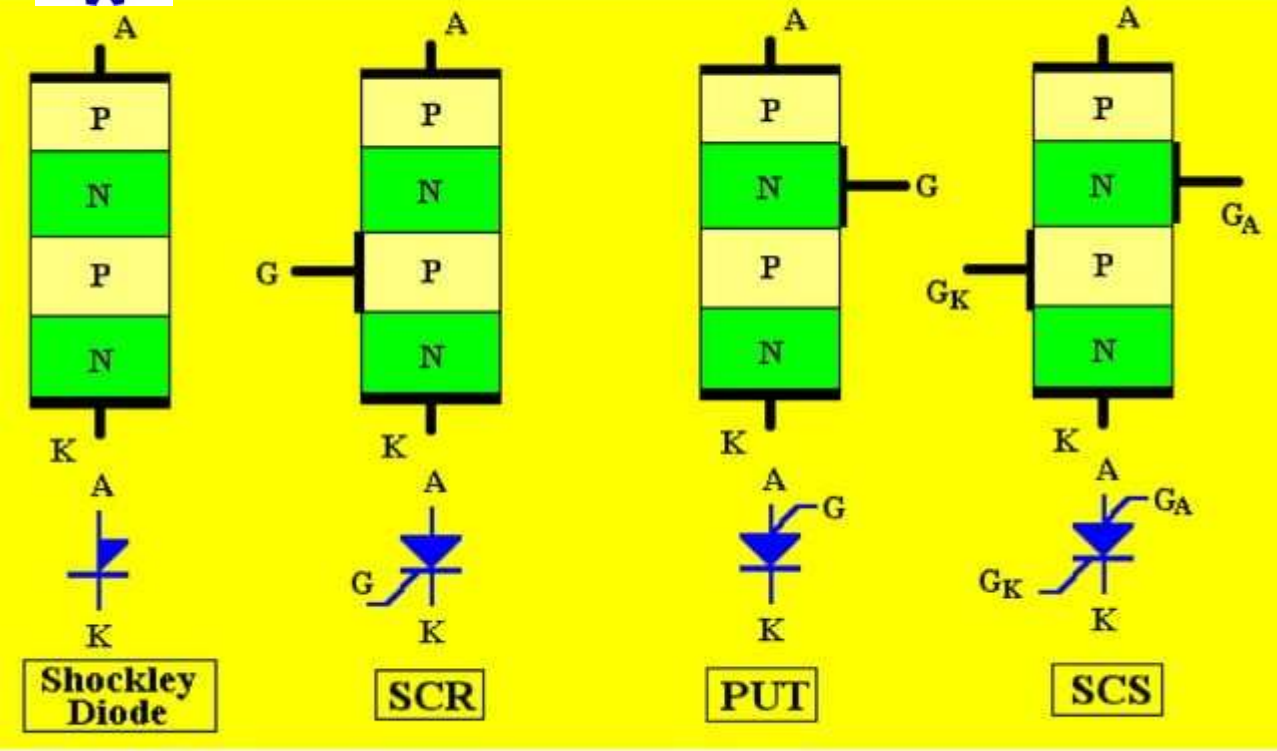


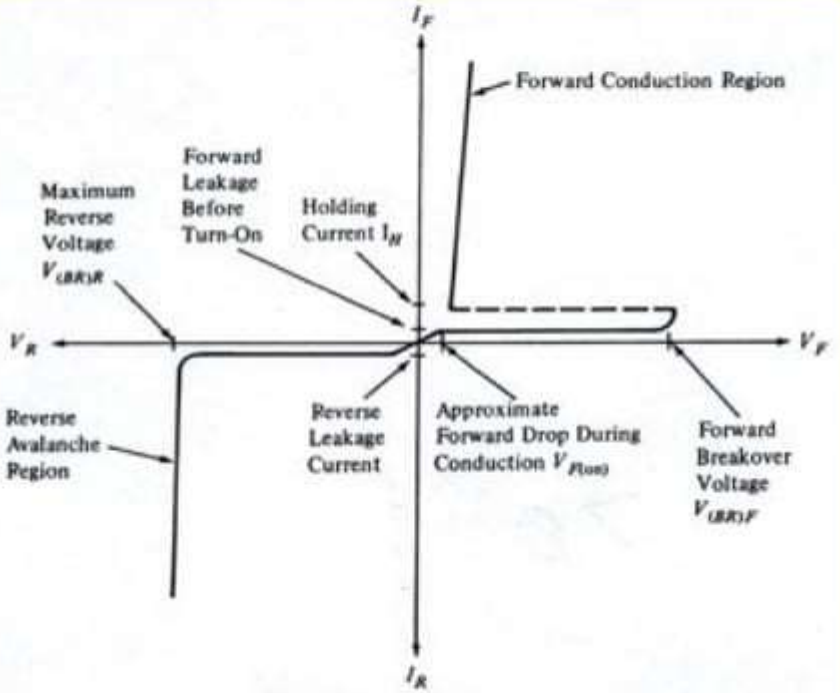
# Silicon Controlled Rectifier

- The operation of a SCR can be understood in terms of a pair of tightly coupled **B**ipolar **J**unction **T**ransistors
- SCR has three states:
  - Reverse blocking mode, forward blocking mode, and forward conducting mode




A
P
N
P
N
K
A
K
Shockley Diode
A
P
N
G
P
N
K
A
G
K
SCR
A
P
N
P
N
G
K
A
G
K
PUT
A
P
N
G_A
P
G_K
N
K
A
G_A
G_K
K
SCS

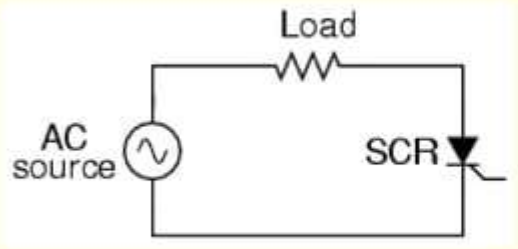
# V-I Characteristic Curve



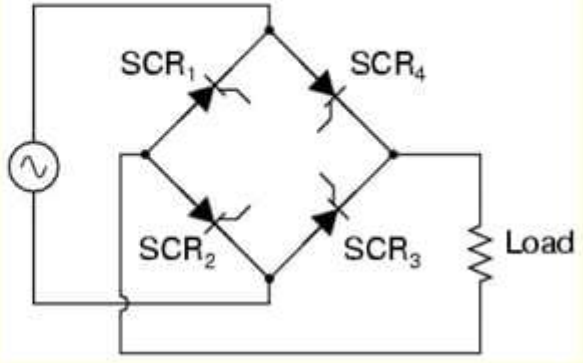

*V–I* characteristics of the SCR with gate open.

# Silicon Controlled Rectifier

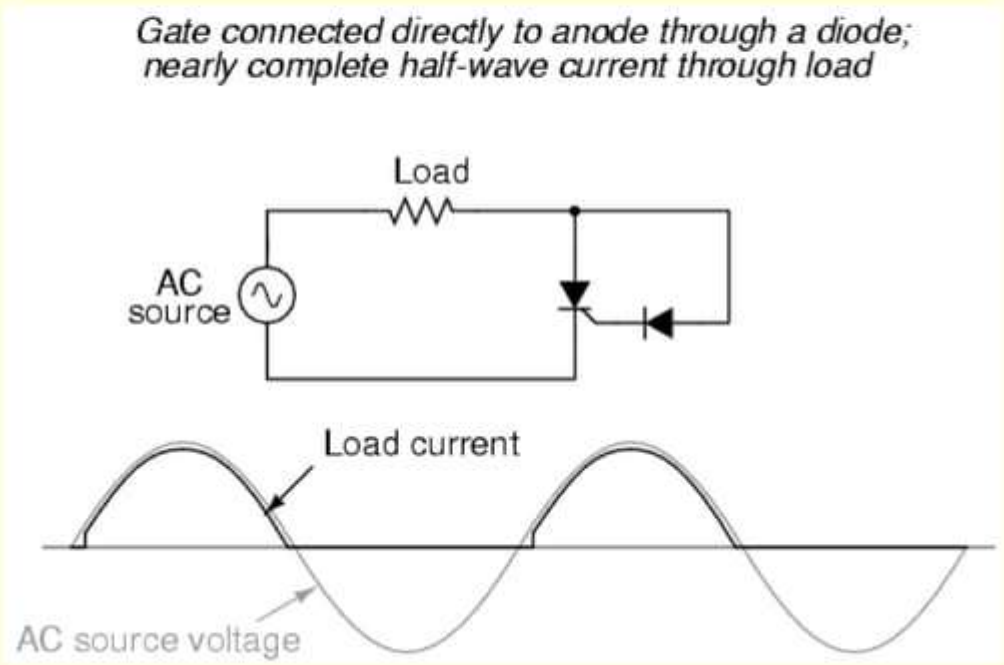
- Industrially SCRs are applied to produce DC voltages for motors from AC line voltage
- Rectifier
  - Half-wave rectifier, full-wave rectifier



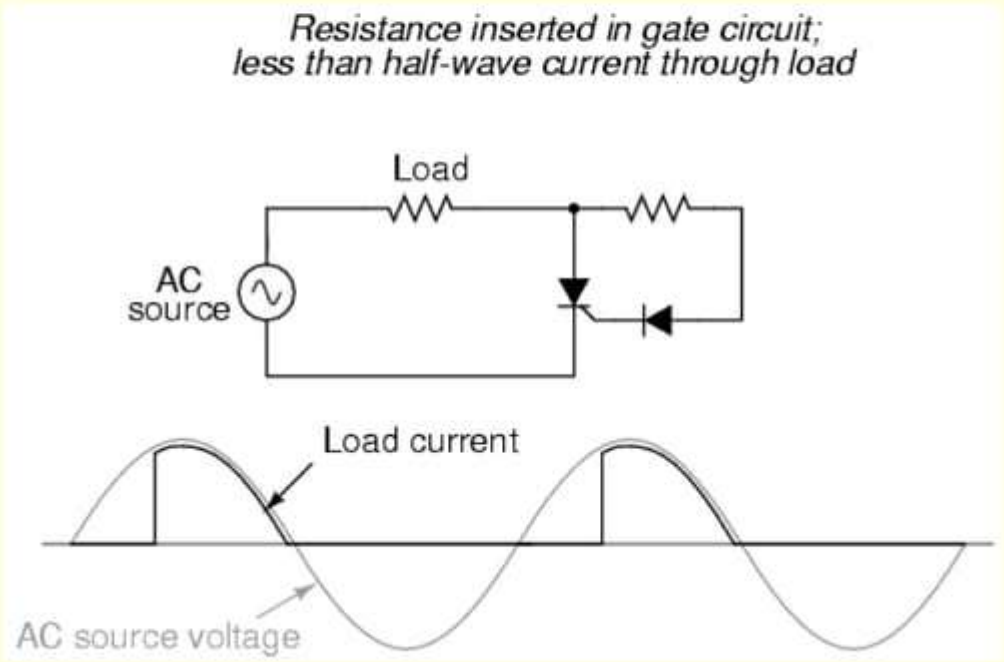

*Controlled bridge rectifier*



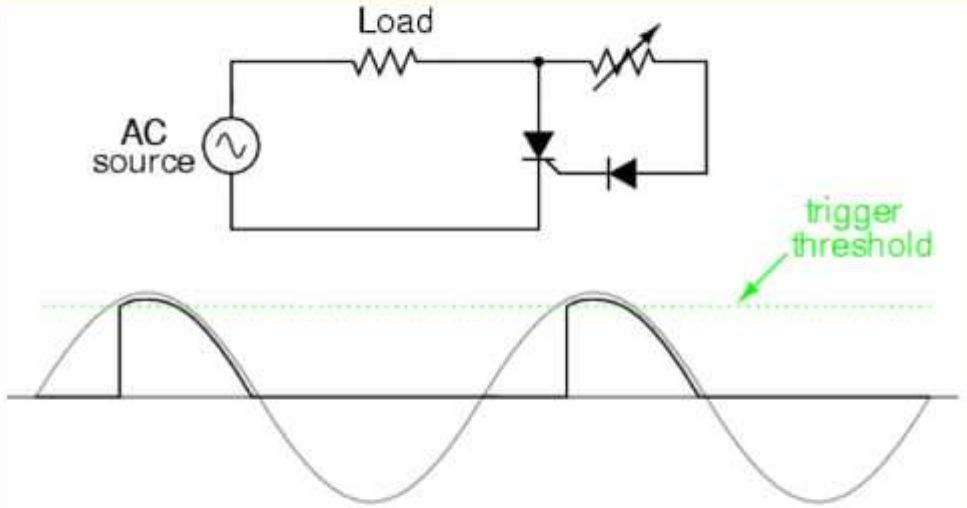
# Half-wave rectifier



# Half-wave rectifier



# Half-wave rectifier




*Increasing the resistance raises the threshold level, causing less power to be delivered to the load.*

*Decreasing the resistance lowers the threshold level, causing more power to be delivered to the load.*

# Application: DC Motor Driver

- DC motor speed generally depends on a combination of the voltage and current flowing in the motor coils and the motor loads or braking torque
- The speed of the motor is proportional to the voltage, and the torque is proportional to the current

# DC Motors Current Driver

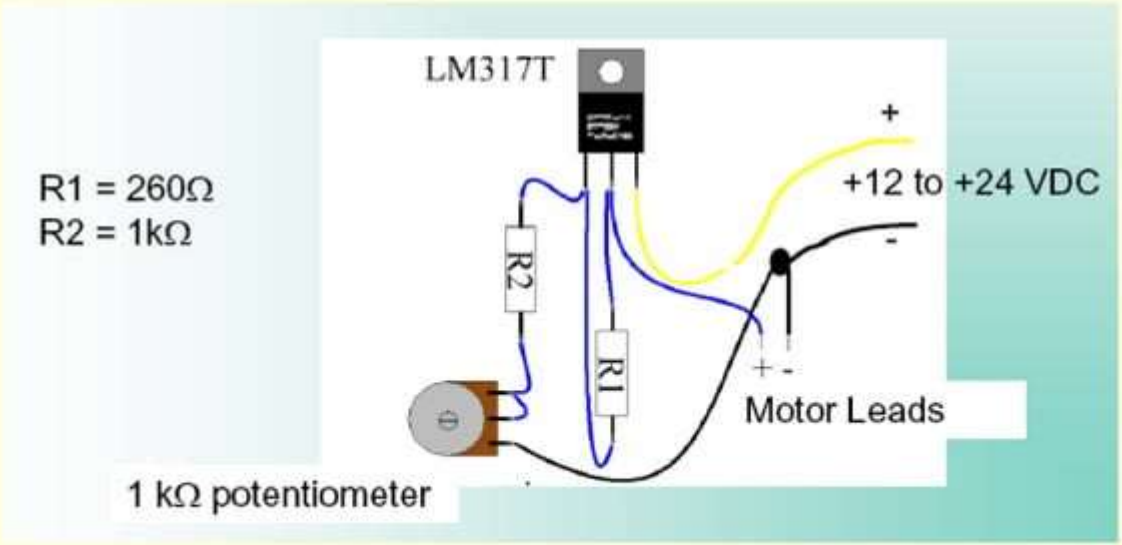
- A rectifier is one or more diodes arranged for converting AC to DC
- The current used to drive the DC motor typically comes from :

  Fixed voltage:
  - Battery
  - Voltage regulator

  Adjustable voltage:
  - PWM current source
  - Silicon controlled rectifier modulated AC source

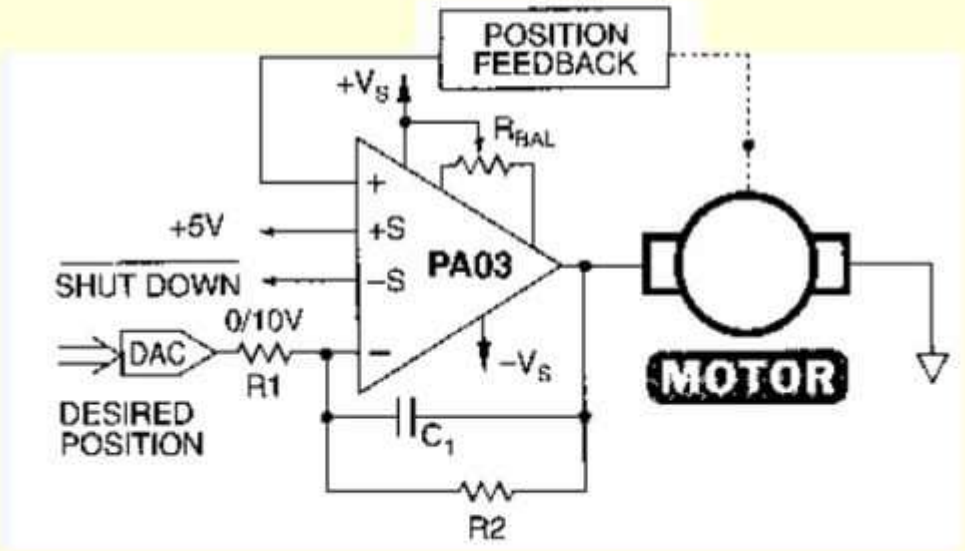
# DC Motors Current Drives

- Voltage regulator



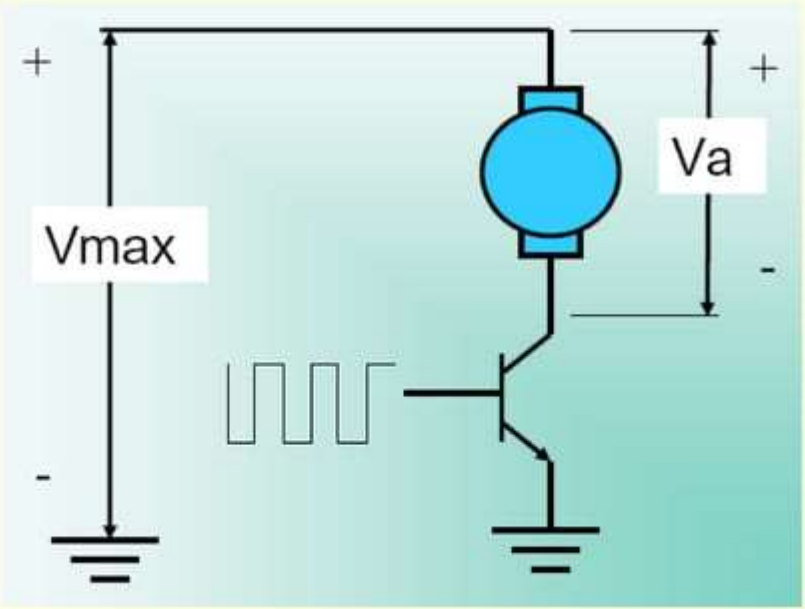
# DC Motors Current Drives

- Linear power transistor & OP amp

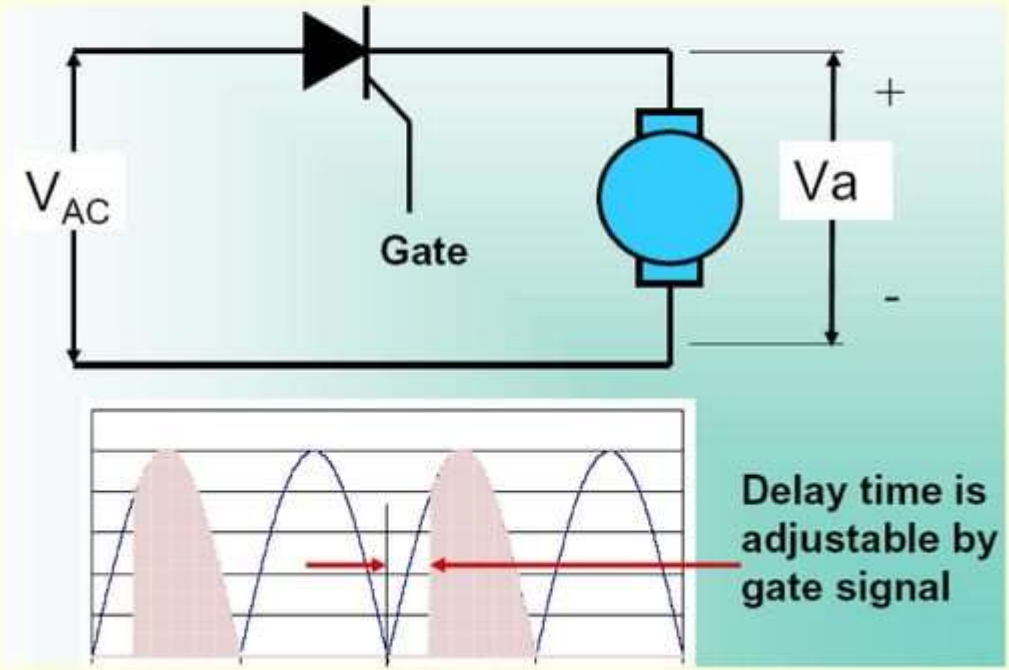


# DC Motors Current Drives

- Pulse Width Modulation



# DC Motors Current Drives



# DC Motors Current Drives