SNS COLLEGE OF ALLIED HEALTH SCIENCE

Affiliated to The Tamil Nadu Dr. M.G.R Medical University, Chennai

DEPARTMENT OF RADIOGRAPHY AND IMAGING TECHNOLOGY

COURSE NAME : GENERAL PHYSICS RELATED TO RADIATION PHYSICS AND DIAGNOSTIC PHYSICS

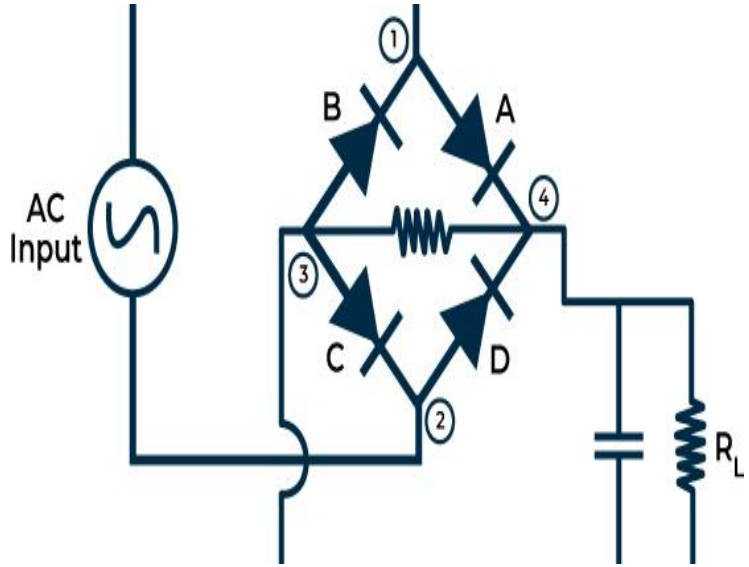
UNIT : 5 Physics of DiagnosticRadiology

TOPICS : FULL VALVE PULSATING CIRCUIT

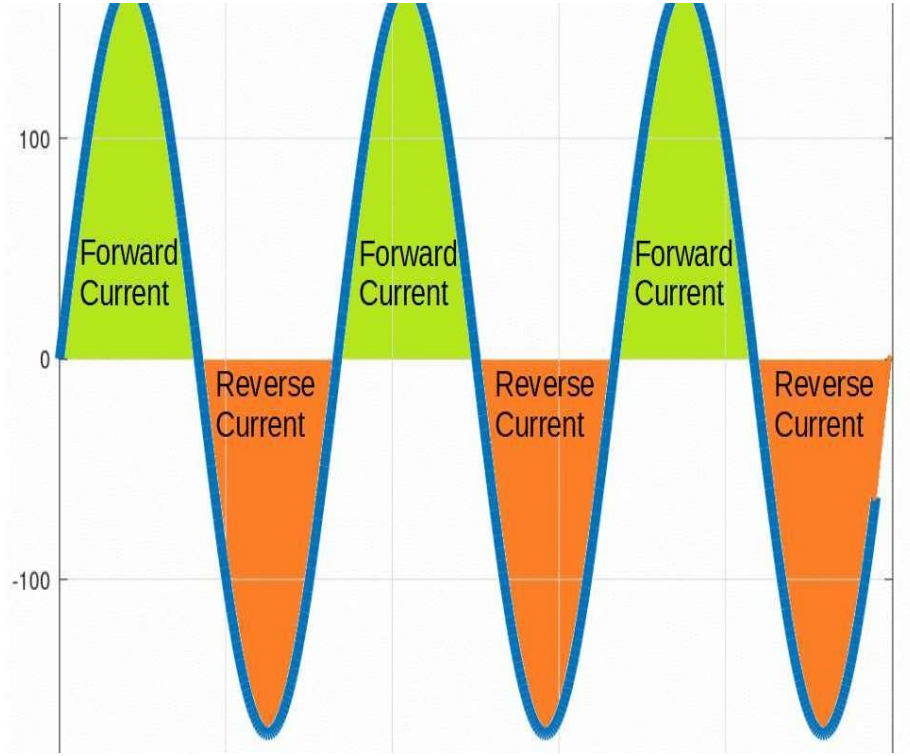
FACULTY NAME : Ms. DHANALAKSHMI M

INTRODUCTION (Define)

- Full Wave Rectifier: Producing Pulsating DC Voltage
- Converts AC to pulsating DC using both half-cycles
- Key topic in power electronics and AC-DC conversion

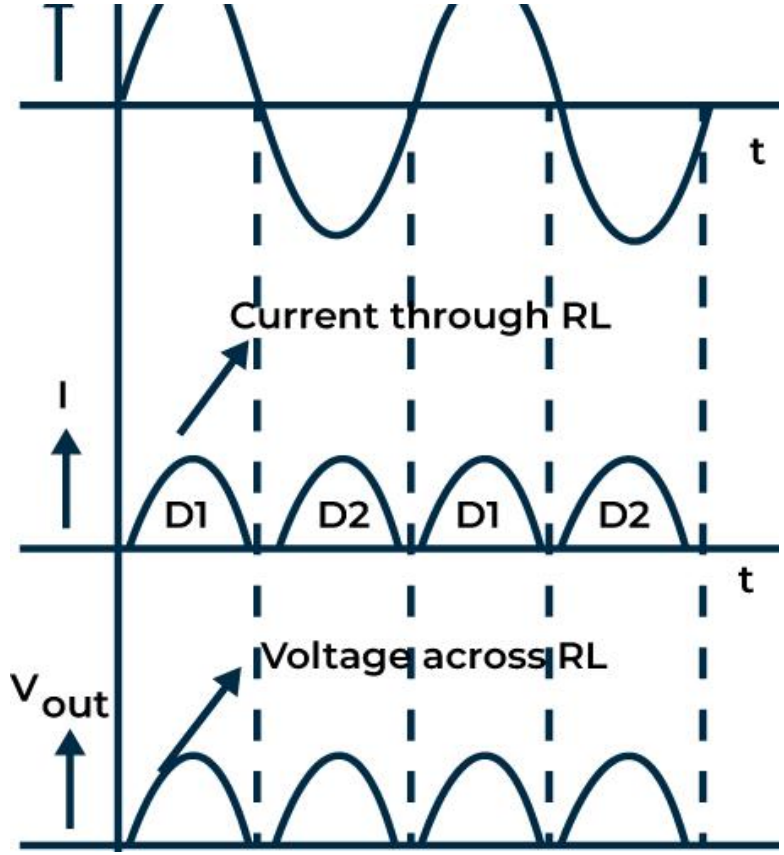


- Converts entire AC waveform into pulsating DC
- Utilizes both positive and negative half-cycles of input
- Output is unidirectional but pulsating (not steady DC)



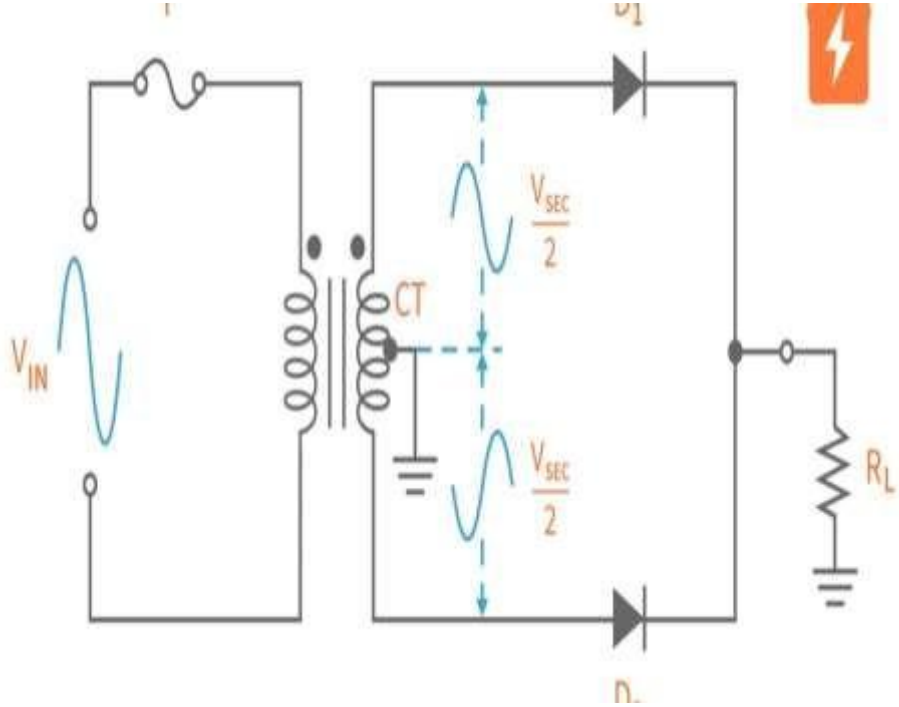
Types of Full Wave Rectifiers

- Center-Tapped (uses 2 diodes + center-tapped transformer)
- Bridge Rectifier (uses 4 diodes, no center tap needed)
- Bridge type is more common and cost-effective



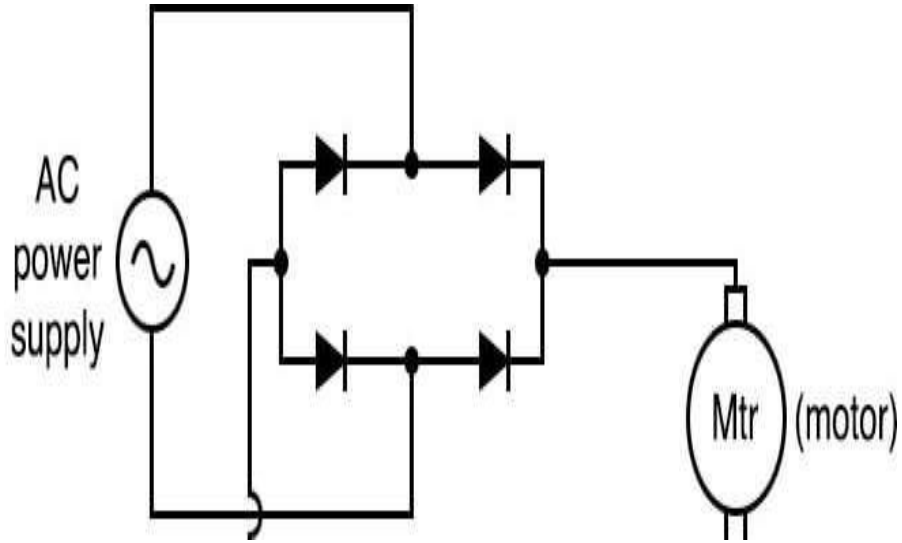
Center-Tapped Circuit Operation

- .Positive half-cycle: One diode conducts, other reverse-biased
- Negative half-cycle: Roles reverse, current flows same direction
- Requires center-tapped transformer for splitting phases



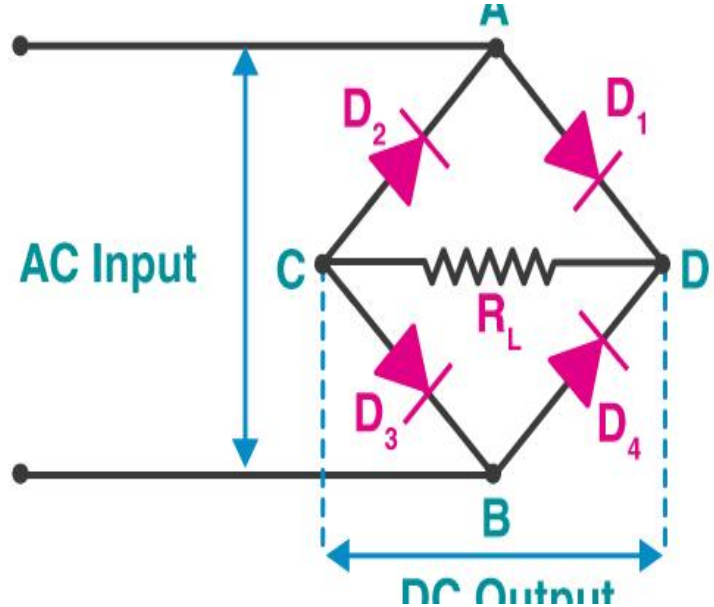
Bridge Rectifier Circuit

- Input: Sinusoidal AC (alternates +ve and -ve)
- Output: Pulsating DC (full humps, twice the frequency)
- No negative portion in output



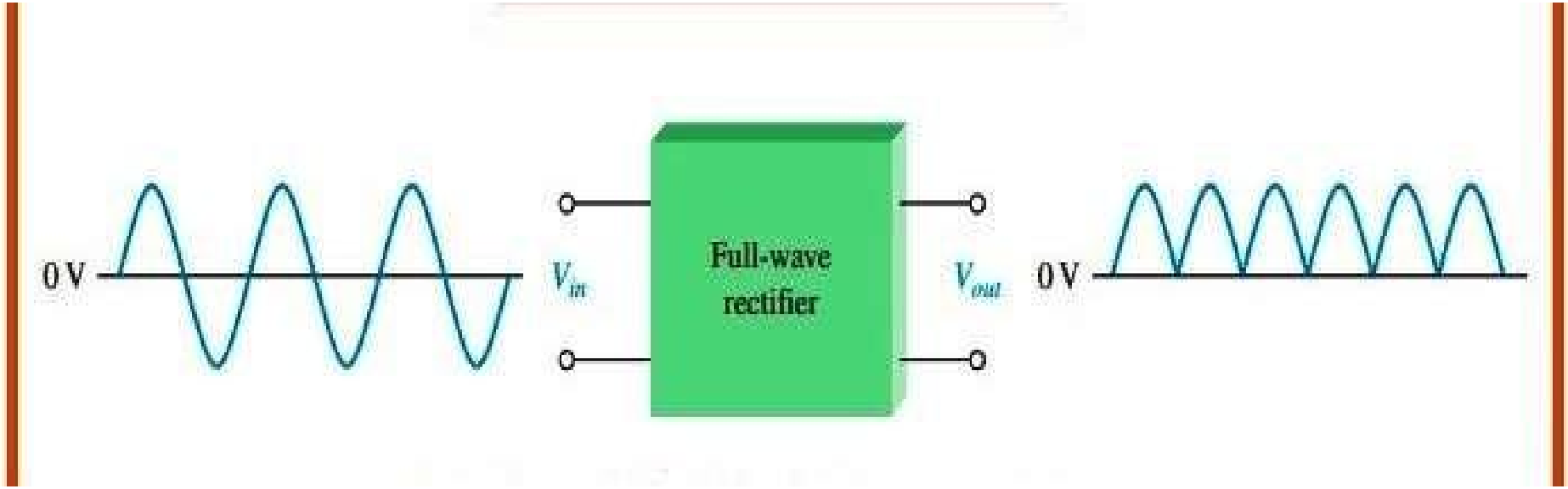
Advantages Over Half-Wave

- Higher average DC output (0.637 × Vm vs 0.318 × Vm)
- Lower ripple, better efficiency (81.2% 40.6%)
- Smoother output, higher power delivery



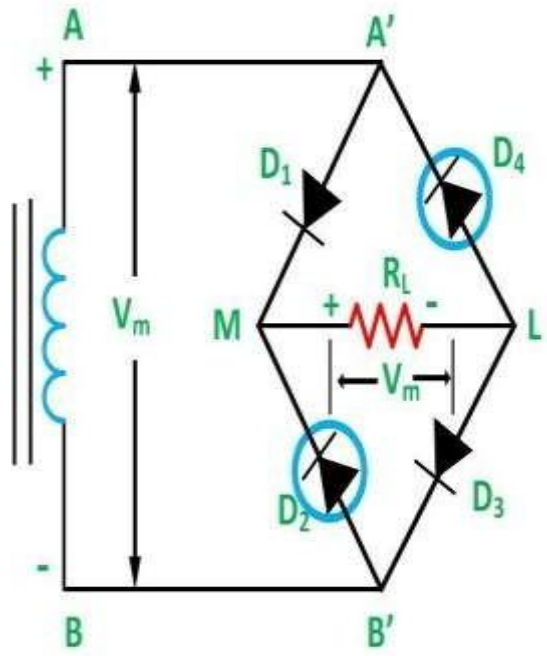
Core Concept & Types

- Converts complete AC sine wave into pulsating DC
- Uses BOTH positive and negative half-cycles (100% utilization)
- Two main types: Center-Tapped & Bridge Rectifier
- Bridge type needs NO center-tapped transformer
- Output frequency = 2 × input frequency (e.g., 50 Hz → 100 Hz ripple)
- Foundation of every mobile charger and SMPS.


0 V
V_{in}
Full-wave rectifier
V_{out}
0 V

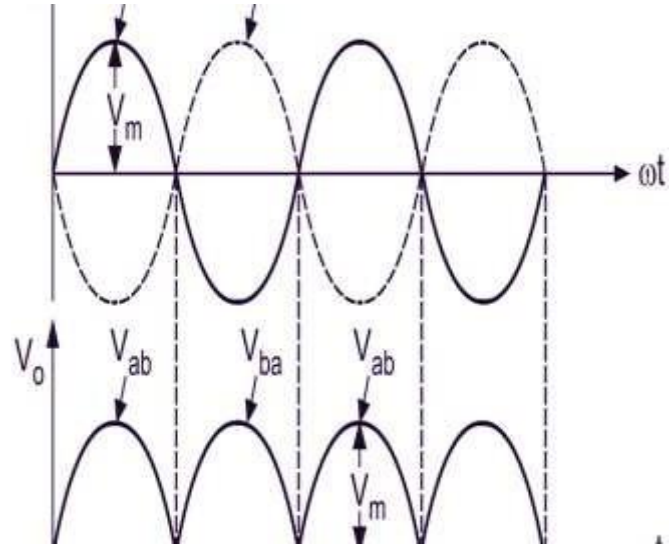
Bridge Rectifier – Circuit & Working

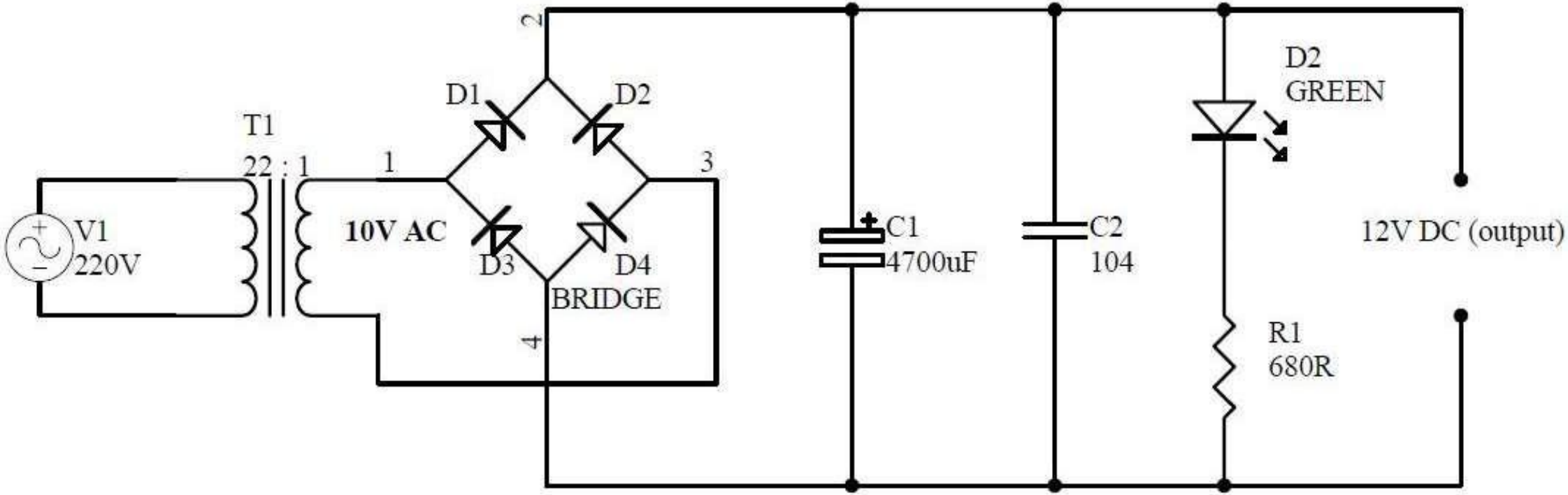
- 4 diodes arranged in diamond/bridge shape
- Positive half-cycle → D1 & D2 conduct, D3 & D4 reverse biased
- Negative half-cycle → D3 & D4 conduct, D1 & D2 reverse biased
- Load current always flows in SAME direction
- Peak output voltage = Vm – 1.4 V (two diode drops)
- Most popular because it's cheap, reliable & efficient



Waveforms & Performance Advantages

- **input**: Pure sine wave (±Vm)
- **Output**: Full-wave rectified (0 to Vm, 100 Hz humps)
- **Average DC value** = 0.637 × Vm (twice that of half-wave)
- **Ripple factor** = 48% (much better than 121% of half-wave)
- **Efficiency** = 81.2% (double the half-wave 40.6%)




T1
22 : 1
1
10V AC
2
D1
D2
3
D3
D4
BRIDGE
4
V1
220V
C1
4700uF
C2
104
D2
GREEN
12V DC (output)
R1
680R

SUMMARY


WAVEFORMS
POWER GENERATION
SIGNAL SUPPLIES
MEDICAL DEVICES
PULSING VOLTAGE
GENERATION METHODS
DUTY CYCLE
OSCILLATORS
FUNCTION GENERATORS PWM

References

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- https://testbook.com/physics/full-wave-rectifier