DBF Dayanand College of Arts and Science, Solapur

Rectifiers, Filters and Regulators

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ELECTRONICS	Paper V: Electronic Circuits
	Module 2: Filters and Regulator
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Prerequisites

The student must know

- Passive Components
- Rectifier Circuits
- Zener Diode Characteristics

Learning Outcome

In this module you will learn about

- Need of Filter Circuit
- Types of Filters
- Working of Capacitor Filter
- Need of Regulator
- Zener Regulator

Filter

- Filter is a circuit which removes ac component present at the output of rectifier
- i.e. Filter circuit make the output of rectifier smooth

Need of Filters

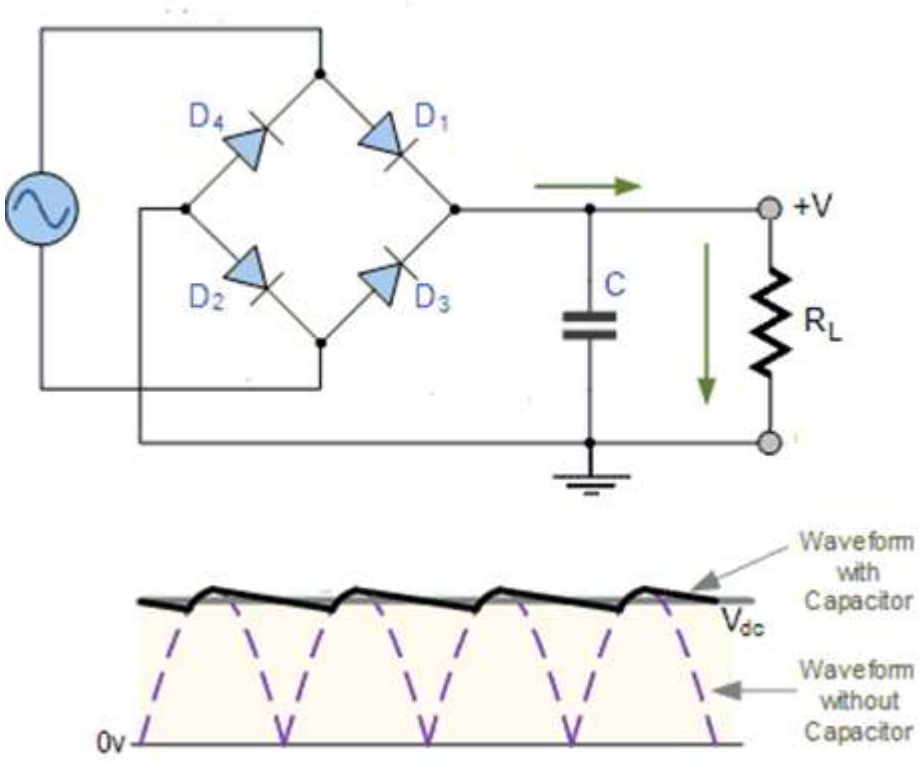
- The output of full wave rectifier is not perfect dc. It is pulsating dc.
- It consists of both ac and dc components
- In order to make the output perfect dc, the ac component must be removed i.e. filtered
- Hence a filter circuit is used to remove ac component

Types of Filters

- The response of capacitor and inductor for ac and dc signals is different.
- Capacitor passes ac voltage but blocks dc voltage
- Inductor passes dc voltage but opposes ac voltage
- Thus capacitor or inductor or both can be used as filter
- Depending on the components used there are four types of filter circuits

1. Capacitor Filter
2. Series Inductor Filter
3. LC Filter (L section)
4. CLC Filter (Pi Filter)

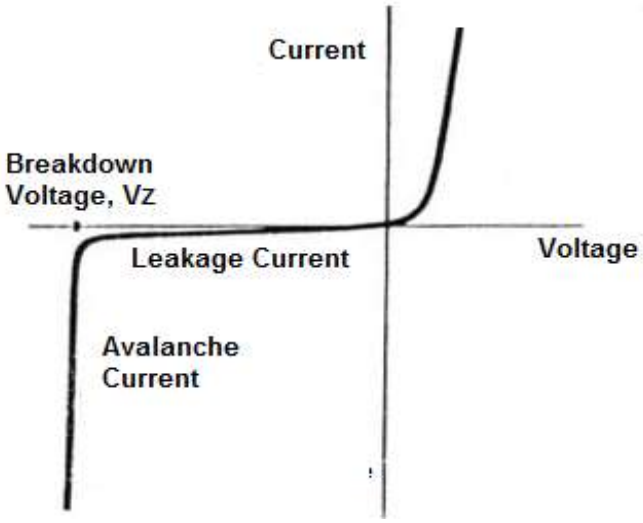
Capacitor Filter



- The capacitor stores dc voltage whereas ac voltage is passed to ground.
- Actually as input voltage increases, capacitor charges to peak value. Capacitor discharges slowly when the input voltage goes low
- It is seen that fluctuations in the output (i.e. ripple) is reduced considerably
- For better performance R_L and C must be large. i.e. Capacitor filter is effective if the load resistance is large

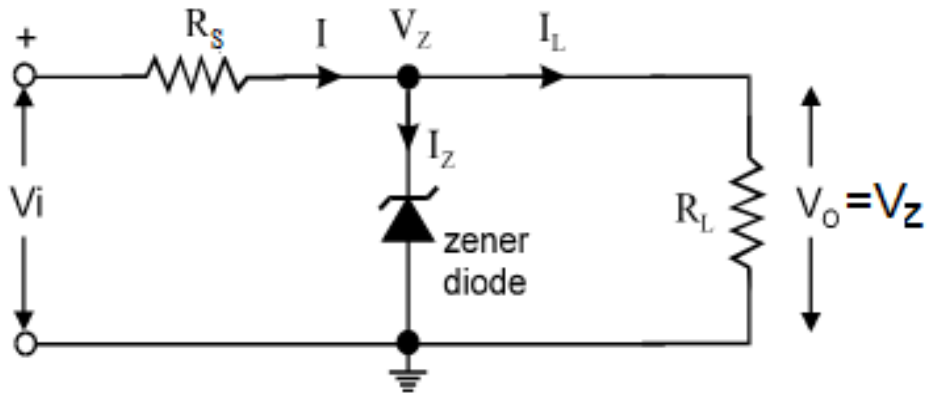
Regulator

- Regulator is a circuit which keeps the output voltage of power supply constant
- The output is independent of input voltage variations and load current variations
- A zener diode can be used as voltage regulator



- The output of simple power supply (rectifier and filter circuit) changes with applied ac input voltage (line voltage) and load current
- There are number of applications in which it requires constant supply voltage.
- Hence it is essential to keep the output voltage constant, independent of line voltage and load current

Simple Zener Regulator



- It consists of a series resistance R_s and a zener diode. The load resistance is in parallel with zener diode
- Zener is operated in the breakdown region
- The output voltage is equal to zener voltage.

$$V_o = V_z$$

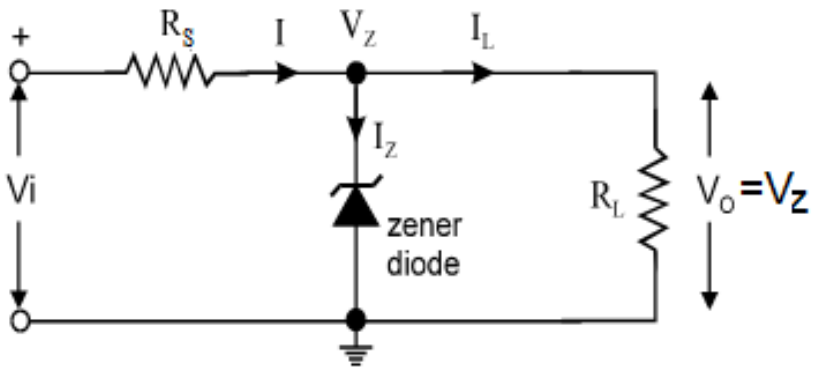
- Thus even though the input voltage is changed or load current is changed, the voltage across zener diode is constant.
- Hence output voltage is constant. i.e. circuit works as regulator
- The required series resistance is given by

$$R_s = \frac{V_i - V_z}{I_z + I_L}$$

Design of Simple Zener Regulator

- Design a regulator for 6V output voltage

  Given: Vi=8V, I_Z=100mA and I_L=100mA



- The required o/p voltage is 6V. Hence select the zener diode with breakdown voltage 6V
- The required value of series resistance is given by

$$R_s = \frac{V_i - V_z}{I_z + I_L}$$

$$= \frac{8-6}{(100+100)\times 10^{-3}} = \frac{2}{200 \times 10^{-3}} = \frac{2000}{200} = 10\Omega$$

- Thus a resistance of 10 Ω is connected in series with zener diode

Links for Video and Assignment

Video

https://drive.google.com/file/d/1mQkZl_0PNl1FrSJXWmzacHcsOSQs2LO4/view?usp=sharing

Assignment

https://forms.gle/Z45Jy7U2CJemj5B37

Additional Resources

1. A text book of Applied Electronics by R. S. Sedha. S. Chand Publication.

2. Electronic Devices and Circuits by Boylstead

3. Basic Electronics (Solid State) by B. L. Theraja, S. Chand & Company Ltd.

4. Basic Electronics and Linear Circuits by N. N. Bhargaya D. C. Kulshreshtha & S. C. Gupta TMH

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