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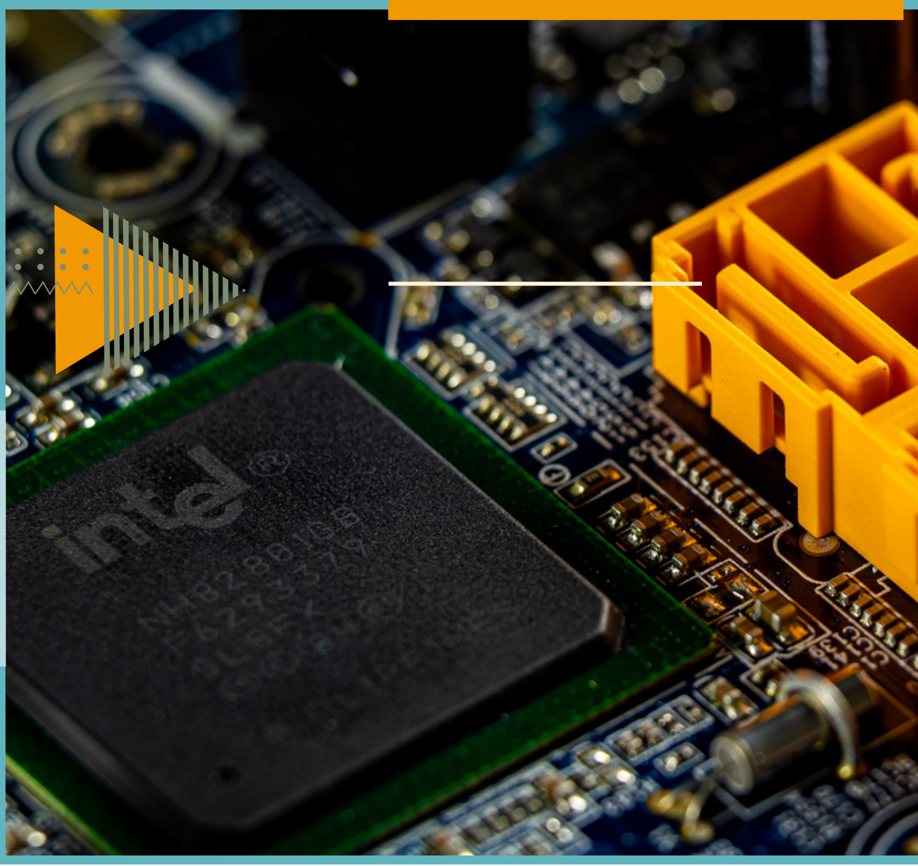
ELECTRONIC CIRCUITS

e-Book

DC POWER SUPPLY



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DC POWER SUPPLY

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SYNOPSIS

"Discover the essentials of DC Power Supply in this dedicated eBook crafted for third-semester students diving into electronic circuits. Covering transformers, rectifiers, filters, and voltage regulators, this guide simplifies complex concepts with clear explanations and practical examples. Tailored for easy understanding, it's an accessible resource packed with real-world applications, enabling students to grasp and apply DC power supply fundamentals effectively."

TABLE OF CONTENTS

IMPORTANCE OF DC POWER SUPPLY:

- Most electric equipment requires DC voltage.
- Dry cells unable to accommodate the needs of electrical equipments.
- Power supplied to the house in AC but electrical equipment needs DC voltage.

BLOCK DIAGRAM

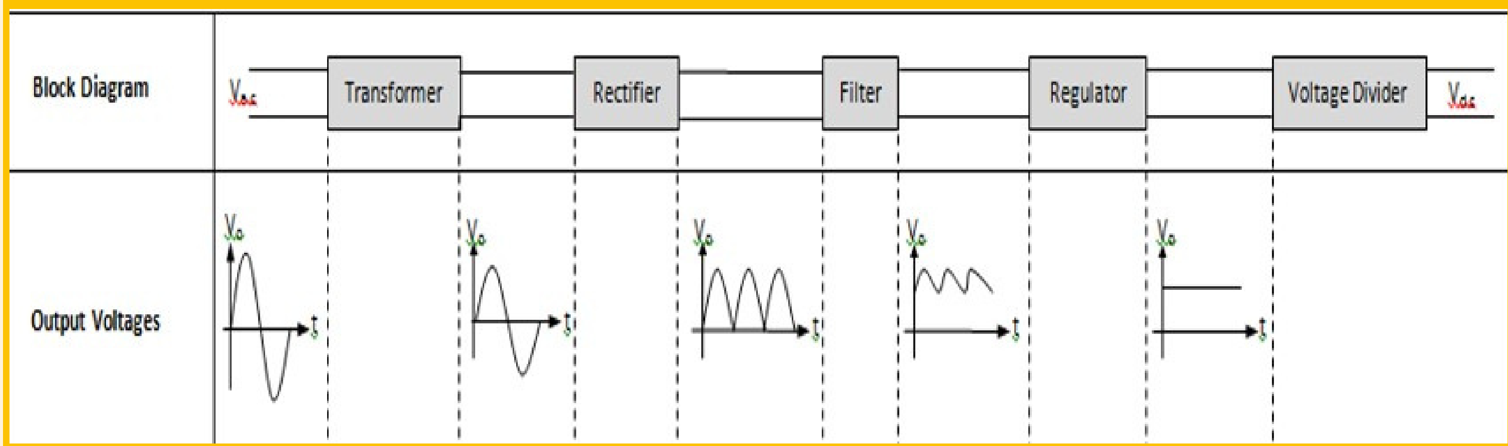


Fig 1 : Block diagram

FUNCTION OF EACH BLOCK

Transformer - steps down high voltage AC mains to low voltage AC.

Rectifier - converts AC to DC, but the DC output is pulsating (varying) DC wave.

Filter - smoothes the DC from varying greatly to a small ripple.

Regulator - eliminates ripple by setting DC output to a fixed voltage.

Voltage divider – distributes DC output voltage to load.

EXAMPLE OF LINEAR DC POWER SUPPLY

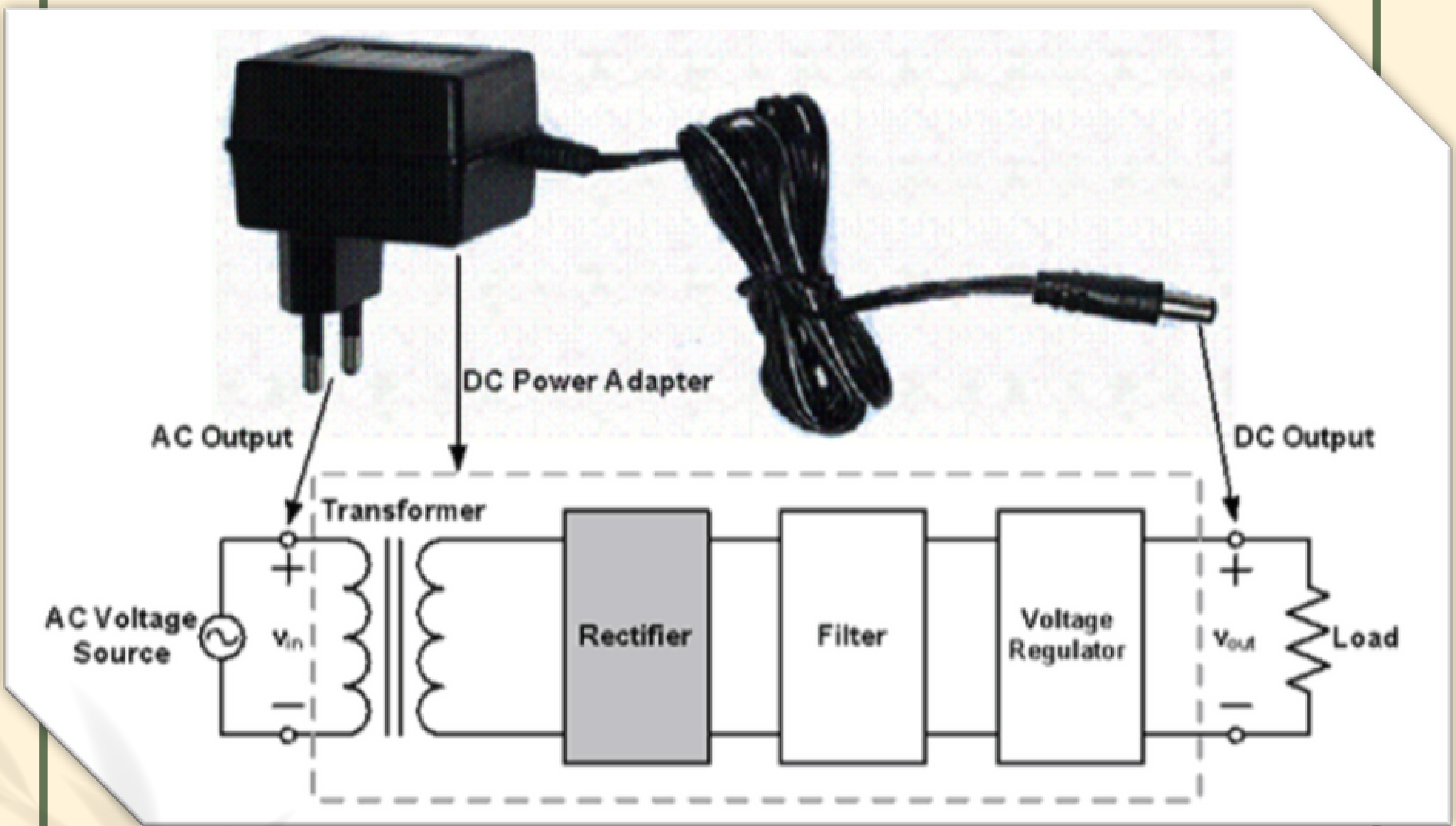
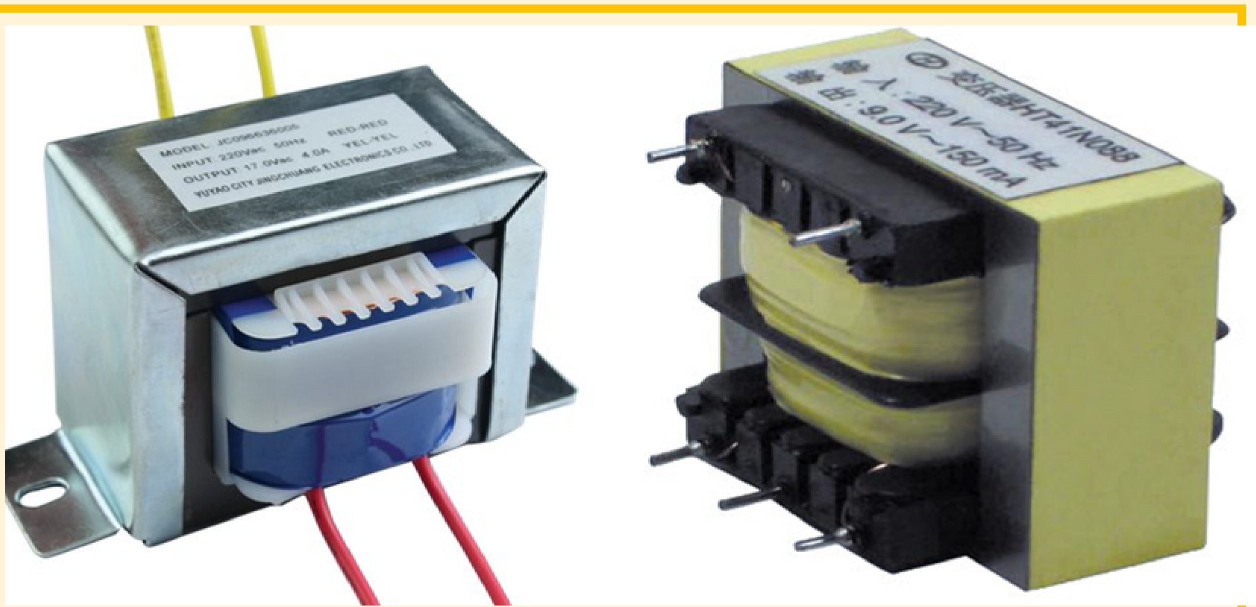


Fig 2: Example of linear DC power supply

TRANSFORMERS



CIRCUIT SYMBOLS

Transformer with two windings and iron core as in figure 4.

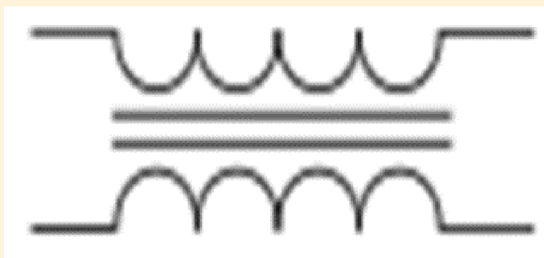


Fig 4: Transformer with two windings and iron core.

Step-down or step-up transformer. The symbol shows which winding has more turn but not usually the exact ratio as in figure 5.

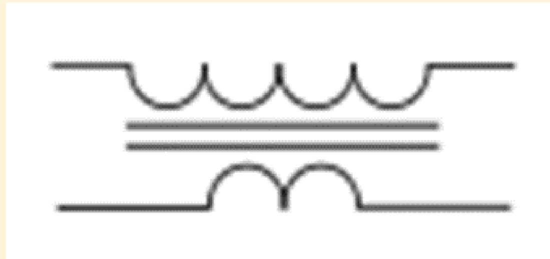


Fig 5:Step-down or step-up transformer.

TRANSFORMER

TRANSFORMER

1. Transformers convert AC electricity from one voltage to another with little loss of power.
2. Transformers work only with AC and this is one of the reasons why mains (wall socket) electricity is AC.
3. Step-up transformers increase voltage, step-down transformers reduce voltage.
4. Most power supplies use a step-down transformer to reduce the dangerously high mains voltage (240V in Malaysia) to a safer low voltage.
5. The input coil is called the primary and the output coil is called the secondary.
6. There is no electrical connection between the two coils, instead they are linked by an alternating magnetic field created in the soft-iron core of the transformer.
7. The two lines in the middle of the circuit symbol represent the core.

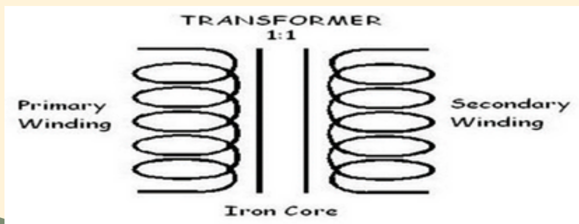


Fig 6:Transformer.

TRANSFORMER

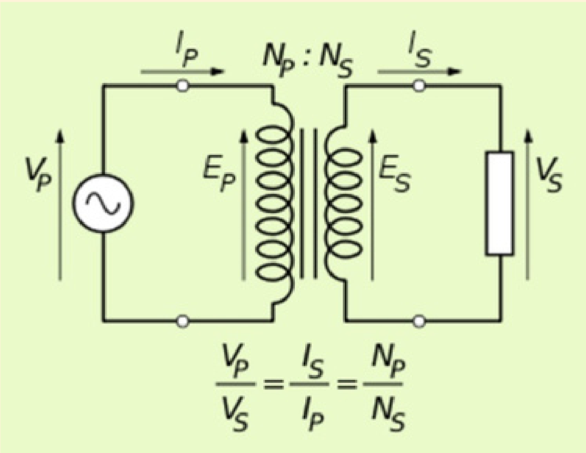


Fig 7:Transformer.

Vp ; Primary (input) Voltage

Np ; Number of turns on primary coil

Ip ; Primary (input) Current

Vs ; Secondary (output) Voltage

Ns ; Number of turns on secondary coil

Is ; Secondary (output) current

- A step-down transformer has a large number of turns on its primary (input) coil which is connected to the high voltage mains supply.
- A small number of turns on its secondary (output) coil to give a low output voltage.
- If the secondary coil is attached to a load that allows current to flow, electrical power is transmitted from the primary circuit to the secondary circuit
- Ideally, the transformer is perfectly efficient; all the incoming energy is transformed from the primary circuit to the magnetic field and into the secondary circuit as figure 7.
- If this condition is met, the incoming electric power must equal the outgoing power:

$$P_{in} = P_{out}$$
$$I_p V_p = I_s V_s$$
$$\frac{V_p}{V_s} = \frac{I_s}{I_p}$$

Ip = primary (input) current
Is = secondary (output) current

TRANSFORMER

- Note that as voltage is stepped down, current is stepped up. If the voltage is increased, then the current is decreased by the same factor.

- An ideal transformer would have no energy losses, and would be 100% efficient.

- In practical, transformers waste very little power so the power out is (almost) equal to the power in. Transformers energy is dissipated in the windings, core, and surrounding structures. Larger transformers are generally more efficient, and those rated for electricity distribution usually perform better than 98%.

RECTIFIER

Conversion of alternating current (or voltage) into direct current (or voltage) is called rectification.

A diode is well-suited for this job because it only conducts when forward-biased. The component at figure 8 is bridge rectifier.

Types Of Rectifiers :

- Half-wave rectifier
- Full-wave rectifier
- Bridge rectifier

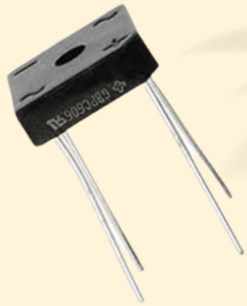


Fig 8:Rectifier.

HALF-WAVE RECTIFIER

- An a.c voltage is applied to a single diode connected in series with a load resistor, RL. the schematic diagram is show in figure 9.
- A single diode can be used as a rectifier but this produces half-wave varying DC which has gaps when the AC is negative.
- It only uses the positive (+) parts of the AC wave to produce half-wave varying DC.

Schematic diagram :

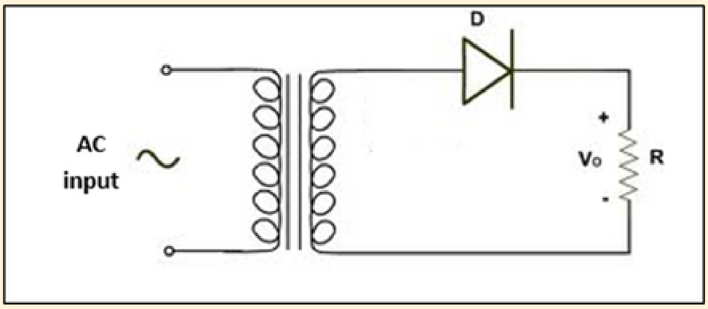


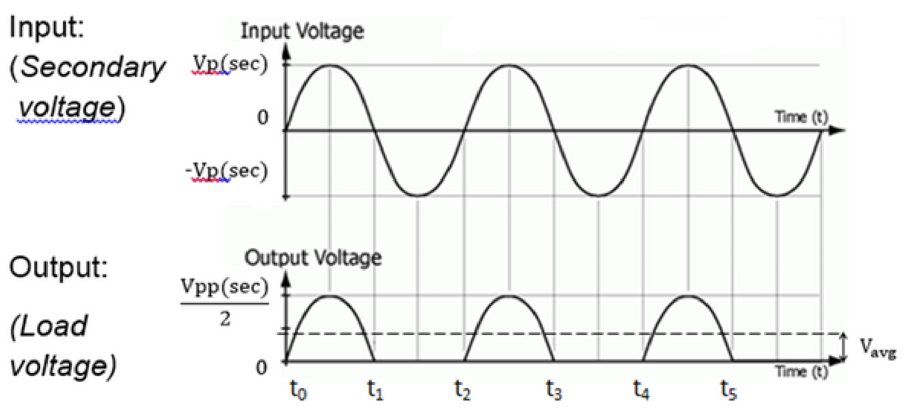
Fig 9:Half-ware rectifier

RECTIFIER

- The AC voltage polarity across the secondary winding changes after every half cycle. The output of half -wave rectifier is show in figure 10.

- During the **positive half-cycles** of the input AC voltage:
  a) The diode, D is forward biased and conducts current.
  b) The input voltage during the positive half-cycles is directly applied to the load, R.
  c) The waveforms of the output voltage during t0 to t1 are of the same shape as that of the input AC voltage.

- During the **negative half cycles** of the input AC voltage:
  a) The diode, D is reverse biased and does not conduct current.
  b) The current and voltage across the load, R remains zero.
  c) For the negative half cycles t1 to t2, no power is delivered to the load, R.



The output voltage:

$$V_{out} = \frac{V_{pp(sec)}}{2} - 0.7V \text{ @ } VP(sec) - 0.7V$$

$$\text{Average Voltage, } V_{avg} = 0.318\, V_{out}$$

Frequency:

The output frequency is the same as the input frequency.

$$f_{out} = f_{in}$$

Fig 10:The output of half -wave rectifier.

RECTIFIER

FULL-WAVE RECTIFIER

- The full-wave rectifier circuit using two diodes and a center-tapped transformer, which usually taken as the ground or zero voltage reference point as show in figure 11.
- It is called a full-wave rectifier because it uses the entire AC wave (both positive and negative sections).
- There are two main types of full wave rectifiers:
  - a) Center-tapped full-wave rectifier
  - b) Bridge rectifier

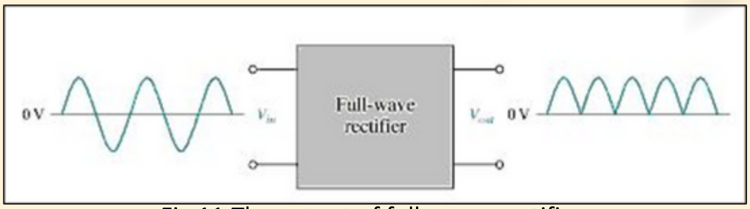


Fig 11:The output of full -wave rectifier.

a) Center-tapped full-wave rectifier :

- The figure 12 shows that two diodes connected to the secondary of a center-tapped transformer can form a full-wave rectifier that allows both half-cycles of the AC waveform to contribute to the DC making it smoother than a half-wave rectifier
- Grounded center tapped results in ½ secondary voltage reaching the load.
- The purpose of center-tapped transformer is to get two a.c. output with the same value but in inverse phase. The input and output voltage of full wave show in figure 13.

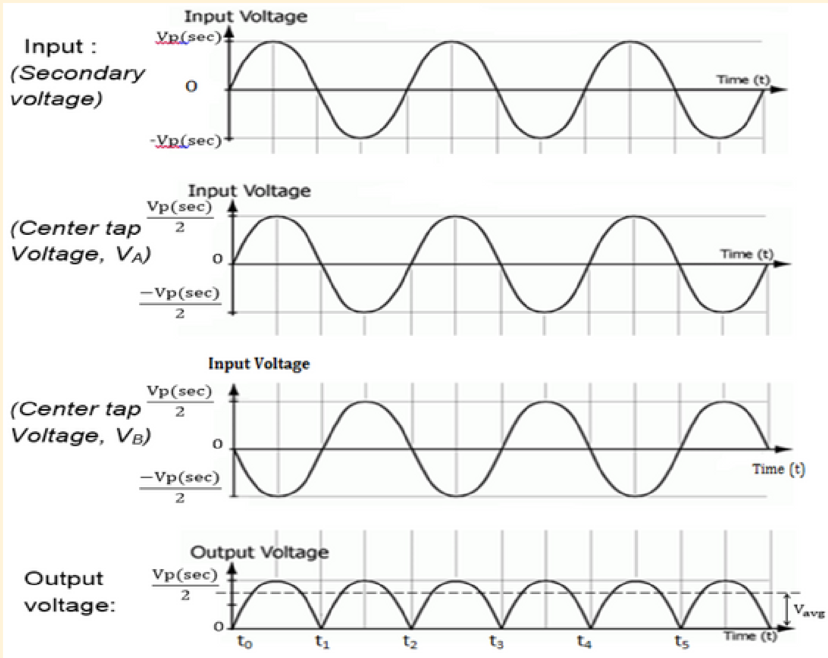


Fig 13:The input and output of full -wave rectifier.

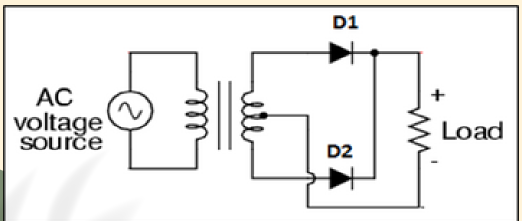


Fig 12:Circuit diagram of full -wave rectifier.

RECTIFIER

- The calculation of output voltage and frequency is shown in figure 14

The output voltage:

$$V_{out} = \frac{V_{p(sec)}}{2} - 0.7V; \quad \text{where } V_{p(sec)} = \frac{V_{pp(sec)}}{2}$$

$$\text{Average Voltage}, V_{avg} = 0.637V_{out}$$

Frequency:

The output frequency is twice the input frequency.

$$f_{out} = 2f_{in}$$

Fig 14:Calculation of full -wave rectifier.

OPERATION :

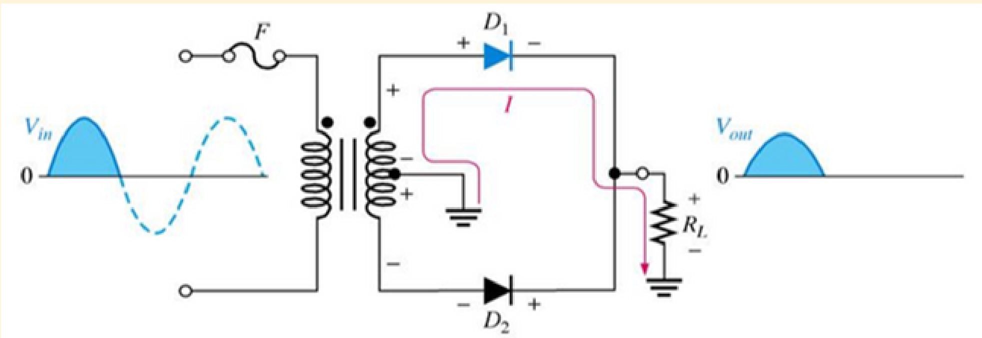


Fig 15:The flow of voltage in full -wave rectifier when positive cycle.

a). During positive half cycle, D1 is forward biased & D2 is reverse biased as in figure 15

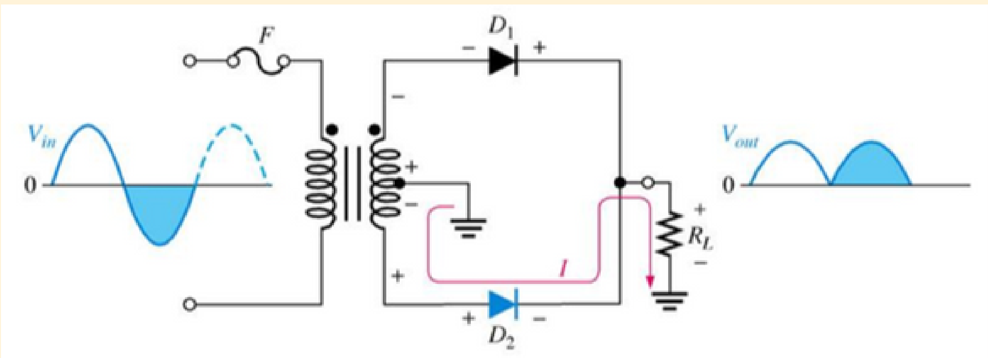


Fig 16:The flow of voltage in full -wave rectifier when negative cycle.

b). During positive half cycle, D2 is forward biased & D1 is reverse biased as in figure 16.

- At any point in time, only one of the diodes is forward biased.
- This allows for continuous conduction through load.

RECTIFIER

b) Bridge rectifier :

Bridge rectifier circuit:

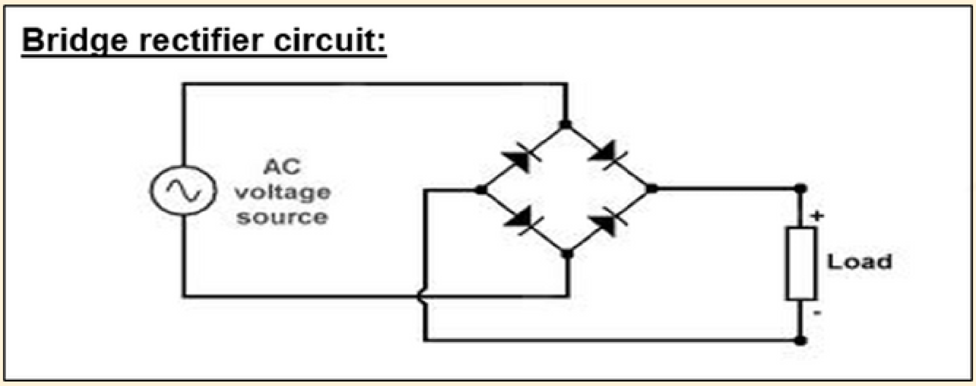


Fig 17:Bridge rectifier circuit diagram.

- A bridge rectifier can be made using four individual diodes as show in figure 17 and the input and output voltage in figure 18.

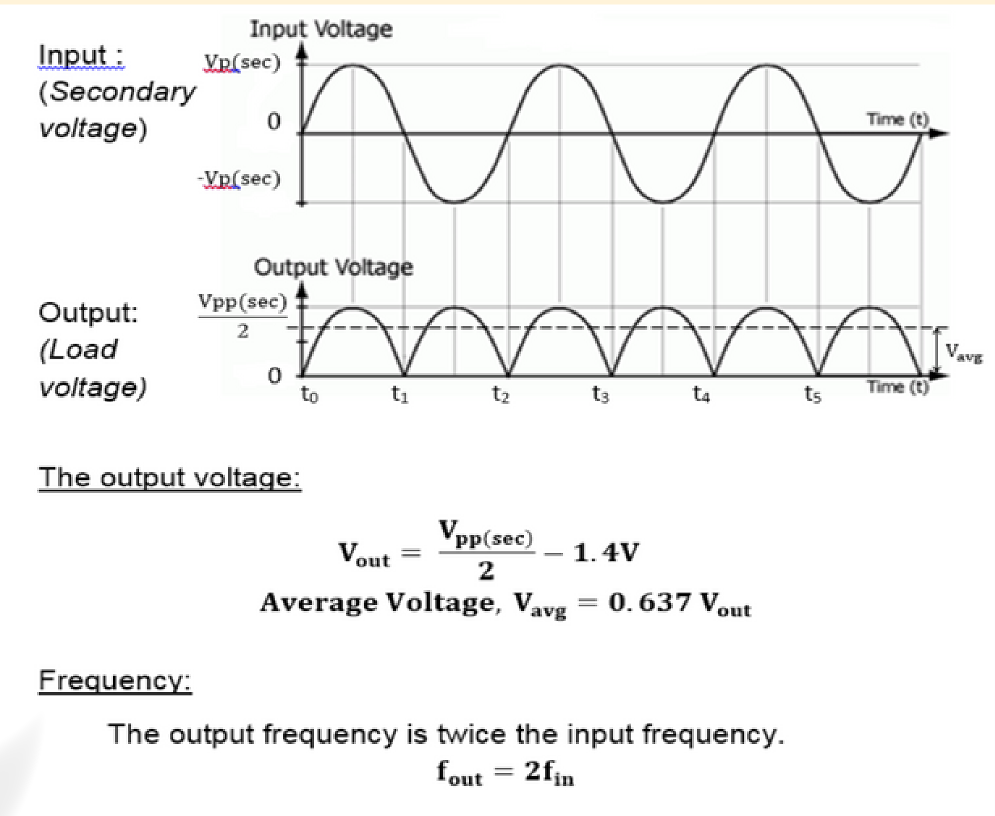


Fig 18:The input and output of bridge rectifier.

RECTIFIER

OPERATION :

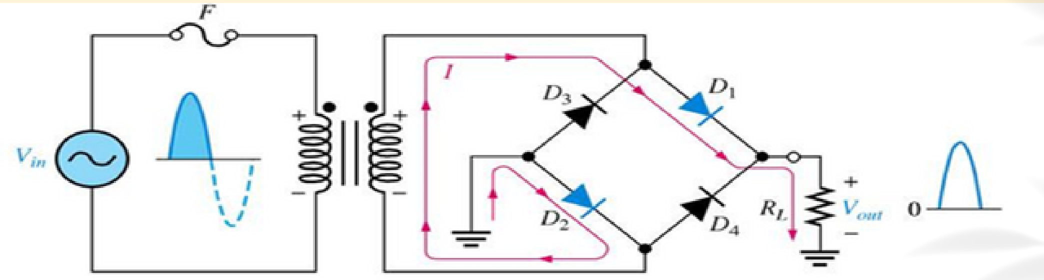


Fig 19:The flow of voltage in bridge rectifier when positive cycle.

a) During positive half-cycle, D1 & D2 are forward biased and conduct current. D3 & D4 are reverse-biased.

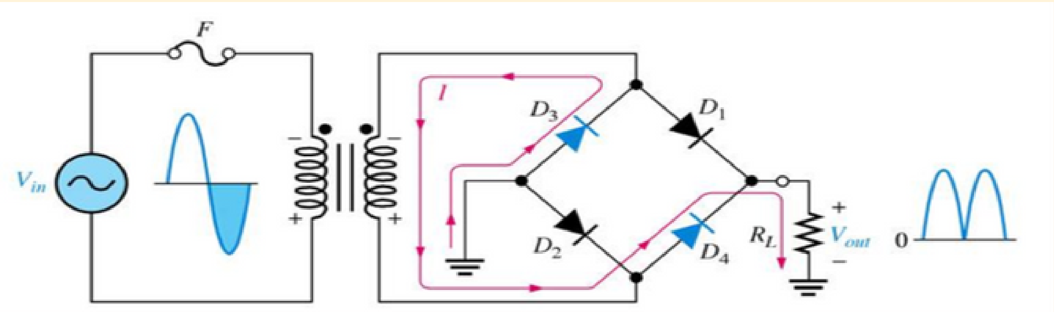


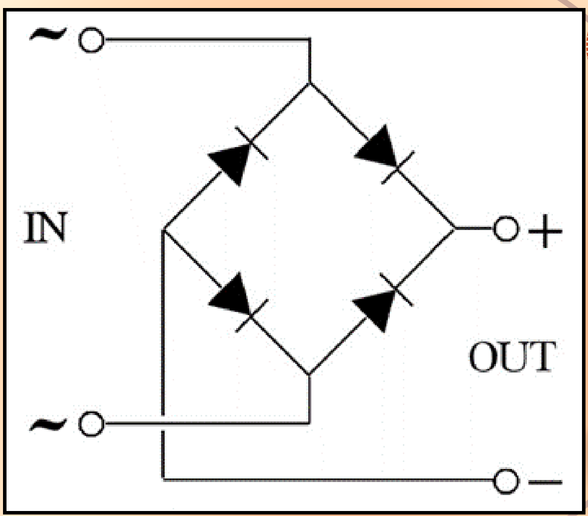
Fig 20:The flow of voltage in bridge rectifier when negative cycle.

b) During negative half-cycle, D3 & D4 are forward biased and conduct current. D1 & D2 are reverse-biased.

- 1.4V is used up in the bridge rectifier because each diode uses 0.7V when conducting and there are always two diodes conducting.
- No center tap results in full secondary voltage reaching the load.

RECTIFIER

Bridge Rectifier IC



Bridge rectifier is also available in special packages containing the four diodes required.

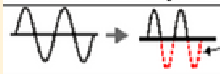
Bridge Rectifiers typically marked with an “BR” on a circuit board.

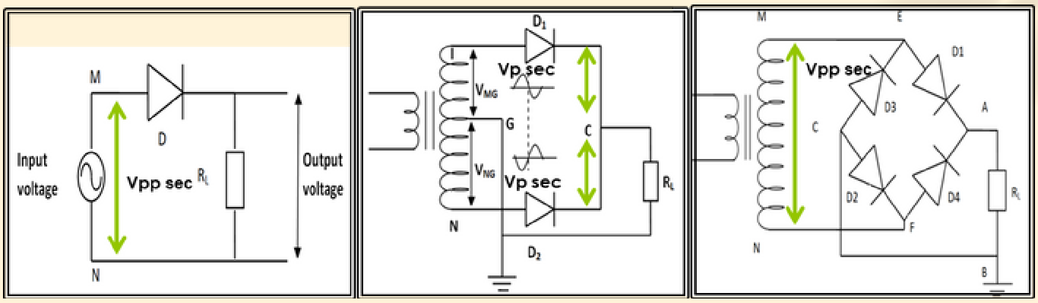
The various case designs are shown figure 21.

Fig 21:Examples of bridge rectifier

SUMMARY RECTIFIER

Table 1: Summary of rectifier

Half-wave rectifier	Center-tapped rectifier	Bridge rectifier
Single diode	Two diodes	Four diodes
Half-wave output	Full-wave output	Full-wave output
 Second half of cycle blocked	 Second half of cycle utilised	 Second half of cycle utilised
	Centre-tap transformer	
	Poor utilization of the transformer windings.	
	Rarely used	



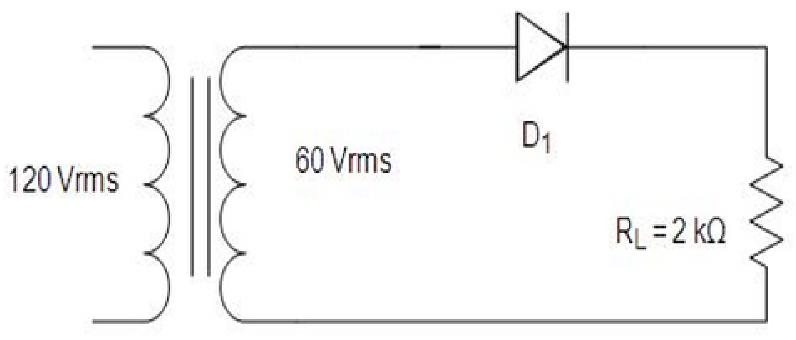
	Halfwave rectifier	*Fullwave Rectifier*	*Bridge rectifier*
No. of diodes	1	2	4
Output Voltage (V_o)	$V_o = V_{p\ sec} - 0.7V$ ** $V_{p\ sec} = \sqrt{2} \times V_{rms}$	$V_o = \frac{V_{p\ sec} - 0.7V}{2}$	$V_o = V_{p\ sec} - 1.4V$
Average Voltage (V_{avg})	$V_{avg} = \frac{V_o}{\pi}$ or... $V_{avg} = 0.318\ V_o$	$V_{avg} = \frac{2V_o}{\pi}$ or.... $V_{avg} = 0.636\ V_o$	
Average Current (I_{avg})	$I_{avg} = \frac{V_{avg}}{R_L}$ or.... $I_{avg} = I_m/\pi$	$I_{avg} = \frac{V_{avg}}{R_L}$ or.... $I_{avg} = 2I_m/\pi$	
Root mean square voltage (Vrms)	$V_{rms} = \frac{V_{p\ sec}}{\sqrt{2}}$ or... $V_{rms} = 0.707\ V_{p\ sec}$		
Output frequency	Same as input freq.	2 x input freq.	

EXAMPLES 1

Example 1:

A half wave rectifier build in 60 Vrms in the secondary of the transformer. Calculate:-

i. The output voltage.
ii.Average voltage of the circuit



Solution :

i. Output voltage, Vo

$$\boxed{Vo = \frac{Vpp_{sec}}{2} - 0.7V \quad @ \quad Vp_{sec} - 0.7V}$$

From formula, Vp sec = √2 x Vrms
= √2 x 60
= 84.85 V

Therefore, Vo = Vp_{sec} - 0.7V
= 84.85 – 0.7
= **84.16V**

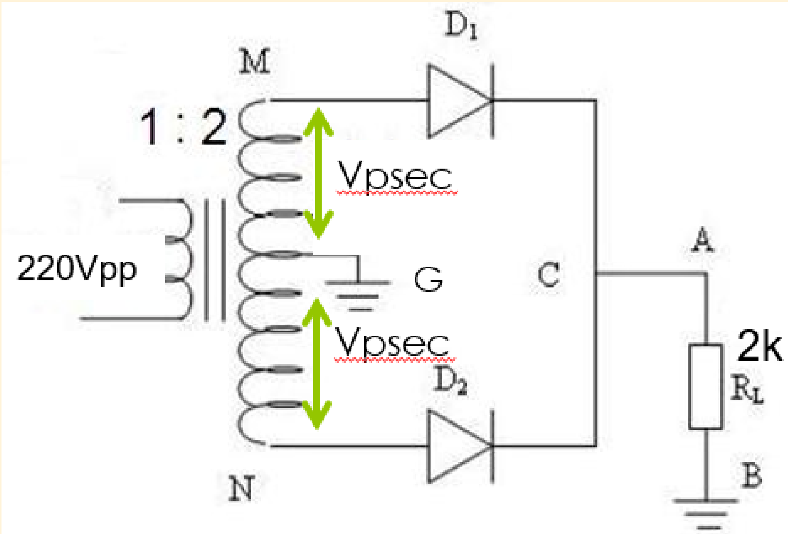
ii. Average voltage, Vavg

$$\boxed{Vavg = \frac{Vo}{\pi}}$$

$$= \frac{84.16}{\pi} = \mathbf{26.7\ V}$$

EXAMPLES 2

Example 2:
In a centre-tap full wave rectifier, load resistance is 2KΩ. The a.c. supply across the primary winding is 220V. Taking transformer turn ratio N1/N2 = ½ and neglecting diode resistance. Determine:-
i. Output voltage
ii. Average voltage
iii. Average current



Solution :

i. Output voltage,Vo

$$\boxed{Vo = \frac{Vp_{sec}}{2} - 0V}$$

neglecting diode resistance

To find Vpp_{sec}:

$$\frac{Vp}{Vs} = \frac{Np}{Ns} \Rightarrow \frac{Vp_{pri}}{Vp_{sec}} = \frac{Np}{Ns}$$

$$\frac{110V}{Vp_{sec}} = \frac{1}{2} \Rightarrow Vp_{sec} = (110V)(2) = 220V$$

So, $Vo = \frac{220}{2} - 0V = \underline{\mathbf{110V}}$

ii. Average voltage, Vavg

$$\boxed{v_{avg} = \frac{2v_0}{\pi}}$$

$$= \frac{(2)(220)}{\pi} = \underline{\mathbf{140V}}$$

iii. Average current, Iavg

$$\boxed{I_{avg} = \frac{v_{avg}}{RL}}$$

$$= \frac{140}{2K\Omega} = \underline{\mathbf{70mA}}$$

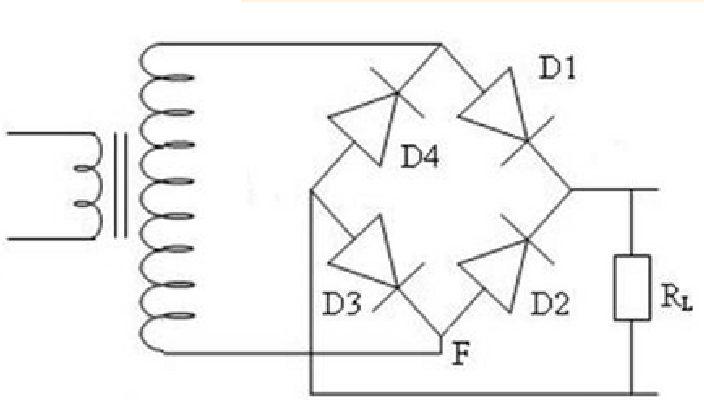
EXAMPLES 3

Example 3:

A full wave rectifier with a 120 Vrms sinusodial input had a load resistor of 1KΩ. If silicone diodes are employed, determine:-

i. Average voltage available at the load.

ii. Average current



Solution :

i. **Average voltage, Vavg**

$$\boxed{v_{avg} = \frac{2v_0}{\pi}}$$

$$\boxed{Vo = \frac{Vpp_{sec}}{2} - 1.4V \;\; @ \;\; Vp_{sec} - 0.7V}$$

$$\boxed{Vp\ sec = \sqrt{2} \times Vrms}$$

Vp sec = $\sqrt{2}$ x 120 = 169.7 V

Vo = Vp sec – 1.4V
= 169.7 – 1.4V = 168.3 V

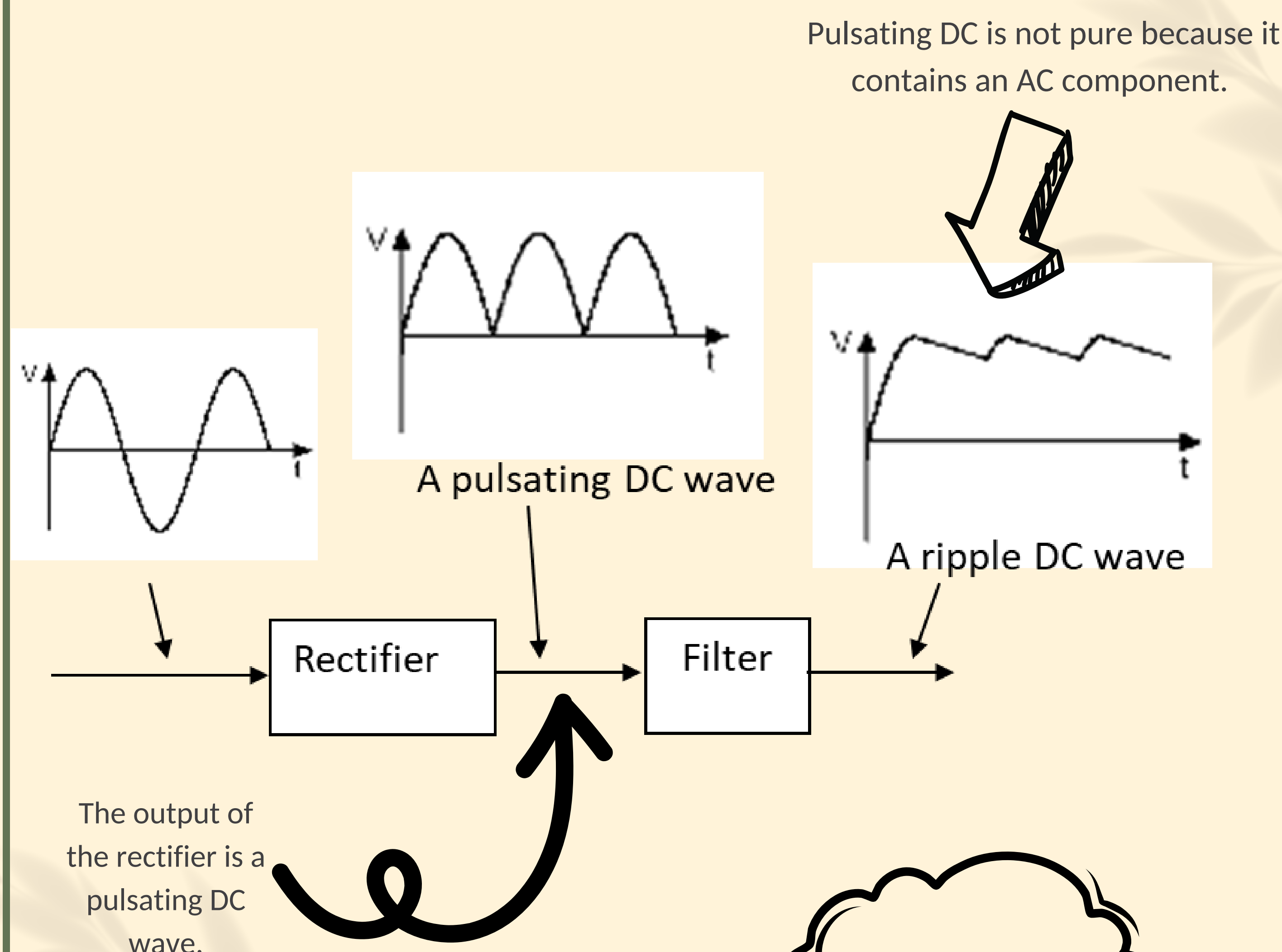
Vavg = $\frac{(2)(168.3)}{\pi}$ = **<u>107.14V</u>**

ii. Average voltage, Vavg

$$\boxed{I_{avg} = \frac{V_{avg}}{RL}}$$

= $\frac{107.14}{1K}$ = **<u>107.14mA</u>**

FILTER


Pulsating DC is not pure because it contains an AC component.
V
t
A pulsating DC wave
V
t
V
t
A ripple DC wave
Rectifier
Filter
The output of the rectifier is a pulsating DC wave.


We need a constant DC output.

FILTER

01
The AC component in DC power supply is called ripple. Ripple is usually to be considered as unwanted effect.

02
Ripple is the small unwanted residual periodic variation of the direct current (DC) output of a power supply which has been derived from an alternating current (AC) source.

03
Filter is the circuit used to remove the ripple and produce a very smooth waveform.

04
To do this, we need to filter out the oscillations from the pulsating DC wave. Figure 2.2 show the The ripple output at (a) Half-wave and (b) Full-wave rectifier.

05
This is obtained with a diode and capacitor combination. The capacitor can more effectively reduce the ripple when the time between peaks is shorter.

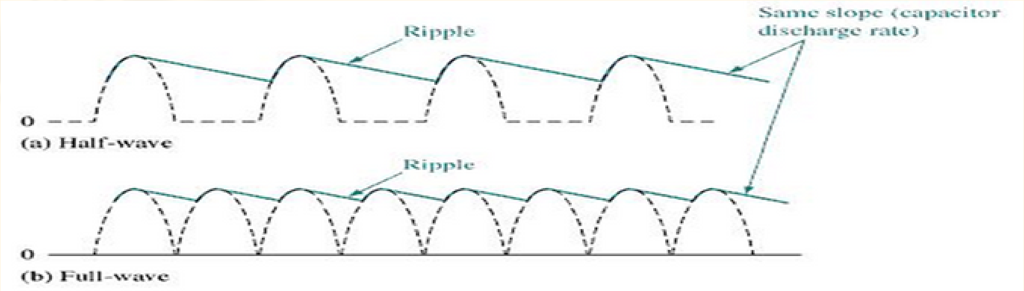


Fig 22:The ripple output at (a) Half-wave and (b) Full-wave rectifier

FILTER

CAPACITOR FILTER

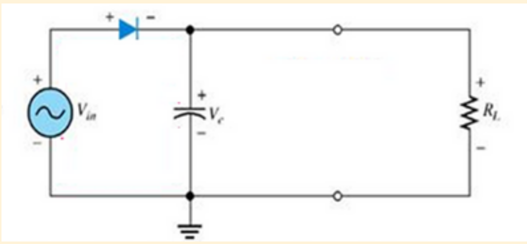


Fig 23:Capacitor Filter

- A capacitor is connected in parallel with a load resistance (RL) as in figure 23.
- Capacitor offers a low reactance to a.c components.
- Once charging, capacitor will store the charges until the current reach a complete cycle.

CAPACITOR FILTER (Operation)

- Initial charging of capacitor (diode is forward-biased) happens only once when power is turned on as in figure 24.
- Currents from a rectifiers will cause a drop voltage across RL and charging the capacitor because they are connected in a parallel circuit.

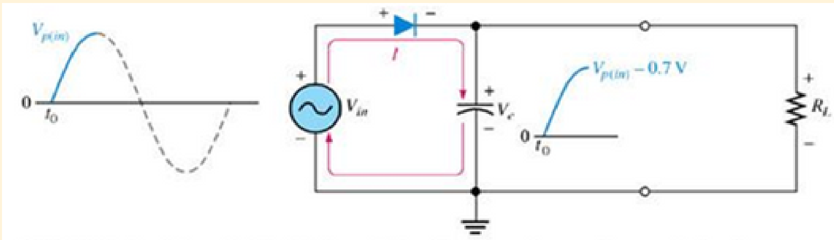


Fig 24:Initial charging of capacitor happens only once when power is turned on.

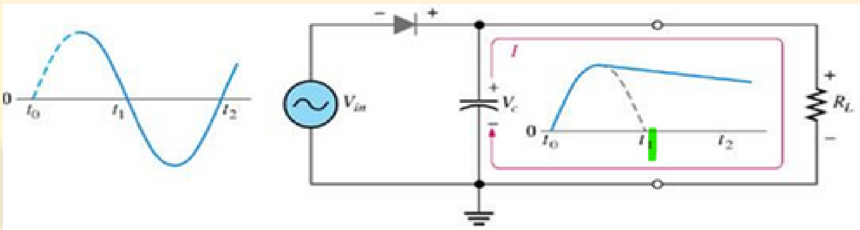


Fig 25:The capacitor discharge through RL .

- The capacitor discharge through RL after peak of positive alteration when the diode is reverse-biased as in figure 25.

- This discharging occurs during the portion of the input voltage indicated by solid curve.
- The input begins to decrease below its peak to 0V, while the capacitor is begin to discharge.
- The discharging time is longer than decreasing the voltage to 0V.

FILTER

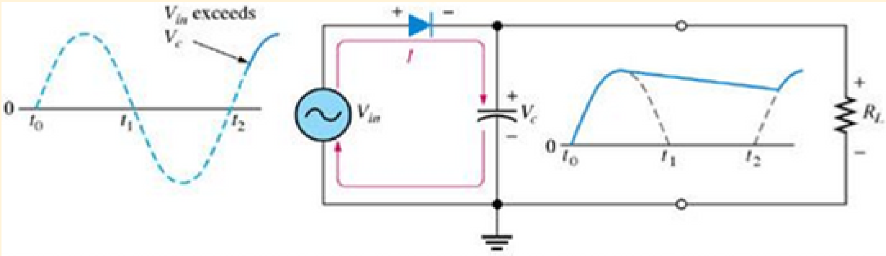


Fig 26:The capacitor charges back to peak of input when diode becomes forward-biased.

- The capacitor charges back to peak of input when the diode becomes forward-biased as in figure 26.
- This charging occurs during the portion of the input voltage indicated by the solid blue curve.
- Before completing the discharging process, another input voltage of the positive half-cycle charging the capacitor once again

- The higher value of capacitor will remove ripple voltage more effective because the higher value of capacitor will take more times to discharge (Time constant longer) as in figure 27.
- Higher capacitor value, smaller ripple voltage.

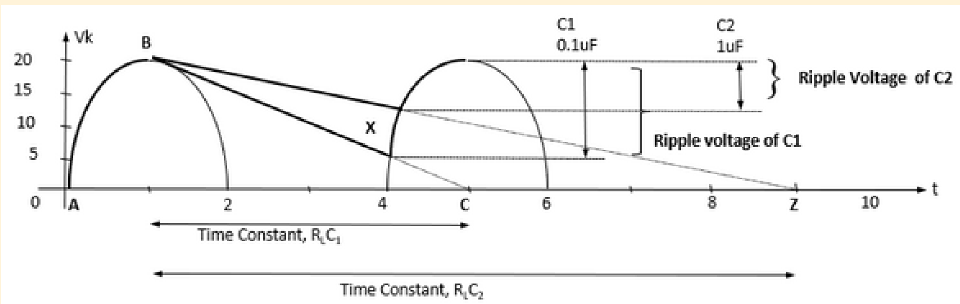
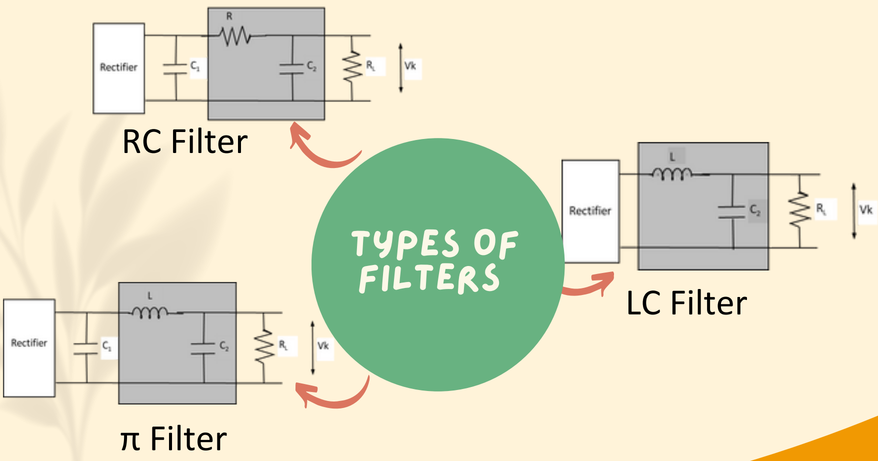


Fig 27:The capacitor charges back to peak of input when diode becomes forward-biased.



FILTER

a). RC FILTER

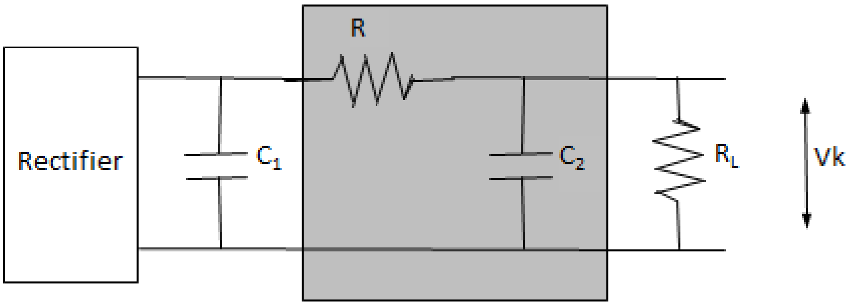


Fig 28:RC Filter circuit

- RC filter is produced by placing a resistor (R) in series with the load, while a capacitor (C_2) in parallel with the load, R_L.
- In this circuit, the ripples have to be made to drop across the resistance (R) instead of the load resistance (RL).
- So, resistance value (R) is kept much larger than reactance of capacitor C_2 (Xc_2).
- Typically, R is kept 10 times greater than Xc2 ; this means each section reduce the ripples by a factor of at least 10.
- C1 performs exactly the same function as it did in the single capacitor filter. It is used to reduce the percentage of ripple to a relatively low value.
- C2 act as a filter for the balance ripples.

The main disadvantages of R-C filter:

• Large voltage drops in the series resistor R (poor voltage regulation). DC output voltage across load, RL will also be diminished to a lower value.

• Power is wasted in R and is dissipated in the form of unwanted heat.

• The RC filter helps to reduce the ripple voltage, but it introduces output DC voltage losses when the load current is higher. Thus R-C filter is suitable only for light loads (small load current or large load resistance).

FILTER

b). π FILTER (C-L-C FILTER)

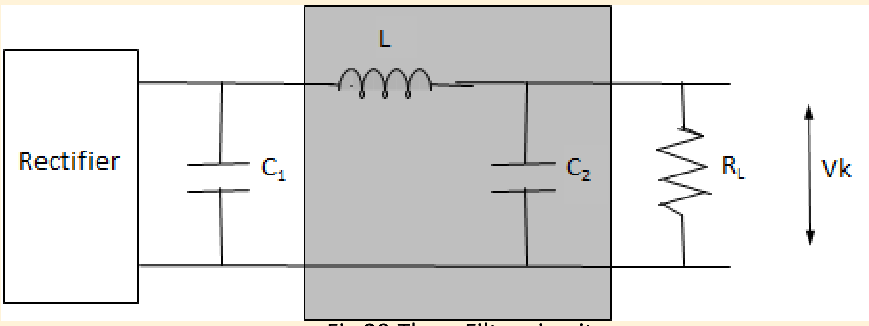


Fig 29:The π Filter circuit

- π Filter act to overcome problems that generated by RC filter.
- Resistor in RC filter is replaced with inductor (L).
- Inductor has lower reactance on d.c but has higher reactance to a.c.
- The first capacitor (C_1) offers a low reactance to a.c component of rectifier output but provide more reactance to d.c components.
- Therefore, most of the a.c components will bypass through C1 and the d.c components flows through inductor (L).
- The capacitor C2 bypasses any other a.c component which the inductor had failed to block. As a result only the DC component appears across the load R_L.

FILTER

c). LC FILTER

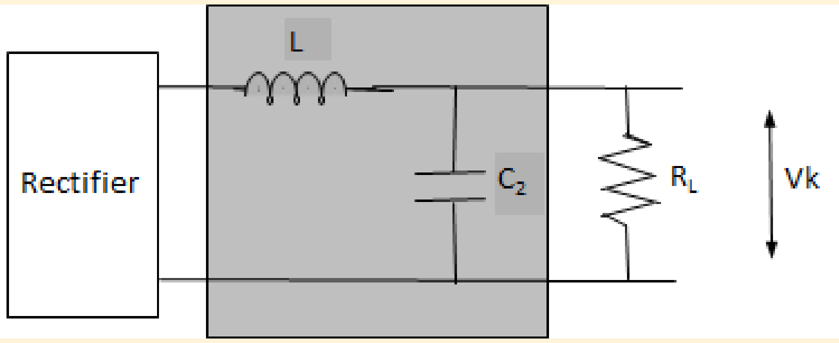
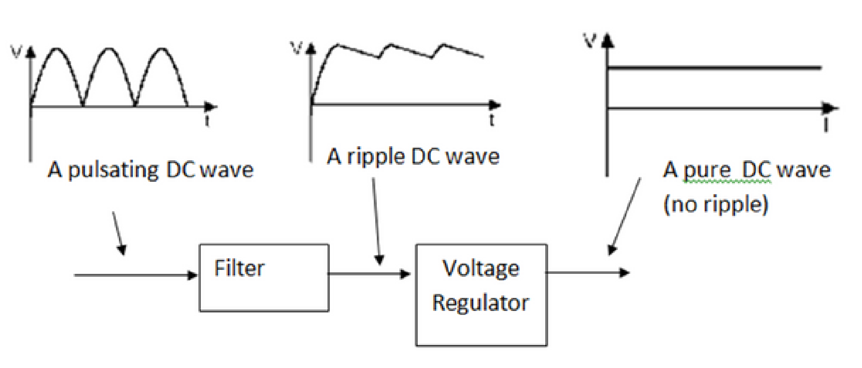


Fig 30:The LC Filter circuit

- Combination of inductor and capacitor filter.
- An inductor is connected in series and a capacitor is connected in parallel to the load.
- L gives low resistance to d.c but high reactance to a.c voltages.
- Series inductor will reduce the ripples, when increasing the load current.
- Since the d.c resistance of the inductor is very low, it allows d.c current to flow easily through it.
- Capacitor appears open for d.c. So, all d.c components passes through the resistor RL.

REGULATOR

VOLTAGE REGULATOR BLOCK DIAGRAM



REGULATOR

REGULATOR?

Regulation of a specific voltage output ensures electronic equipment does not receive electrical power surges. These surges often destroy electronic components in computers, televisions and other electronic equipment.

PURPOSE

To reduce changes to zero or at least to a value that most minimum (to maintain a constant voltage across a load regardless of variations in the applied input voltage and variations in the load current supply).

- The regulated DC output is very smooth with no ripple.
- It is suitable for all electronic circuits.

TYPES OF VOLTAGE REGULATOR CIRCUIT

a). Zener diode
b). Serial transistor
c). Integrated circuits

REGULATOR

a). ZENER DIODE'S VOLTAGE REGULATOR

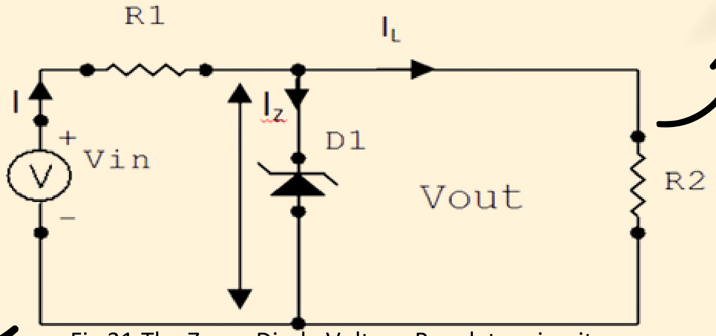


Fig 31:The Zener Diode Voltage Regulator circuit

1
A zener diode can serve as voltage regulator when working in reverse bias.

2
As a voltage regulator, a stable maximum voltage is allowed to pass through the diode.

3
This maximum voltage is determined by the voltage rating of the zener diode.

4
To operate in zener region, input voltage must be greater than zener voltage.

5
As the input voltage increases, the current through the zener diode increase but the voltage drop remains constant

REGULATOR

b). SERIAL TRANSISTOR REGULATOR

ZENER DIODE

Zener diodes is used as a **reference voltage.**

OPERATION

i. When input voltage increase, constant current is delivered to a load as show in figure 32.

SCHEMATIC DIAGRAM

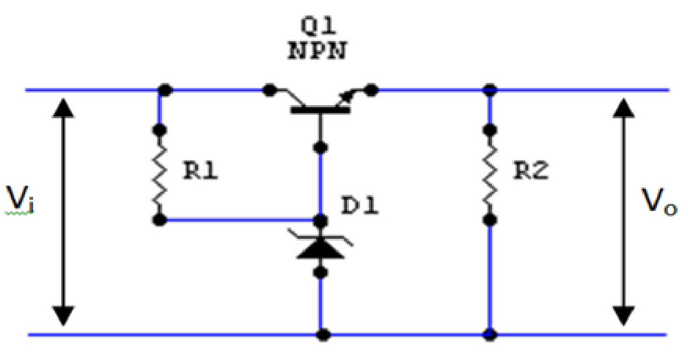


Fig 32:The Serial Transistor Regulator circuit

OPERATION

ii. When input voltage increasing, zener voltage is constant but because R1 and Zener diode is serial, voltage drop across R1 is increasing too.

OPERATION

iii. Zener diodes makes base voltage is constant and it will cause constant current flow through transistor and load.

OPERATION

Because of constant current at Base, constant current will deliver to load. A constant current value means output voltage is constant.

REGULATOR

c). INTEGRATED CIRCUIT REGULATOR

- A regulator has 3 terminals:
  - input
  - output
  - reference (common).

- LM 78**XX** (where XX = 05,06, 08, 10, 12, 15, 18 or 24) was voltage regulator with three terminals as show in figure 33.

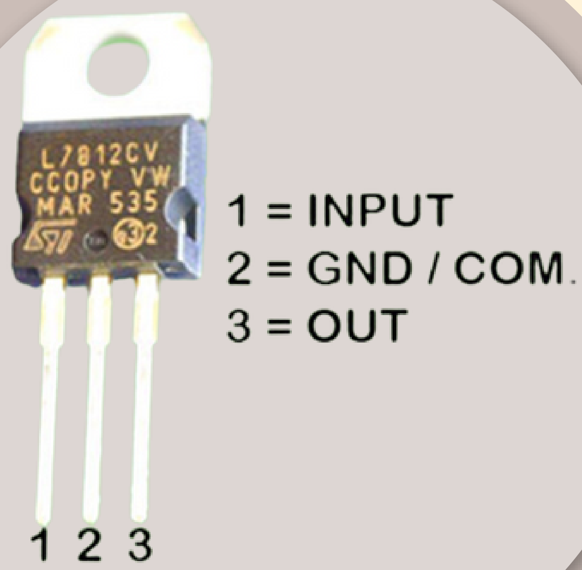


Fig 33:The Intergrated Circuit Regulator

- The **XX** value represents the output voltages.
- For example, ouput of LM78**05** = 5V and LM78**12** = 12V.

- The 78XX series are examples of positive output regulators. The output voltage show in table 2.

Table 2:The **78XX** series output voltage

Type Number 78XX	Output Voltag
7805	+5 V
7806	+6 V
7808	+8 V
7809	+9 V
7812	+12 V
7815	+15 V

- The 79XX series are examples of negative output regulators. The output voltage show in table 3.

Table 3:The **79XX** series output voltage

Type Number 79XX	Output Voltage
7905	-5 V
7905.2	-5.2 V
7906	-6.0 V
7908	-8.0 V
7912	-12 V
7915	-15 V

VOLTAGE DIVIDER

TYPES OF VOLTAGE DIVIDER

Fixed Voltage Divider

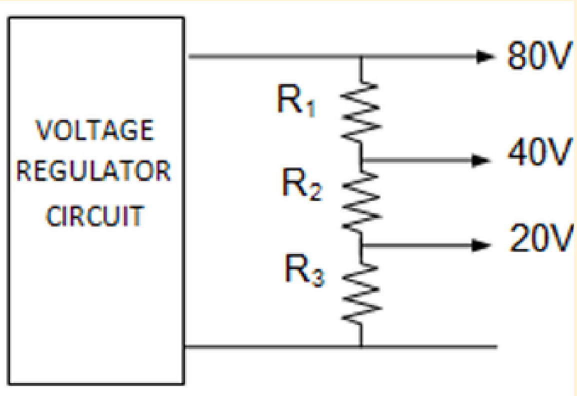


Fig 34:The Fixed Voltage Divider

Variable Voltage Divider

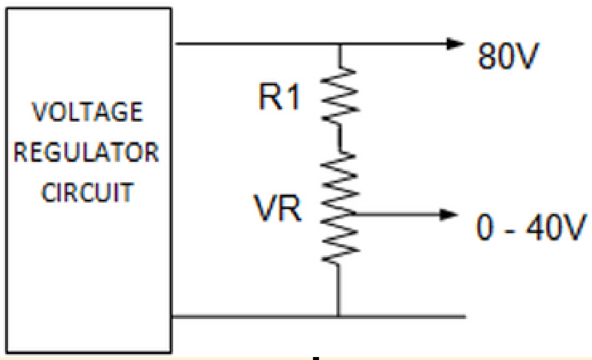


Fig 35:The Variable Voltage Divider

In several equipment system, especially tools that large or complicated, contained several circuit level which are respectively use d.c volts with different values.

Example : TV system – There are more than 10 level of circuit with different functions and require DC voltage at 100V, 48V, 12V etc.

EXERCISES

Question 1:

Describe the operation of the DC power supply block diagram which comprises these stages: transformer, rectifier, filter and voltage regulator.

Question 2

A power supply is a device that supplies electrical energy to one or more electric loads. It may also refer to devices that convert another form of energy (e.g: mechanical, chemical, solar) to electrical energy. Write the operation with aid of schematic diagram of a simple power supply. Includes your diagram with full wave rectifier, π filter and zener diode voltage regulator circuits.

Question 3

State THREE (3) types of rectifier and briefly explain function of diode in rectifier circuit

Question 4

Sketch a schematic diagram of a simple power supply unit which includes of transformer, full- wave rectifier, π filter and serial transistor voltage regulator circuits.

Question 5

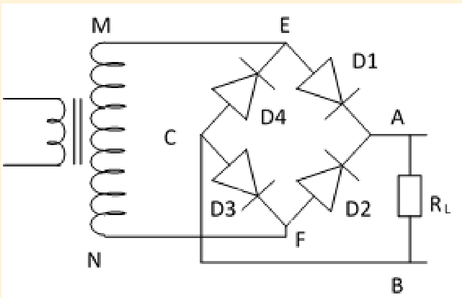


Figure 1

State the name of the rectifier circuit in figure 1 above and explain the operation during negative half of the input cycle.

EXERCISES (OBJECTIVE)

1. In an unregulated power supply, if input a.c. voltage increases, the output voltage ....

A Increases

B Decreases

C Remains the same

D None of the above

2. A power supply which has voltage regulation of .... is unregulated power supply

A. 0 %

B. 5 %

C. 10 %

D. 8%

3. An ideal regulated power supply is one which has voltage regulation of ....

A. 0%

B. 5%

C.10%

D. 1%

4. A Zener voltage regulator will cease to act as a voltage regulator if Zener current becomes ____________

A. Less than load current

B. Zero

C. More than load current

D. None of the above

5. A Zener regulator ____________ in the power supply

A. Increases the ripple

B .Decreases the ripple

C. Neither increases nor decreases the ripple

D. Data insufficient

6. The rectification is a process of converting _________

A. Alternating current into direct quantity

B. Alternating voltage into direct quantity

C. Alternating current or voltage into direct quantity

D. None of the above

EXERCISES (OBJECTIVE)

7. Rectification can be done by using ______
A. Transformers
B. Conductors
C. Bridge rectifiers
D. None of the above

8. The output of the rectification is ______
A. Unidirectional
B. Bidirectional
C. Multi-directional
D. None of the above

9. The advantages of the traditional switching DC power supply are _____
A. Small size
B. Light-weight
C. Cost-effective
D. All of the above

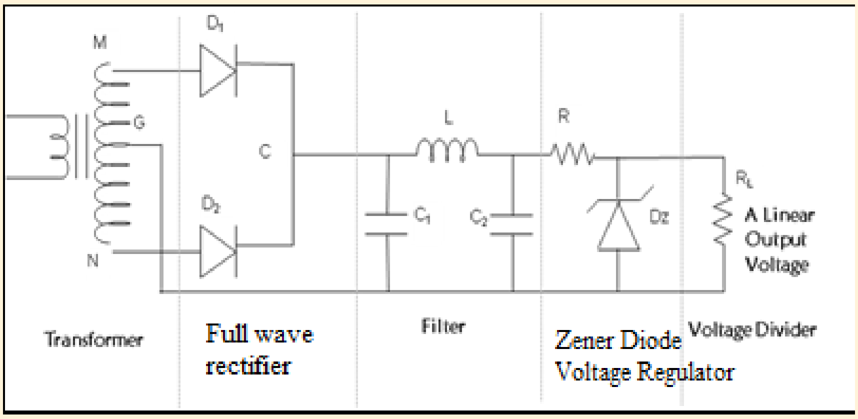
10. The efficiency of linear power supply is around ______
A. 10-20%
B. 15-20%
C. 30-40%
D. 20-30%

ANSWER

Question 1

- Transformer – To step up or step down the AC voltage. In a power supply unit, usually a step-down transformer is used to reduce the value of the input AC voltage to the required voltage of the electronic device
- Rectifier – Is a circuit that converts the pulsating sinusoidal AC voltage to a pulsating DC voltage.
- Filter – Is used to convert the pulse voltage to a ripple voltage. A filter circuit is a smoothing circuit that is used to obtain a smoother DC signal.
- Voltage Regulator – Is used to reduce the voltage difference to zero. A voltage regulator helps to maintain constant output voltage.

Question 2



- Power supply circuits build using transformer, rectifier and filter. The addition parts are voltage regulator and voltage divider.

- Starting with an ac voltage, a steady dc voltage is obtained by rectifying the ac voltage, then filtering to a dc level and finally regulating to obtain a desired fixed dc voltage.

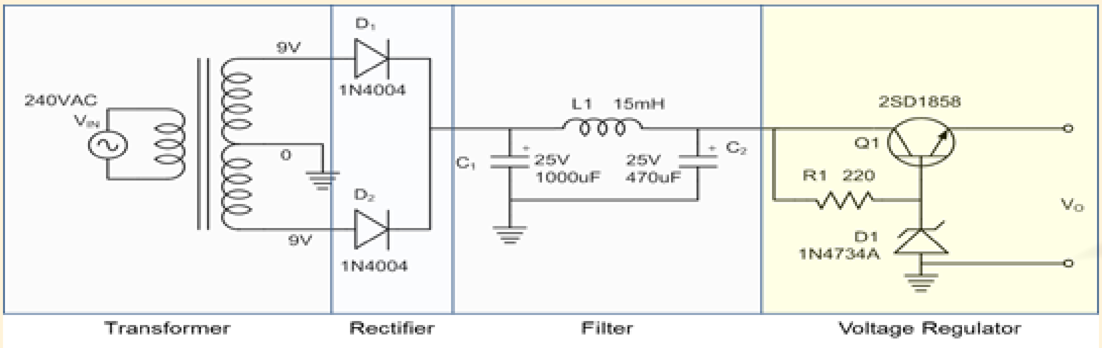
Question 3

i) Half-wave rectifier
ii) Full-wave rectifier
iii) Bridge rectifier.

- Rectifier diodes are used to current flow in the circuit to a uni-direction. When diode is in forward bias condition, it will acts as a switch (close condition) and the current can pass through the circuit.
- But if diode is in reverse biased condition, it will acts as a switch (open condition) so the current can not pass through the circuit.

ANSWER

Question 4



Question 5
Bridge Rectifier Circuit

Operation

During the negative half of the input voltage cycle, M is negative and N is positive. D2 and D4 are forward biased, D1 and D3 are reversed biased. The direction will flow along N, F, A, B, C, E, M. A positive wave cycle will result at RL load. Since the direction current flow through RL is similar to the current flow through the positive cycles, so similar wave will be produced

ANSWER (OBJECTIVE)

1. A
2. C
3. A
4. B
5. B
6. A
7. C
8. A
9. D
10. C

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