26/3/2022

Assignment - 1

Q.1] Define electronics and explain it's applications in 3-fields.
Q.2] What are electronic components?
Q.3] Define active and passive components and state it's classification.
Q.4] What is Resistor? Draw the symbol, state the unit and give classification.
Q.5] Explain linear and non-linear resistors?
Q.6] What is capacitor? Draw symbols of fixed and variable capacitor, state it's unit and give the expression for capacitance?
Q.7] Classify capacitors?
Q.8] Define inductors / inductance. Draw the symbol, state unit and give classification.
Q.9] What is signal? State types of signal
Q.10] Define the terms:
a) cycle
b) time period / periodic time
c) frequency
d) amplitude
e) wavelength.
Q.11] Draw the following signals:
- sinewave
- cosinewave
- regular wave
- square wave
- digital signal

Q.12] What are integrated circuits? (IC's)
Q.13] State different types of IC's.
Q.14] What is the meaning: SSI, MSI, LSI, VLSI, ULSI.
Q.15] State advantages of IC's
Q.16] State 4 dis advantages of IC's
Q.17] Give application of IC's.
Q.18] Differentiate linear & non-linear IC's.

Analog Digital

Answers:

1.] Electronics is a branch of science which deals with the electronic devices in which flow and control of electrons takes place through a vacuum, gas or semiconductor media.

Applications of Electronics:

- Communication
- Defense / Military : use of RADAR
- Medical services : X-RAY, ECG etc.

2.] The components used in designing or assembling of an electronic circuit are called electronic components.

eg: diodes, transistors, resistors etc.

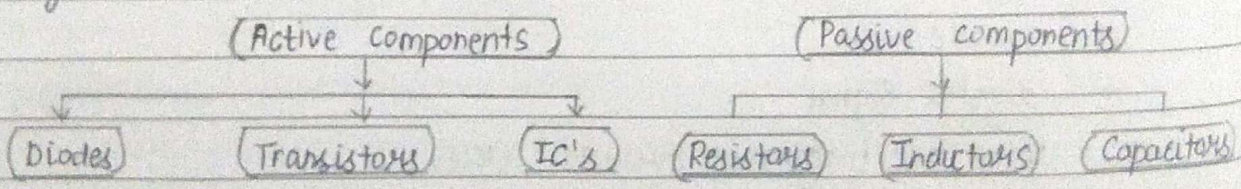
3.] Active components - the electrical components, which by themselves are capable of amplifying or processing an electrical signal are called active components.

eg: diode, transistors, ic's.

Passive components - the electrical components, which by themselves are not capable of amplifying or processing an electrical signal are called passive components.

eg: resistors, inductors, capacitors.

Classification:



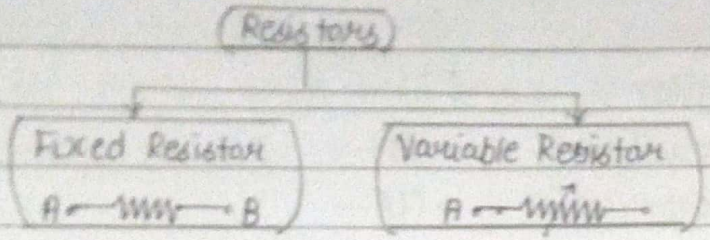
4.] The passive component, which opposes flow of current (electric current) and has a positive temperature coefficient of resistance is called resistor.

The opposition to the flow of current through any material is called resistance.

Resistor is denoted by (R). Symbol A —/\/\/\— B

The unit of resistor is ohm (Ω)

Classification:



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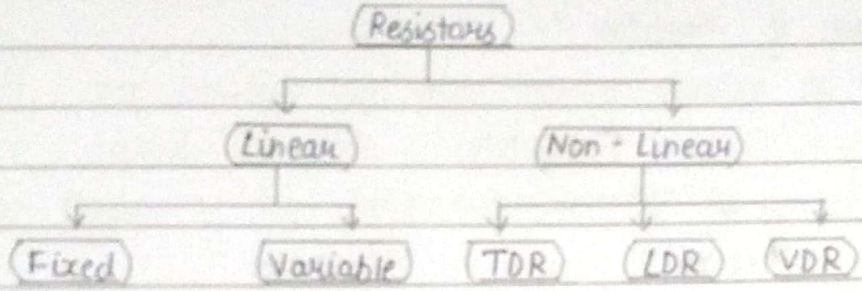


- Fixed: Wire wound, Carbon Composition, Metal thin
- Variable: Potentiometer, Trimmer, Rheostat
- TDR : temperature dependent
- LDR : light dependent
- VDR : voltage dependent.

5.) Linear resistor : if the voltage across and current flowing through a resistor possess linear relationship, then the resistor is called linear resistor.

Types : fixed resistor & variable resistor.

Non - linear resistor : if the voltage across and current flowing through a resistor possess non - linear relationship, then the resistor is called non - linear resistor.

Types : TDR, LDR and VDR.

6.) A capacitor is an electronic passive component, which has the ability to store the charge.

It is denoted by (C)

Unit of capacitor is Farad.

Capacitance is the ratio of charge (Q) to the voltage (V).

expression : $C = \frac{Q}{V}$ Ratio of charge / Ratio of voltage

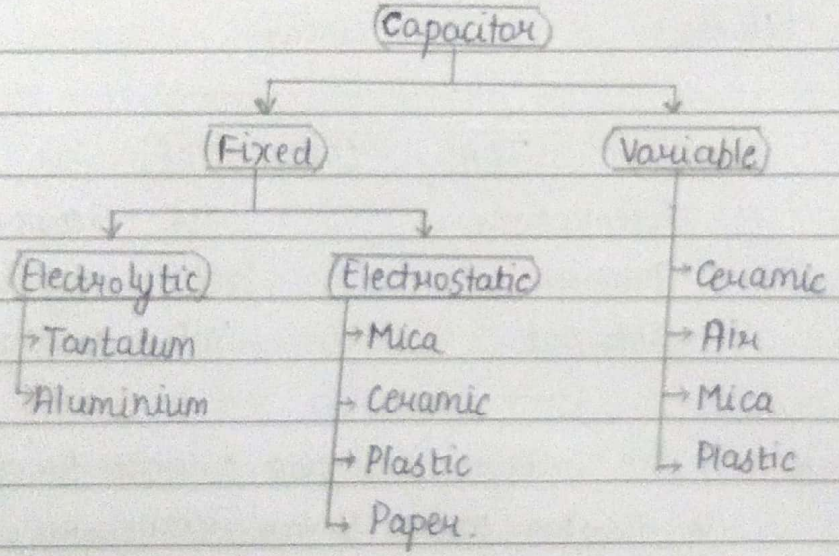
Symbols :

a) Fixed capacitor - ⊣⊢

b) Variable capacitor - ⊣⊢↗

c) Polarized capacitor - ⊣⊢ (+)

7) Classification of capacitor :

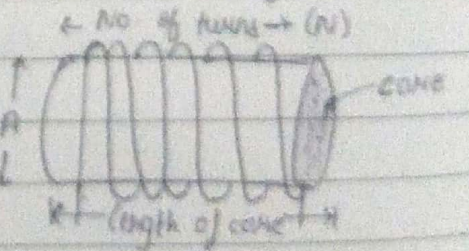


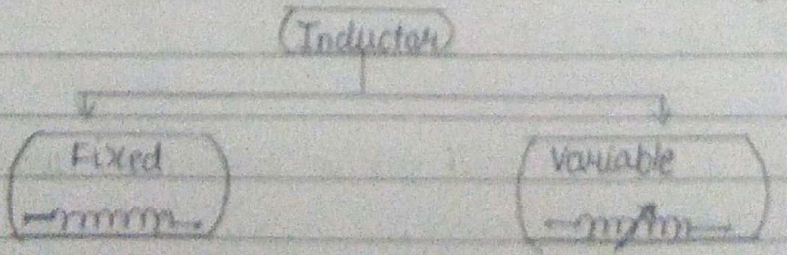
8.] Inductor is an electronic component which stores changes in magnetic field.

It is denoted by (L)

Unit of Inductor is Henry (H)

Symbol : ⌇⌇⌇⌇





Formula : $L = \frac{Vt}{(dI/dt)}$

9] A signal is a physical quantity which carries information.

Types of signal:

Analog: The electric signal whose amplitude varies continuously over a specified duration of time is called analog signal.

Digital: the signal, which only has a finite number of distinct values i.e 0, 1.

10] Define:

a) Cycle: one positive and one negative portion of AC waveform is called as cycle.

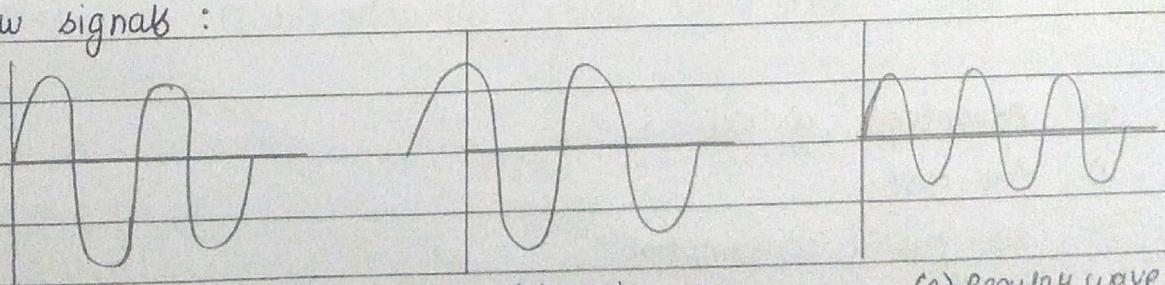
b) Time Period: the time required by AC waveform to complete one cycle is called time period.

c) Frequency: the number of cycles completed in one second. It is denoted by F and measured in Hertz (Hz).

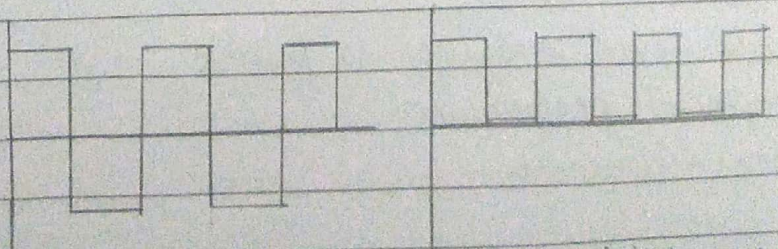
d) Amplitude: the peak value of AC waveform; positive or negative portion is called amplitude.

e) Waveform / wavelength: the distance between one positive and one negative portion of an AC waveform is known as it's wavelength.

11] Draw signals:



(a) Sine wave (b) Cosine wave (c) Regular wave



(e) Square wave (f) digital wave

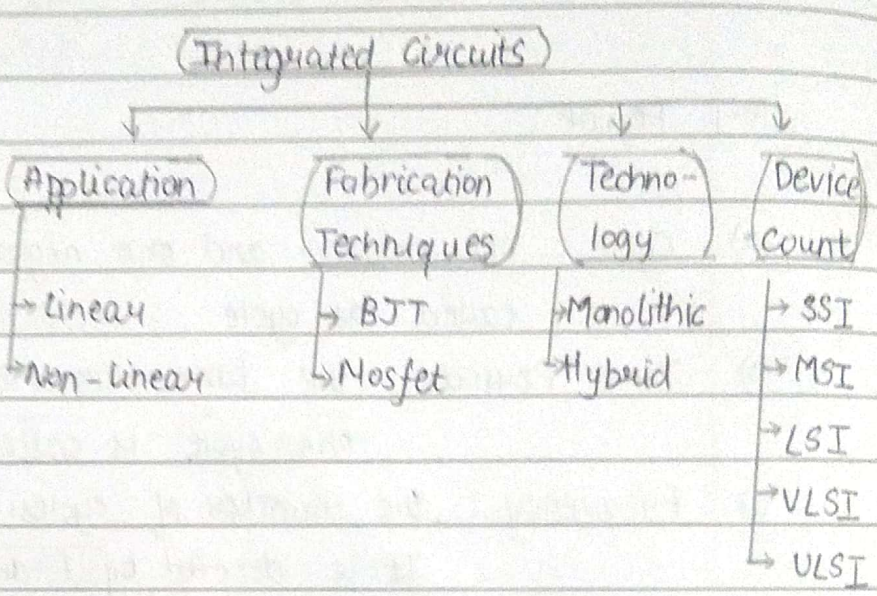
12) An integrated circuit is a miniature, low cost complete electronic circuit consisting of active and passive components, that are inseparably joined together on a single small crystal chip of semiconductor material usually silicon or on a single insulating substrate, such as glass, ceramic or saphire.

13) Types of IC's

→ Analog IC

→ Digital IC

→ Mixed IC



14)

	Level of Integration	Number of active devices
1.	Small Scale Integration (SSI)	< 100
2.	Middle Scale Integration (MSI)	100 – 1000
3.	Large Scale Integration (LSI)	1000 – 10,000
4.	Very Large Scale Integration (VLSI)	over 10,000
5.	Ultra large Scale Integration (ULSI)	over 1 million.

15) Advantages of IC's

1) low cost
2) low power consumption
3) occupies less space
4) mass scale production is possible
5) improved performance
6) easy replacement.

16) Disadvantages of IC's

1) high grade P-N-P is not possible
2) it is difficult to fabricate an IC with low noise
3) it is difficult to achieve low temperature coefficient
4) not possible to manufacture high power IC.

17) Application of IC's

1) used in smart phones, mp3 players, laptops and computers
2) used in television and camera's
3) used in aircraft and spacecraft systems.
4) It is a basic component of scientific calculators and digital watches

18)

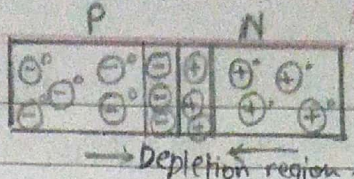
Analog IC	Digital IC
i) It's input and output can take on a continuous range of values of amplitudes and the output is generally proportional to the input.	i) It's input and output can take on only two discrete values (binary) and the output is not proportional to the input.
ii) The design requirements are more stringent	ii) The design requirements are less stringent.
iii) Requires large biasing supply voltage.	iii) Requires very less biasing supply voltage such as ±5V or ±12V.

26/3/2022

Assignment - 2

Q.1] Explain the formation of junction in P-N diode?
Q.2] Define biasing?
Q.3] Explain the operation of P-N junction in reverse bias condition?
Q.4] Explain forward biasing in P-N junction diode?
Q.5] Define reverse saturation current?
Q.6] Draw and explain V-I characteristics of PN junction diode (FB & RB)
Q.7] Compare silicon and germanium diode.
Q.8] Differentiate between ideal and real diode
Q.9] Draw the symbol of zener diode and describe the operation and V-I characteristics.
Q.10] Explain zener breakdown.
Q.11] Compare P-N junction diode and zener diode
Q.12] Draw symbol of LED. draw construction and explain.
Q.13] Describe the operating principle of LED.
Q.14] State applications of LED.
Q.15]

Answers :



1) A p-n junction diode is formed by connecting 'p' and 'n' type semi-conductors under suitable conditions using a special technique. P-N diode consists of a p-n junction which is formed either of silicon or germanium.
N-type region has a high electron concentration and the p-type, a high-hole concentration, electrons diffuse from the n-type side to the p-type side.

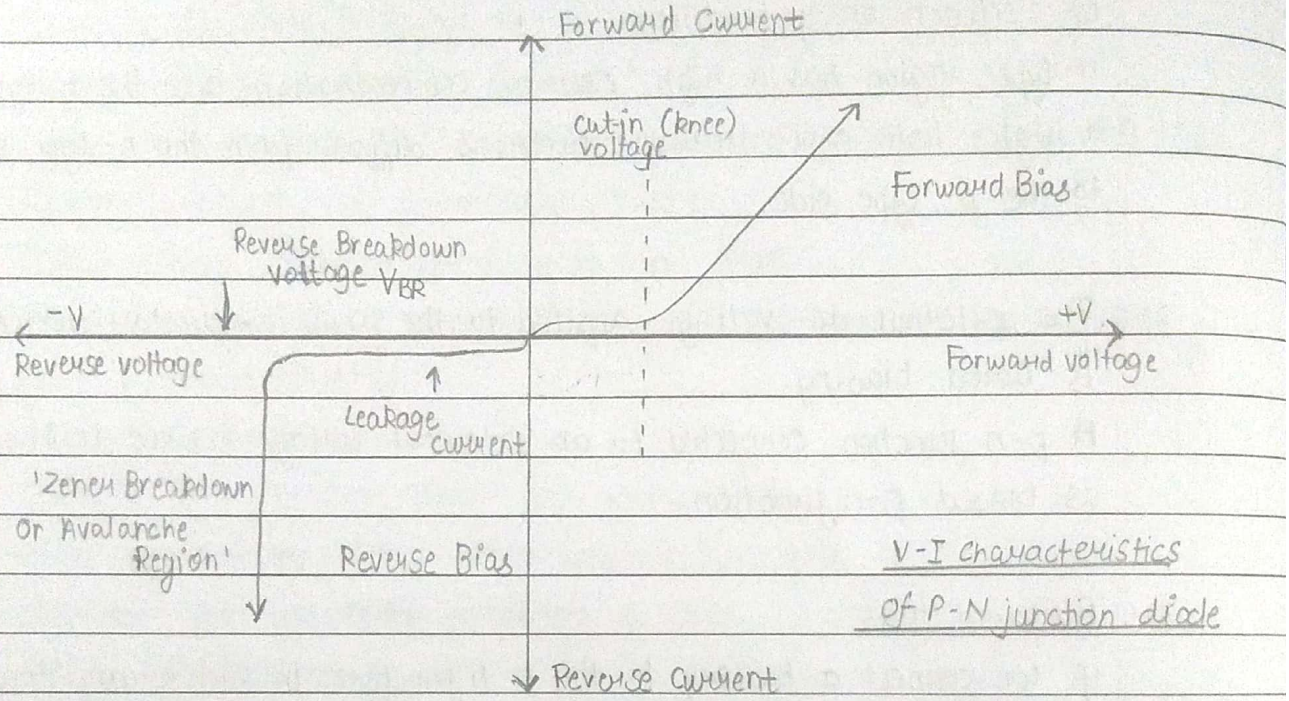
2) The external dc voltage applied to the semi-conductor device is called biasing.
A p-n junction connected to an external voltage source is known as biased p-n junction.

3) Forward bias :
if we connect a battery to the p-n junction in such a way that the positive terminal of the battery is connected to the P-region and the negative terminal of the battery is connected to the N-region, then the biasing is called forward biasing.
Majority charge carriers diffuse across the junction, hence large amount of current flows through the P-N junction when connected in forward bias, this current is called forward current (I_F).

4) Reverse Bias :
If we connect a battery to the P-N junction in such alway that the positive terminal of the battery is connected to the N-region and the negative terminal is connected to the P-region, then the biasing is called reverse biasing.
There is no current due to majority charge carriers in reverse p-n junction.

5) When a p-n junction is connected in reverse bias, there is no current due to the majority charge carriers, the current due to minority charge carriers remains constant, whether applied voltage is increased or decreased, this current is called reverse saturation current (I_0).

6)



V-I characteristics of P-N junction diode

The V-I characteristic is a graph between the voltage applied across the terminals of an semi-conductor diode and the resulting current that flows through it.

Forward characteristics:

Observation: p-n junction conducts only after the cut-in (knee) voltage.

Reverse characteristics:

Observation: in p-n junction flow of reverse current is very small till the break down voltage V_{BR} is reached.

7)

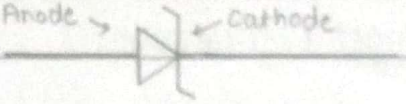
Silicon diode	Germanium diode
i) Works in breakdown when $V_R > 50V$	i) Works in breakdown when $V_R > 12$
ii) It does require 0.7 volts to become forward-bias	ii) It does require 0.3 volts to become forward bias.

8)

	Ideal diode	Practical / Real diode
i)	ideal diode acts as a perfect conductor and insulator.	i) real diode does not act as a perfect conductor and insulator
ii)	it draws no current when connected in reverse bias	ii) it draws very low current when connected in reverse bias
iii)	it offers infinite resistance.	iii) it offers high resistance.

9) A properly doped P-N junction diode, which has a sharp reverse breakdown is known as zener diode, it is also called voltage regulator or breakdown diode.

Symbol:

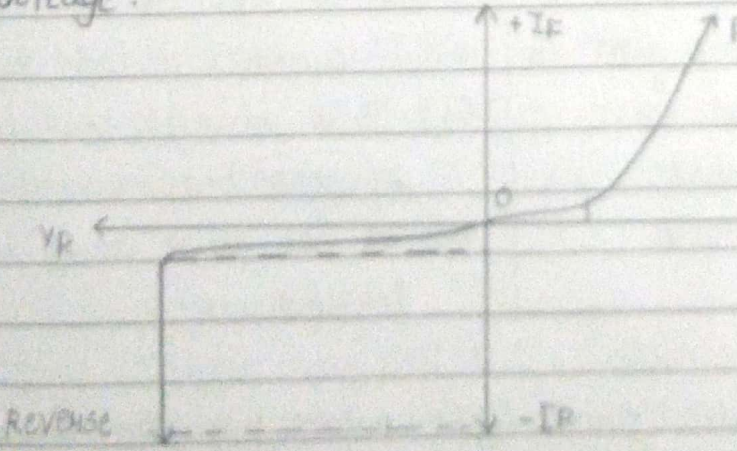


Forward Bias:

when a zener diode is forward bias, it conducts the forward current due to majority charge carriers as an ordinary p-n junction.

Reverse Bias:

when a zener diode is reverse bias it conducts reverse current due to minority charge carriers and this reverse current will be very small so long as the reverse voltage is less than breakdown voltage.



Forward characteristic: forward current is very small for voltages below knee voltage and large for voltages above knee.

Reverse Characteristic:

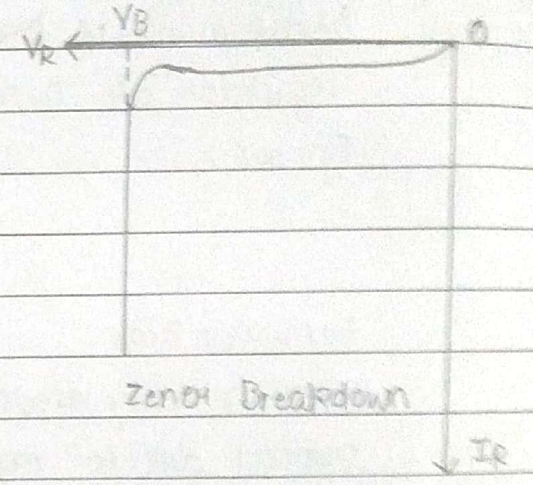
It indicates that negligible reverse saturation current flows until breakdown voltage is reached.

10) Zener Breakdown:

i) it occurs in the p-n junctions which are heavily doped.

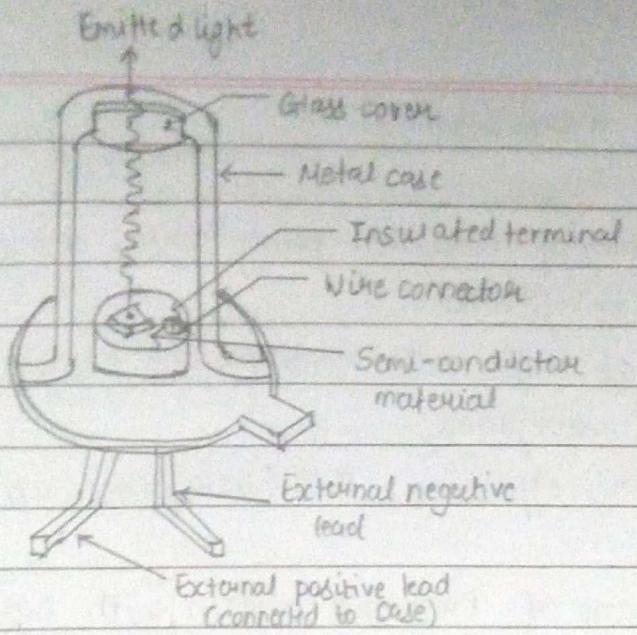
ii) when reverse voltage is increased, the electric field across the p-n junction also increases. the high value of electric field causes the bond to break from the crystal structure of P-N junction.

c) Due to this, a large number of minority charge carriers are generated and large current flows through p-n junction. This mechanism is called zener breakdown.

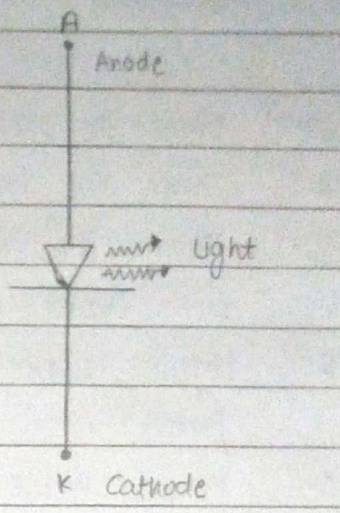


11)	P-N junction Diode	Zener diode
i)	It is not properly doped to control reverse breakdown.	i) It is properly doped to control reverse breakdown.
ii)	It conducts only in one direction	ii) It conducts in both direction.
iii)	It is always operated in forward-bias condition.	iii) It is always operated in reverse bias condition.
iv)	It has no sharp reverse breakdown	iv) It has quite sharp reverse breakdown.

12) A p-n junction, which emits light when forward biased is known as light-emitting diode (LED).



Construction



Symbol.

i) LED's are fabricated by using vapor phase or liquid phase epitaxy.

ii) Direct band gap red LED's are fabricated on GaAs substrate and indirect band gap LED's are an GaAP substrate. Indirect band gap LED's emit orange, yellow or green light.

iii) The N-type layer is grown on a P-type substrate by diffusion. Then a thin P-type layer is grown on a N-type layer.

iv) The metal connection to both the layers make anode and cathode terminals. The transparent window is provided at the top of the surface.

13) LED's work on the principle of Electro luminescence. On passing a current through the diode, minority charge carriers and majority charge carriers combine at the junction. On recombination, energy is released in the form of photons. As the forward voltage increases, the intensity of the light increases and reaches a maximum.

14) Applications of LED.

i) Used in opto couplers.

ii) Used in infrared remote controls.

iii) Used in burglar alarm systems.

iv) Used in optical communication systems.

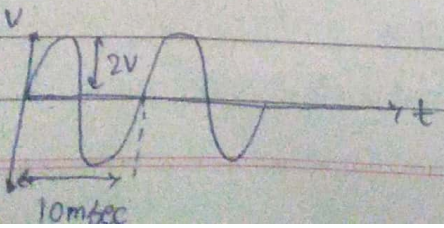
28/3/22

Assignment - 3

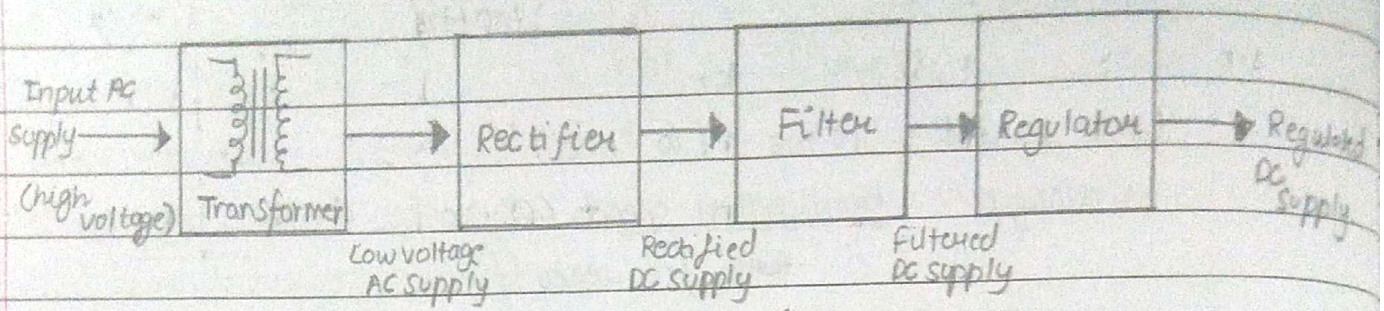
* Q.1] Draw the block diagram of regulated power supply and explain?
Q.2] State the need of rectification?
Q.3] Draw the circuit of half-wave rectifier and explain it's working with input-output waveforms
Q.4] Define ripple-factor, efficiency, TUF (transformer utilization factor)
Q.5] Draw circuit diagram of FWR and explain with input, output waveform.
Q.6] Draw circuit of bridge rectifier?
* Q.7] State applications of rectifier?
* Q.8] Explain necessicity of filter in DC power supply?
Q.9] Explain working of C filter
Q.10] Draw and explain inductor filter?
Q.11] Compare shunt capacitor filter & series ~~capacitor~~ inductor filter.
Q.12] Draw circuit diagram of zener diode used as a regulator

Question-Bank for CT-1

- color code
- V-I characteristics of Zener diode
- Active and passive components
- Advantages of Ic's
- Symbols.
- Filter
- Operation of p-n junction diode.
- Full wave rectifier.
- LED (working / construction)
- Calculate Amplitude (peak to peak)
- frequency (calc) time period (calc) wavelength (calc)



Answers :

1. 

Regulated Power Supply.

Transformer : A step-down transformer will step-down the voltage from the input AC supply at (high voltage) and will give low voltage AC supply as the output.

Rectifier : it is a circuit consisting of diodes which is used to convert alternating current or voltage into corresponding DC quantity. it thus gives unidirectional pulsating DC as the output.

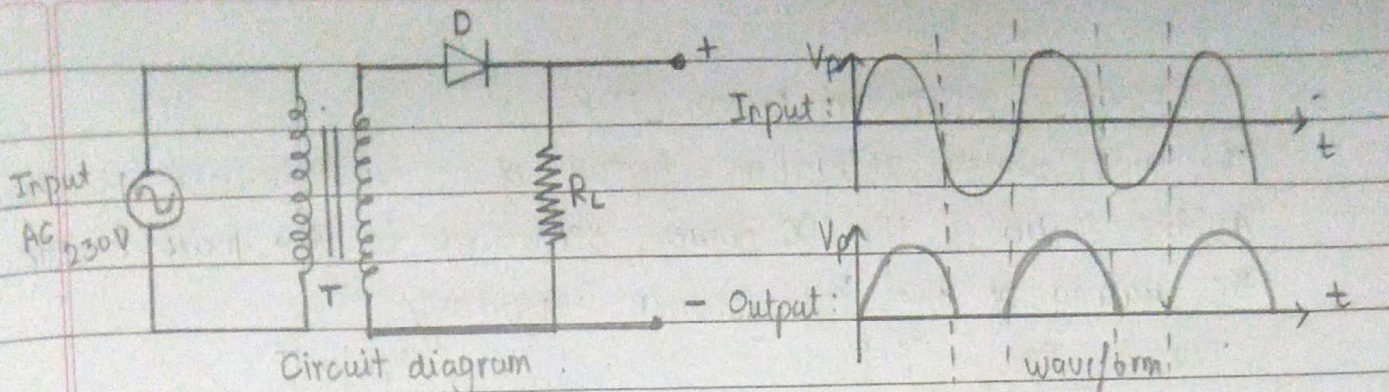
Filter : The pulsating DC contains a large amount of ripple. the function of the filter is to filter out the ripples and provide DC voltage output.

Regulator : The unregulated DC voltage is applied to the voltage regulator, this makes the DC voltage steady and improves line regulation thus providing regulated DC voltage across the load.

2. Need for Rectification :

Every electronic circuit such as amplifiers needs a dc power for it's operation. The dc voltage can be obtained from the ac supply, first the ac supply at high voltage needs to be stepped-down using a transformer and then converted into dc by using a rectifier thus stating the need for rectification.

3. Half-wave Rectifier.



1) A half-wave rectifier is an electronic circuit which allows the unidirectional (dc) current to flow through the load during one-half period of the input ac cycle.

2) The rectifier conducts only during positive half-cycles of input ac supply. the negative-half cycles are suppressed, and there is no flow of current and no-voltage drops across the load.

*working

3) During the positive-half cycle of the ac input voltage the polarity is such that the p-n junction is in forward biased, hence the diode D conducts and the current flows through the load resistor for all instantaneous voltages greater than knee voltage.

4) During negative half-cycle of the ac input voltage the polarity is such that the p-n junction diode is in reversed biased, hence the diode D does not conduct and there is partial or no flow of current through the load resistor.

4. Define:

a) Ripple factor: The measure of how successful, a rectifier circuit is doing the rectification is called ripple factor. It is denoted by (γ).

$$\text{Ripple factor} = \frac{\text{RMS value of AC component}}{\text{DC value of output voltage}}$$

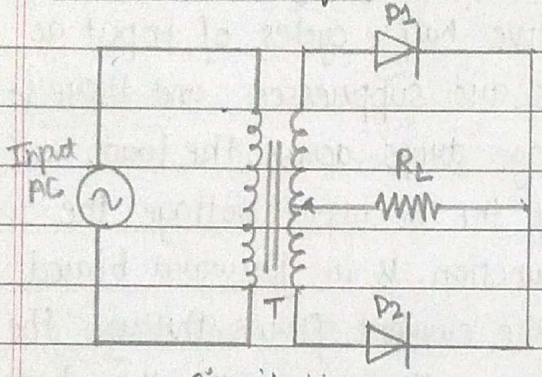
b) Ripple factor efficiency: The ratio of output dc power delivered to the load to the applied input ac power is called rectifier efficiency. It is denoted by (η)

c) Transformer utilization factor (TUF):

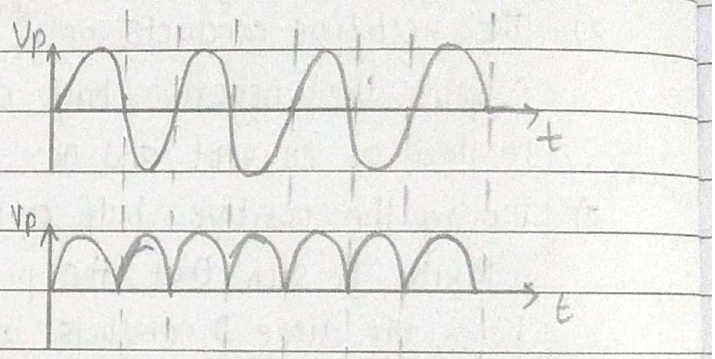
The transformer utilization factor of a transformer is defined as the ratio of the DC power delivered to the load to the AC rating of the transformer secondary.

$$TUF = \frac{P_{dc}}{P_{ac\ rated}}$$

5) Full-wave Rectifier:



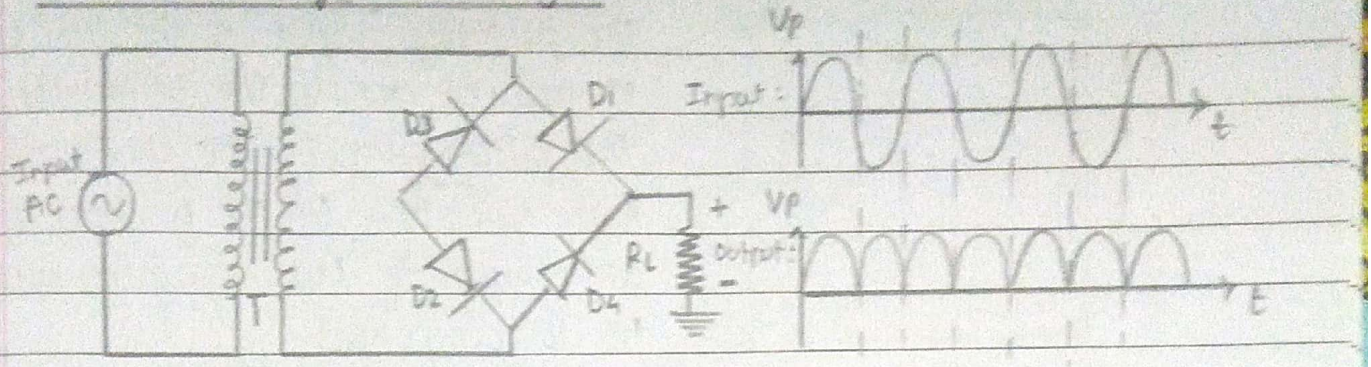
Circuit diagram



waveform.

1) A full-wave rectifier is an electronic circuit which utilizes a centre-tap transformer and allows the unidirectional (dc) current to flow through the load during the entire period of input ac-signal.
2) In full-wave rectifier, both half cycles of input AC signal are utilized ie positive and negative half-cycle.
3) During the positive half-cycle of the ac input voltage, the polarity is such that the p-n junction is forward biased, hence the diode D1 conducts (D2 is in reverse boiased) and the current flows through the load resistor for all instantaneous voltages greater than knee voltage.
4) During the negative half-cycle of the ac input voltage, the polarity is such that the p-n junction is in forward biased, hence the diode D2 conducts (D1 is in reversed biased) and the current flows through load resistor for all instantaneous voltages greater than knee voltage.

6) Full Wave Rectifier : Bridge.



Circuit diagram Waveform

7) Applications of rectifiers :

half - wave :

1) used in eliminators, which are used for pocket radio, walkman.
2) used in battery chargers.

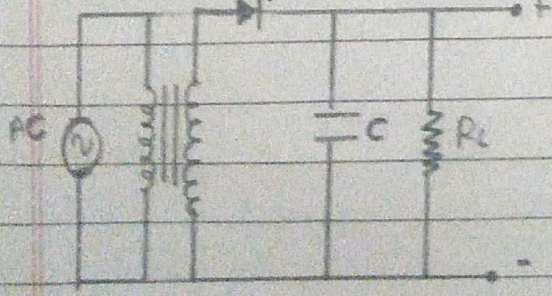
full - wave :

1) used in battery chargers
2) used in high - current power supplies.
3) used in power supplies used in laboratories

8) Need for filters :

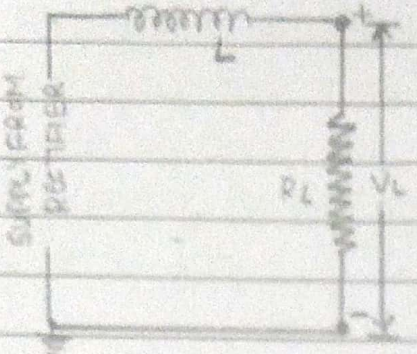
1) used to provide ripple free dc voltage.
2) the ripple must be kept away from load, and should be removed and rectified.
3) the work of filter is to allow ripple free dc voltage to reach the load.

9) Working of C - filter.



The shunt capacitor filter comprise of capacitor which is connected in parallel with respect to the output of rectifier. circuit and also parallel to load resistor. During conduction the capacitor starts charging and stores energy in electrostatic field. The capacitor will charge to it's peak value because charging time constant is zero.

10) Series Inductor Filter

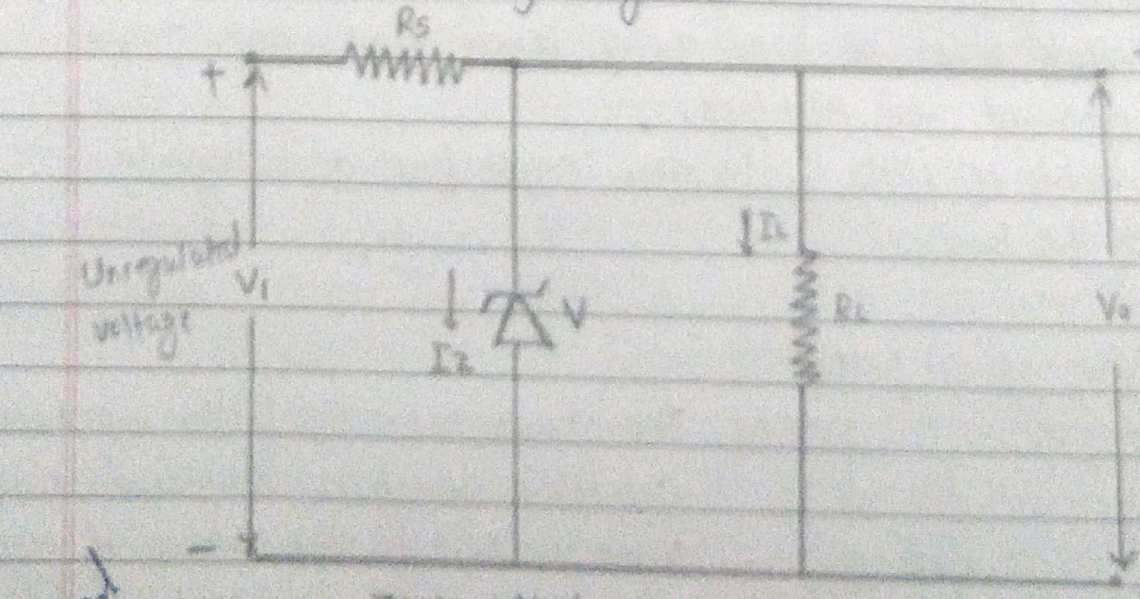


The pulsating output of the rectifier is applied across the terminals of the filter circuit. The choke offers high opposition to the passage of ac component but negligible opposition to dc component.

The result is that most of the ac component appears across the choke while whole dc component passes through the choke on it's way to load.

11)	Series Inductor Filter	Shunt Capacitor Filter
a)	An inductor is connected in series with load.	a) A capacitor is connected across the load.
b)	Ripple increases with increase in load resistance.	b) Ripple decreases with increase in load resistance
c)	It has better voltage regulation	c) It has poor voltage regulation
d)	It is useful for heavy loads	d) It is useful for light loads

12) Zener Diode as voltage regulator.



Zener diode as voltage regulator.

Good
4/14/x