UNIT 1.

SMALL-SIGNAL AND LARGE SIGNAL AMPLIFIERS

1.Why do we choose q point at the center of the loadline?

The operating point of a transistor is kept fixed usually at the center of the active region in order that the input signal is well amplified. If the point is fixed in the saturation region or the cut off region the positive and negative half cycle gets clipped off respectively.

2.Name the two techniques used in the stability of the q point .explain.

Stabilization technique: This refers to the use of resistive biasing circuit which allows I_B to vary so as to keep I_C relatively constant with variations in I_{co},â, and V_{BE}.

Compensation techniques: This refers to the use of temperature sensitive devices such as thermistors diodes. They provide compensating voltages &currents to maintain operating point constant.

3.Give the expression for stability factor.

$S= (1+â)/[(1- â)(ä I_B/ ä I_C)]$

4.List out the different types of biasing.

1. Voltage divider bias
2. Base bias
3. Emitter feed back bias
4. Collector feedback bias

5.What do you meant by thermal runway?

Due to the self heating at the collector junction, the collector current rises. This causes damage to the device. This phenomenon is called thermal runway.

6. Why is the transistor called a current controlled device?

The output characteristics of the transistor depend on the input current. So the transistor is called a current controlled device.

7. Define current amplification factor?

It is defined as the ratio of change in output current to the change in input current at constant other side voltage.

8. What are the requirements for biasing circuits?

1. The q point must be taken at the Centre of the active region of the output
2. characteristics.
3. Stabilize the collector current against the temperature variations.
4. Make the q point independent of the transistor parameters.
5. When the transistor is replaced, it must be of same type.

9. When does a transistor act as a switch?

The transistor acts as a switch when it is operated at either cutoff region or saturation region.

10. What is biasing?

To use the transistor in any application it is necessary to provide sufficient voltage and current to operate the transistor. This is called biasing.

11. What is operating point?

For the proper operation of the transistor a fixed level of current and voltages are required. This values of currents and voltages defined at a point at which the transistor operate is called operating point.

12. What is stability factor?

Stability factor is defined as the rate of change of collector current with respect to the rate of change of reverse saturation current.

13. What is d.c load line?

The d.c load line is defined as a line on the output characteristics of the transistor which gives the value of Ic & Vce corresponding to zero signal condition.

14. What are the advantages of fixed bias circuit?

This is simple circuit which uses a few components. The operating point can be fixed any where on the Centre of the active region

15. Explain about the various regions in a transistor?

The three regions are active region saturation region cutoff region.

16. Explain about the characteristics of a transistor?

Input characteristics: it is drawn between input voltage & input current while keeping output voltage as constant.

Output characteristics: It is drawn between the output voltage &output current while keeping input current as constant.

17. What is the necessary of the coupling capacitor?

It is used to block the c signal to the transistor amplifier. It allows a c &blocks the d c.

18. What is reverse saturation current?

The current due to the minority carriers is called the reverse saturation current.

19. Why is the operating point selected at the Centre of the active region?

The operating point is selected at the Centre of the active region to get to perfect amplification. Moreover there is no distortion.

20. What are the basic rules of an operating amplifier?

The operating point should be fixed on the load line. The upper end of the load line lies on the saturation region &lower end lies on the cutoff region.

21. What is an amplifier?

An amplifier is a device which produces a large electrical output of similar characteristics to that of the input parameters.

22. How are amplifiers classified according to the input?

1. Small – signal amplifier 2. Large – signal amplifier

23. How are amplifiers classified according to the transistor configuration?

1. Common emitter amplifier 2. Common base amplifier 3. Common collector amplifier

24. What is the different analysis available to analyze a transistor?

1. AC analysis 2. DC analysis

25. How can a DC equivalent circuit of an amplifier be obtained?

By open circuiting the capacitor.

26. How can a AC equivalent circuit of a amplifier be obtained?

By replacing dc supply by a ground and short- circuiting capacitors.

27)What does UJT stands for? Justify the name UJT.

UJT stands for unijunction transistor. The UJT is a three terminal semiconductor device having two doped regions. It has one emitter terminal (E) and two base terminals ($B_1$and B_2). It has only one junction, moreover from the out look, it resembles to a transistor hence the name unijunction transistor.

28) Give the symbol and structure of UJT.

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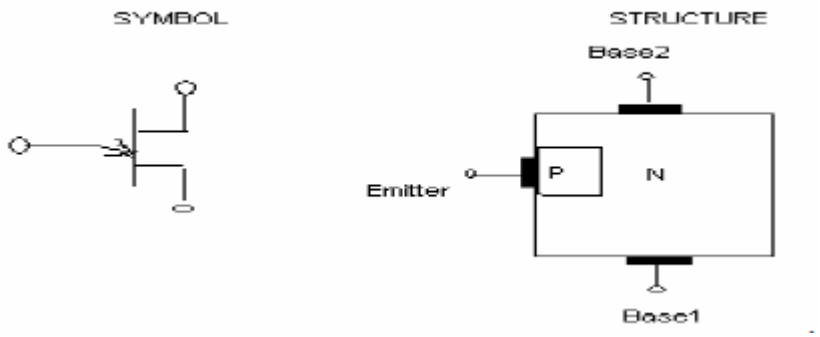
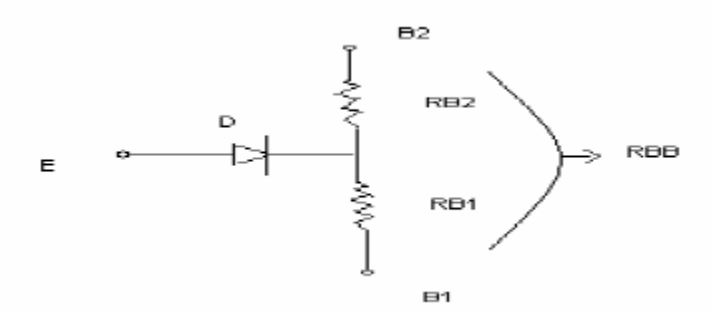


29) Give the equivalent circuit of UJT.



30) What is intrinsic stand- off ratio of an UJT?

If a voltage V_{BB} is applied between the bases with emitter open the circuit will behave as a potential divider. Thus the voltage V_{BB} will be divided across R_{B1} and R_{B2}

Voltage across r esistance

$$V_1 = \frac{R_{B1}}{R_{B1}+R_{B2}} * V_{BB} = \frac{R_{B1}}{R_{BB}} * V_{BB} = \eta * V_{BB}$$

R_{B1},

The resistance ratio _ = R_{B1} / R_{BB} is known as intrinsic stand -off ratio.

31) What is interbase resistance of UJT?

The resistance between the two bases ($B_1$and B_2) of UJT is called as interbase resistance.

Interbase resistance = R_{B1} + R_{B2}

R_{B1}- resistance of silicon bar between B_1 and emitter junction.

R_{B2} - resistance of silicon bar between B_2 and emitter junction

32) Give the expression for peak point voltage for UJT?

V_P = _ V_{BB} + V_D

Where

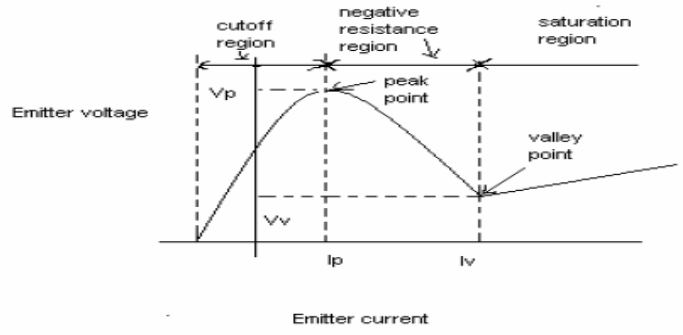
V_P - peak point voltage

_ - intrinsic stand -off ratio

V_{BB} - voltage applied between the bases

V_D – barrier potential of UJT

33) Give the VI characteristics of UJT.



34) What are the regions in the VI characteristics of UJT?

Cut-off region

Negative resistance region.

Saturation region

35) What is meant by negative resistance region of UJT?

In a UJT when the emitter voltage reaches the peak point voltage, emitter current starts flowing. After the peak point any effort to increase in emitter voltage further leads to sudden increase in the emitter current with corresponding decrease in emitter voltage, exhibiting negative resistance. This takes place until the valley point is reached. This region between the peak point and valley point is called negative resistance region.

36) Mention the applications of UJT.

- It is used in timing circuits
- It is used in switching circuits
- It is used in phase control circuits
- It can be used as trigger device for SCR and triac.
- It is used in saw tooth generator.
- It is used for pulse generation.

37) Differentiate BJT and UJT.

BJT	UJT
1. It has two PN junctions	1. It has only one PN junctions
2. three terminals present are emitter, base, collector	2. three terminals present are emitter, base1,base2
3. basically a amplifying device	3. basically a switching device

38) What is a thyristor?

Thyristor is a semiconductor device having three or more junctions .Such a device acts as a switch without any bias and can be fabricated to have voltage ratings of severalhundred volts and current ratings from a few amperes to almost thousand amperes.

39) What are the types of thyristors?

1. Unidirectional thyristors
2. Bidirectional thyristors
3. Low-power thyristors

40) What is a FET?

a. A field effect transistor is a three terminal semiconductor device in which current conduction is by one type of carriers (either electrons or holes) and is controlled by an electric field.

41) Which device is called as unipolar device? Why?

i. Since the operation of FET depends upon the flow of majority carriers (either the electrons or holes) only, the FET is said to be unipolar device.

42) What are the main drawbacks in BJT?

i. The main two drawbacks in BJT are
ii. Low input impedance
iii. Considerable noise level.

43) What is pinch off voltage?

i. Drain source voltage above which the drain current become constant is known as pinch off voltage. The point N is called as pinch off point. Above the pinch off voltage the channel width becomes narrow and drain current remains constant.

44) What are advantages of FET?

i. It is a voltage control, constant current driven device that is the variation in input voltage controls the output current.

Ii. The input impedance is very high so it allows a high degree of isolation between the input and the output circuit.

iii. The carriers are not crossing the junction hence the noise is highly reduced.

iv. It has a negative temperature co-efficient of resistance. This can avoid thermal runaway.

45) What are the two types of small signal model?

i. The small signal model is of two types
ii. Low frequency small signal model.
iii. High frequency small signal model.

46) Define transconductance?

a. It is the ratio of change in drain current to the change in gate source voltage at constant drain source voltage.

47) Define amplification factor?

i. It is the product of drain resistance and transconductance

48) State the two types of MOSFET. State also the modes in which they operate.

i. Types: (a) N- channel MOSFET, (b) P-channel MOSFET
ii. Depletion mode: In this mode the gate is maintained at positive potential with respect to source.
iii. Enhancement mode: In this mode both the gate and drain are maintained at positive potential with respect to source.

49) Why the input impedance of FET is more than that of a BJT?

i. The input impedance of FET is more than that of BJT because the input circuit of FET is reverse biased whereas the input circuit of BJT is forward biased.

50) What is MOSFET?

i. The MOSFET is an abbreviation for Metal Oxide Semiconductor Field Effect Transistor. It is a three terminal semiconductor device similar to FET with gate insulated from the channel.

51) Difference between FET and BJT

FET	BJT
1. It is a unipolar device.	1. It is a biopolar device
2. It is a voltage controlled device	2. It is a current driven device
3. Its input resistance is very high.	3. Its input resistance is very low.
4. It is less noisy.	4. It is comparatively more noisy.
5. No thermal runaway	5. There is thermal runaway
6. High switching speed	6. Lower switching speed.

52) Difference between MOSFET and FET

a. FET	MOSFET
1. Input impedance is of the order of 10	1. Input impedance is of the order or
2. It is operated only in depletion mode.	2. The depletion MOSFET can be operated in both depletion mode and enhancement mode.
3. Gate current is high.	3. Gate current is low.
4. High drain resistance.	4. Higher drain resistance.

53) Difference between UJT and BJT?

a. UJT	BJT
1. It has only one PN junction.	1. It has two PN junctions
2. The three terminals are labeled as Emitter(E), Base1 (B1) and Base2 (B2)	2. The three terminals are labeled as Emitter (E), Base (B) and Collector(C).
3. It has no ability to amplify signals.	3. It can amplify signals.

54) What is meant by negative resistance region of UJT?

i. In a UJT when the emitter voltage reaches the peak point voltage (Vp), emitter current starts flowing. After the peak point any effort to increase in emitter voltage (VE) further leads to sudden increase in the emitter current with corresponding decrease in VE, exhibiting negative resistance. This takes place until the valley point is reached. The region between the peak point and valley point is called “negative resistance region”.

55) Name the special features of a FET?

High input resistance
Low noise
Better thermal stability
High power gain
High frequency repose.

56) The noise level in FET is very small. Why?

i. In FET, for current conduction no junction is involved . The conduction is either through an N- type or P-type semiconductor. Therefore, the noise level is very small.

Unit 2
DIFFERENTIAL AND TUNED AMPLIFIERS

1). What is a tuned amplifier?

The amplifier with a circuit that is capable of amplifying a signal over a narrow band of frequencies are called tuned amplifiers.

2). What is the expression for resonant frequency?

fr=1/2 LC

3). What happens to the circuit above and below resonance?

Above resonance the circuit acts as capacitive and below resonance the circuit acts as inductive.

4). What are the different coil losses?

Hysteresis loss
Copper loss
Eddy current loss

5). What is Q factor?

It is the ratio of reactance to resistance.

6). What is dissipation factor?

It is referred as the total loss within a component i.e1/Q

7). What is the classification of tuned amplifiers?

Single tuned
Double tuned
Stagger tuned

8). What is a single tuned amplifier?

A single tuned amplifier circuit that uses a single parallel tuned circuit as a load is called single tuned amplifier.

9). What are the advantages of tuned amplifiers?

- They amplify defined frequencies.
- Signal to noise ratio at output is good
- They are suited for radio transmitters and receivers

10). What are the disadvantages of tuned amplifiers?

- The circuit is bulky and costly
- The design is complex.
- They are not suited to amplify audio frequencies.

11). What is neutralization?

The effect of collector to base capacitance of the transistor is neutralized by introducing a signal that cancels the signal coupled through collector base capacitance. This process is called neutralization.

12). What are double tuned amplifiers?

The amplifiers having two parallel resonant circuit in its load are called double tuned amplifiers.

13). What is a stagger tuned amplifier?

It is a circuit in which two single tuned cascaded amplifiers having certain bandwidth are taken and their resonant frequencies are adjusted that they are separated by an amount equal to the bandwidth of each stage. Since resonant frequencies are displaced it is called stagger tuned amplifier.

14). What are the advantages of stagger tuned amplifier?

The advantage of stagger tuned amplifier is to have better flat, wideband characteristics.

15). What are the advantages of double tuned over single tuned?

1. Possess flatter response having steeper sides
2. Provides larger 3 db bandwidth
3. Provides large gain-bandwidth product.

Unit 3

FEEDBACK AMPLIFIER AND OSCILLATORS

1). Give the expression for the frequency of oscillations in an op-amp sine wave oscillator?

The expression for the frequency of oscillations in an op-amp sine wave oscillator is,

f = 1 / (2ðRC)

2). What are the conditions for sustained oscillator or what is Barkhausen criterion?

Condition for sustained oscillation,

a. Magnitude condition |Avâ| = 1

b. Phase condition LAvâ = 0°

These conditions are called as Barkhausen criterion.

3). What is Oscillator circuit?

A circuit with an active device is used to produce an alternating current is called an oscillator circuit.

4). What are the classifications of Oscillators?

*Based on wave generated:

i. Sinusoidal Oscillator,

ii. Non-sinusoidal Oscillator or Relaxation Oscillator

Ex: Square wave, Triangular wave, Rectangular wave etc.

*According to principle involved:

i. Negative resistance Oscillator, ii. Feedback Oscillator.

*According to frequency generated:

i. Audio frequency oscillator

20 Hz – 20 kHz

ii. Radio frequency Oscillator

30 kHz – 30 MHz

iii. Ultrahigh frequency Oscillator

30 MHz – 3 GHz

iv. Microwave Oscillator

3 GHz – above.

* Crystal Oscillators.

5). What are the types of feedback oscillators?

* RC-Phase shift Oscillator,

* LC-Oscillators

i. Tuned collector Oscillator

ii. Tuned emitter Oscillator

iii. Tuned collector base Oscillator

iv. Hartley Oscillator

v. Colpits Oscillator

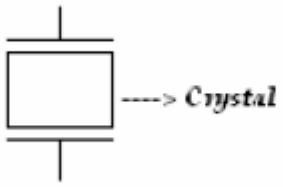
vi. Clap Oscillator

6). What are the conditions for oscillation?

The total phase shift of an oscillator should be 360o. For feedback oscillator it should satisfies Barhausen criterion.

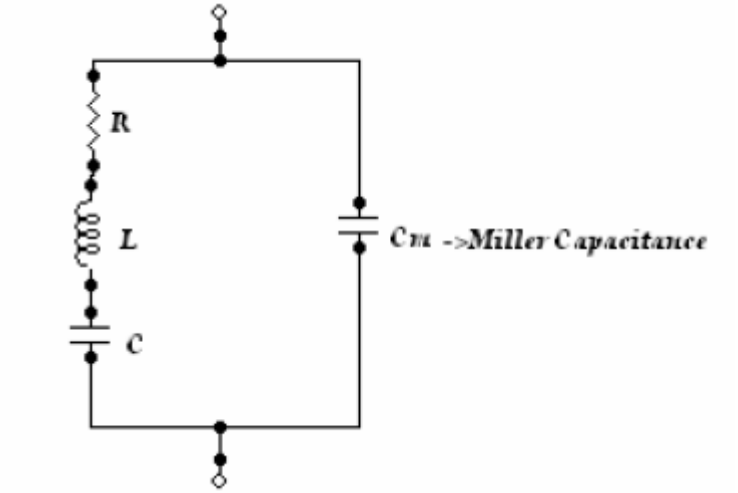
7). Define Piezoelectric effect.

When applying mechanical energy to some type of crystals called piezoelectric crystals the mechanical energy is converted into electrical energy is called piezoelectric effect.



F α 1/T.

8). Draw the equivalent circuit of crystal oscillator.



UNIT 4
PULSE CIRCUITS

1). What is feed back?

It is the process of injecting some energy from the output and then returns it back to the input.

2). What are feed back amplifiers?

Amplifiers which uses feed back principle is called as feed back amplifiers.

3). What are the types of feed back?

1. Positive feedback 2. Negative feedback.

4). What is positive feedback?

If the feed back signal is applied in such a way that it is in phase with the input signal and thus increases it is said to be positive feedback.

5). What is negative feed back?

If the feed back signal is applied in such a way that it is out of phase with the input signal and thus decreases it is said to be positive feedback.

6). Which feedback decreases the gain of the amplifier?

Negative feed back

7). Which feedback increases the gain of the amplifier?

Positive feedback

8). What is the advantage of negative feed back?

1. increased stability 2. Increased bandwidth 3. Decreased noise 4. Less frequency distortion

9). What is the disadvantage of negative feed back?

Reduces amplifier gain.

10). Define sensitivity.

It is the ratio of percentage change in voltage gain with feedback to the percentage change in voltage gain without feed back.

11). Define Desensitivity.

It is the ratio of percentage change in voltage gain without feedback to the percentage change in voltage gain with feed back. the reciprocal of sensitivity.

12). What is an op-amp?

The operational amplifier is a multi-terminal device, which is quite complex internally. An operational amplifier is a direct coupled high gain amplifier usually consisting of one or more differential amplifiers and usually followed by a level translator and an output stage. An operational amplifier is available as a single integrated circuit package. It is a versatile device that can be used to amplify dc as well as ac input signals and was originally designed for computing such mathematical functions.

13). What are the characteristics of ideal op-amp?

a. Open loop voltage gain, (AOL) =
b. Input impedance (Ri) =
c. Output impedance (Ro) = 0
d. Bandwidth (BW) =
e. Zero offset Vo = 0, when V1 = V2 = 0

14). Define loading?

A large value of Rc cannot be used in a circuit since,a large value of resistance requires a large chip area.For large Rc, quiescent drop across it increases and hence a large power supply is required. These difficulties removed by using a current source. Hence, a current source can also be used as an active load for an amplifier to obtain a very large voltage gain.

15). Define input offset voltage?

It is defined as the voltage that must be applied between the input

terminals of an op-amp to nullify the output.

16). Define input offset current?

It is defined as the algebraic difference between the current entering the inverting and non-inverting terminal of an op-amp.

17). Define input bias current?

It is defined as the average of the currents entering into the input terminals of an op-amp.

18). What are the two compensating techniques used in frequency compensation?

Two types of compensating techniques are used, they are,

a. External compensation
b. Internal compensation

19). What is compensated op-amp?

Op-amp, which uses a capacitor internally for compensation, is called a compensated op-amp. This op-amp has a high gain stability and low bandwidth.

20). What are the methods used in external compensation technique?

a. Dominant-pole compensation
b. Pole-zero compensation

21). Define slew rate?

Slew rate can be defined as the maximum rate of change of output voltage of op-amp with respect to time.

22). How can the slew rate be made faster?

The slew rate can be made faster by having a high charging current or a small capacitance value.

23). What are the methods to improve slew rate?

a. The slew rate can be improved with higher closed-loop gain and dc supply voltage. But the slew rate also varies with temperature. i.e., slew rate decreases with increase in temperature.

b. Another method for improving slew rate is, the rate at which voltage across the capacitor increases is gain by,

$dVc/dt = I / C.$

where, I is the maximum current furnished by the op-amp to the capacitor C. From the equation it is clear that for a higher slew rate, op-amp should have either a higher current or a small value of capacitor.

25). What is the type of feedback employed in the inverting op-amp amplifier?

Negative feedback is employed in the inverting op-amp amplifier.

26). List the applications of instrumentation amplifier.

a. Temperature indicator
b. Temperature controller
c. Light intensity meters
d. Water flow meter
e. Thermal conductivity meter
f. Analog weight scale

27). What is the basic building block of an op-amp?

The basic building block of an op-amp is differential amplifier.

28). Define non-inverting amplifier?

The input is applied to the non-inverting input terminal and the inverting terminal connected to the ground.

29). What is meant by voltage follower?

If the output voltage of an op-amp follows the input i.e., if the output voltage is equal to the input voltage it is called as a voltage follower.

30). Define Common Mode Rejection Ratio.

The relative sensitivity of an op-amp to a difference signal as compared to a common mode signal is called common-mode and gives the figure of merit ñ for

the differential amplifier.

CMRR, ñ =|Ad/Ac|

31).what is a Schmitt trigger?

Schmitt trigger is a regenerative comparator. It converts sinusoidal input into a square wave output. The output of Schmitt trigger swings between upper and lower threshold voltages, which are the reference voltages of the input waveform.

32). What is a multivibrator?

Multivibrators are a group of regenerative circuits that are used extensively in timing applications. It is a wave shaping circuit which gives symmetric or asymmetric square output. It has two states stable or quasi- stable depending on the type of multivibrator.

33). What do you mean by monostable multivibrator?

Monostable multivibrator is one which generates a single pulse of specified duration in response to each external trigger signal. It has only one stable state. Application of a trigger causes a change to the quasi-stable state. An external trigger signal generated due to charging and discharging of the capacitor produces the transition to the original stable state.

34). What is an astable multivibrator?

Astable multivibrator is a free running oscillator having two quasi-stable states. Thus, there is an oscillation between these two states and no external signal is required to produce the change in state.

35). What is a bistable multivibrator?

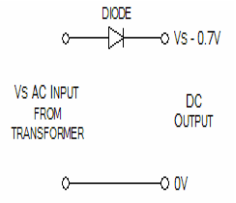
Bistable multivibrator is one that maintains a given output voltage level unless an external trigger is applied. Application of an external trigger signal causes a change of state, and this output level is maintained indefinitely until a second trigger is applied. Thus, it requires two external triggers before it returns to its initial state.

UNIT 5
RECTIFIERS AND POWER SUPPLY CIRCUITS

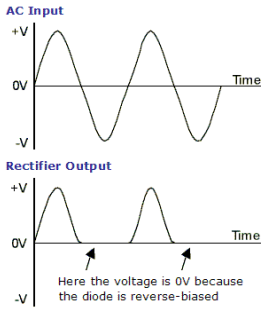
1.Define rectifier

A rectifier is an electrical device that converts alternating current to direct current. Typically this is done with a diode because they have the ability to conduct current one way & block current from going in the other way

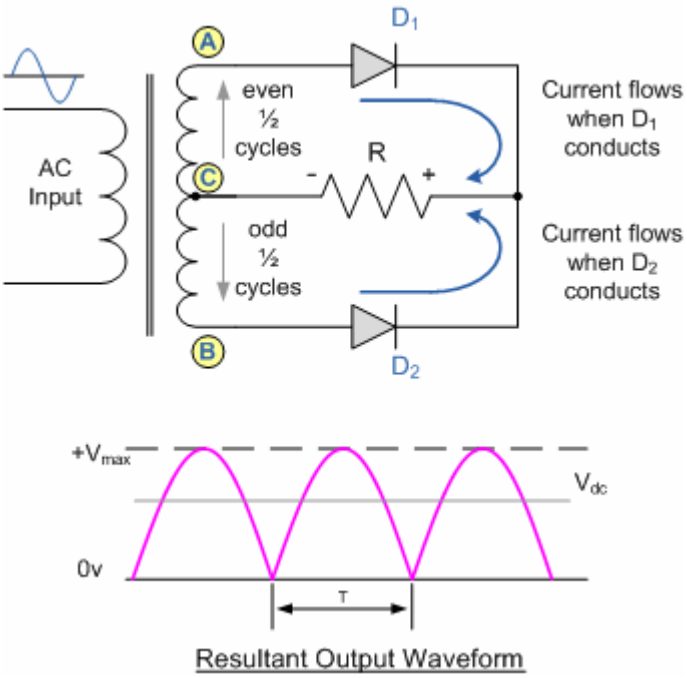
Draw the circuit diagram for half wave rectifier



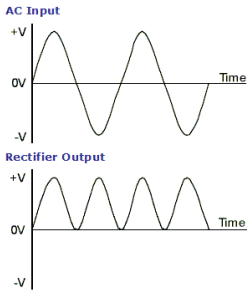
2.Draw the output wave form for half wave rectifier



3.Draw the circuit diagram for full wave rectifier

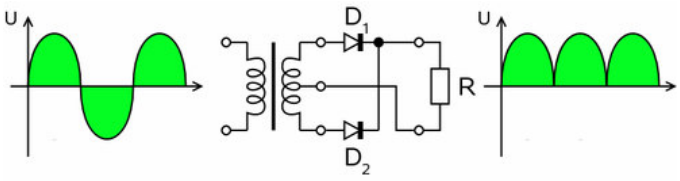


4.Draw the output wave form for full wave rectifier



5.Draw the circuit diagram for a full wave rectifier using centre tapped transformer

During a positive half-cycle D_1 is forward-biased and D_2 is reversed-biased. And During a negative half-cycle, D_2 is forward-biased and D_1 is reversed-biased



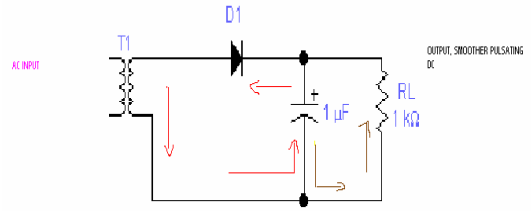
6.Define filter

A filter is a component that is used to reduce the ripple voltage. Generally the component used is a capacitor

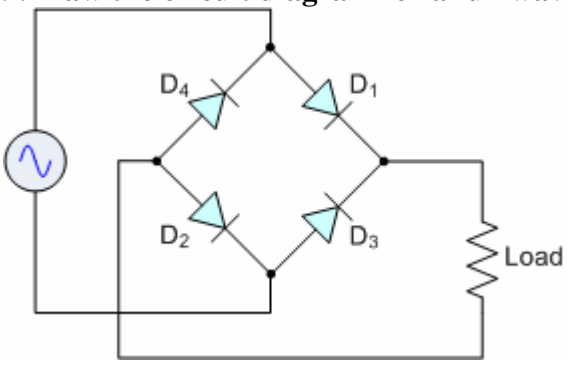
7.Define regulator

Regulators maintain a constant voltage level. It does this by comparing the output voltage to the fixed reference.

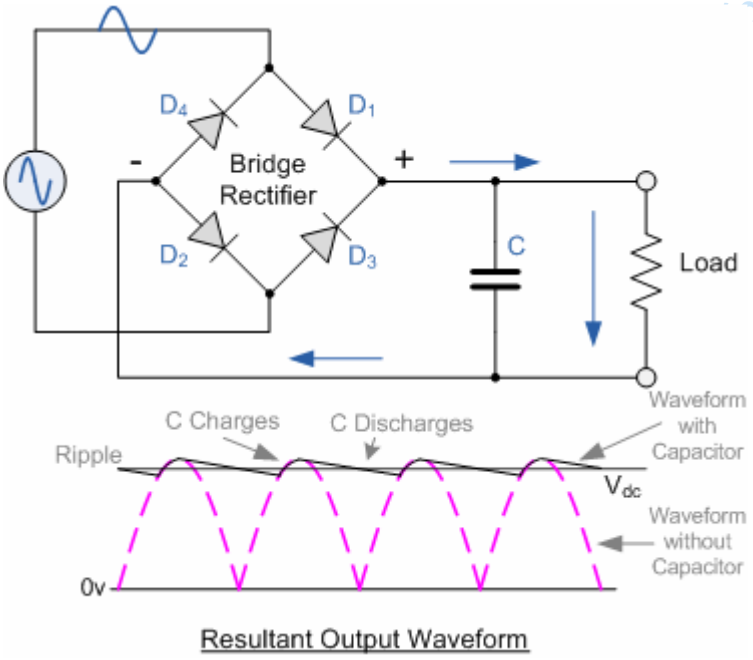
8.Draw the circuit diagram for half rectifier with capacitive filter



9.Draw the circuit diagram for a full wave rectifier using bridge rectifier



10.Draw the circuit diagram for a full wave rectifier with capacitive filter rectifier

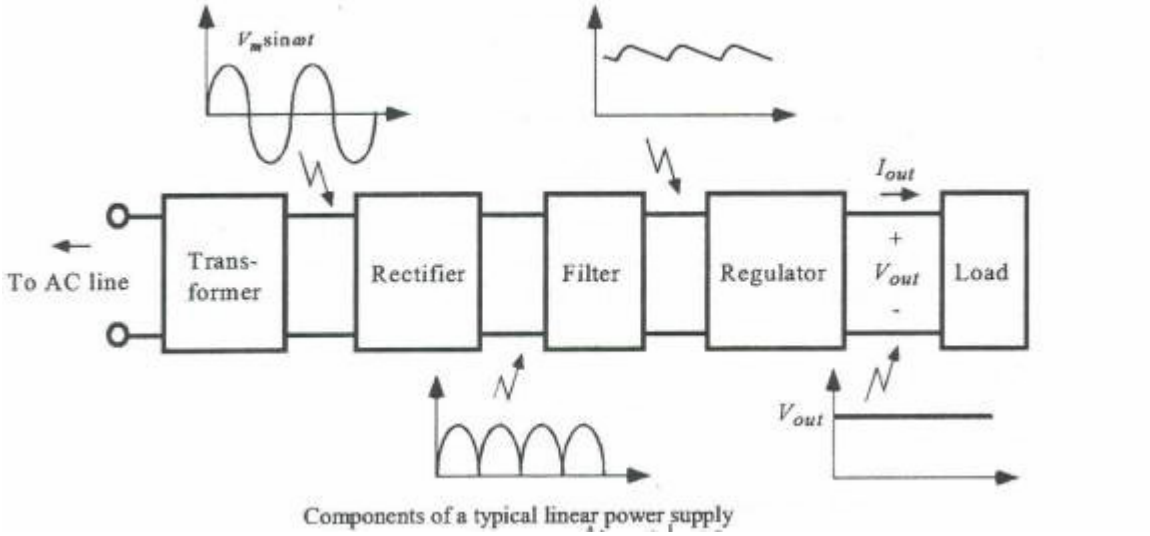


Resultant Output Waveform

11.Define SMPS

SMPS stands for switch mode power supply. In such a device power handling electronic components are continuously switching on and off with high frequency in order to provide the transfer of electric power via energy storage components (inductors and capacitors). By varying duty cycle, frequency or a relative phase of these transitions average value of output voltage or current is controlled . The frequency range of an SMPS is from 20 kHz to several MHz.

12.Draw a typical power supply



Components of a typical linear power supply

13.Draw the internal power supply diagram

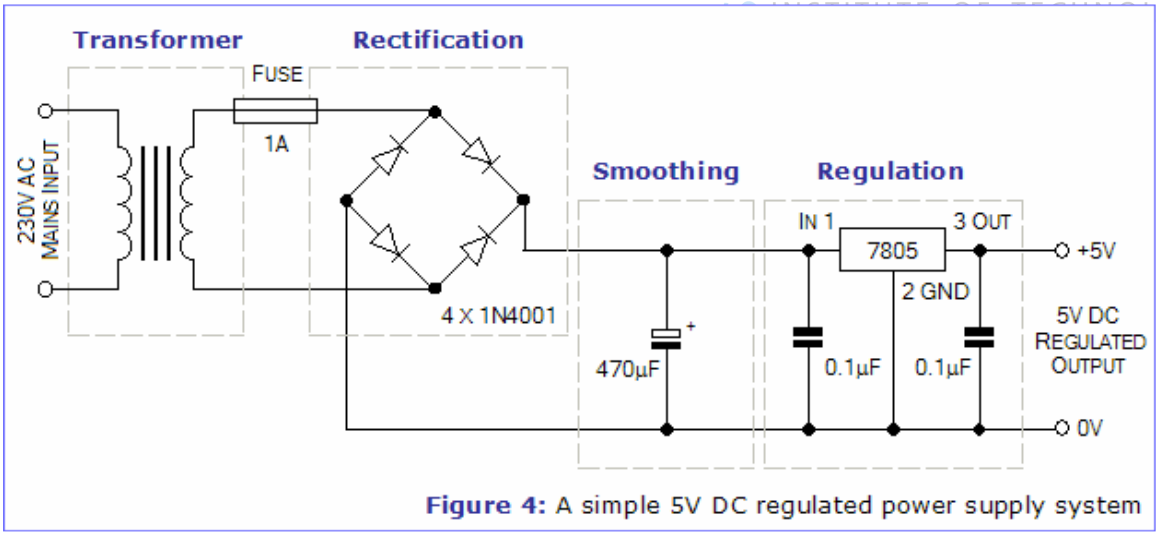
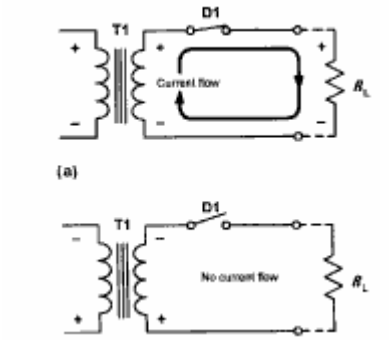


Figure 4: A simple 5V DC regulated power supply system

14.Draw the current waveform for half wave rectifier



15.Classify two types of power supply

Linear power supply

Non linear power supply