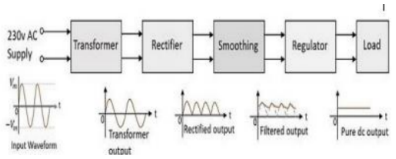
Draw the block diagram of regulated power supply, explain function of each block and draw waveforms of each stage.

The block diagram of a Regulated Power supply unit is as shown below



A typical Regulated Power supply unit consists of the following.

Transformer – Stp Up or Step Down input transformer for the stepping up or down AC power supply.

Rectifier – A Rectifier circuit to convert the AC signal into pulsating DC components.

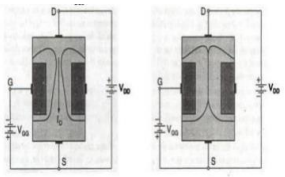
Smoothing – A filtering circuit to smoothen the variations present in the rectified output.

Regulator – A voltage regulator circuit is used to control the voltage to a desired output level against line and load variations.

Load – The load which uses the pure dc output from the regulated output.

With the help of N-channel JFET describe the effect of input voltage VGS on output current ID.

Working of N channel FET:



- When a voltage is applied between the drain and source with a DC supply (VDD), the electrons flows from source to drain through narrow channel existing between the depletion regions.
- This constitutes drain current, ID.
- The value of drain current is maximum when the external voltage applied between gate and source 0V.
- When the gate to source voltage (applied by VGG) becomes negative,, the reverse bias voltage across gate source junction is increased.
- The depletion region is widened. This reduces the width of the channel and thus controls the flow of current.
- The gate source voltage reaches a point where the channel gets completely blocked and the drain current becomes zero is called pinch- off voltage.

Define PIV, TUF, ripple factor, efficiency of rectifier.

Peak Inverse Voltage (PIV):

The maximum value of reverse voltage (for the diode in a rectifier) occurring at the peak of the negative cycle of the input cycle is called Peak Inverse Voltage.

Transformer Utilization Factor (TUF):

It is the ratio of dc power delivered to the load and the ac rating of the transformer secondary.

Ripple factor:

The factor which represents ac component present in the rectifier output, with respect to dc component is called Ripple Factor. OR The ratio of r.m.s. value of a.c. component to the d.c. component in the rectifier output is known as ripple factor.

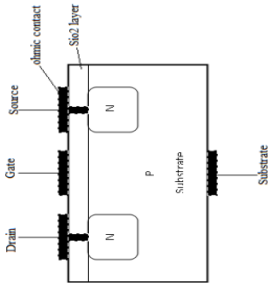
Efficiency of rectifier :

This is defined as the ratio of dc power delivered to the load to the ac input power from the secondary winding of the transformer.

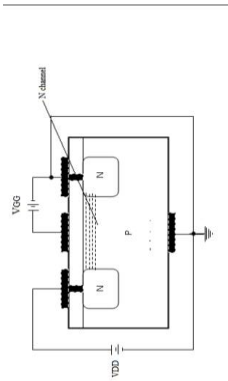
Sketch N-Channel MOSFET and describe its working.

Note: N channel Depletion MOSFET also can be consider.

Sketch N-Channel MOSFET:



Working:



In fig. both V_{GS} [VGG]& V_{DS} [VDD] have been set at positive with respect to the source. The positive potential at the gate will attract the electrons from the P substrate & accumulated in the region near to the surface of SiO_2 layer. The SiO_2 layer & its insulating qualities will prevent the negative carrier [i.e. electron] from being absorbed at the gate.

As V_{GS} increase by increasing VGG the concentration of electron near the SiO_2 surface increases & there is formation of channel & the current starts following through the circuit for further applied voltage.

For V_{GS} = 0V & negative value of V_{GS}, the absence of n channel will result zero current.

As positive value of V_{GS} less than V_{GSth} drain current is zero. if $V_{GS} > V_{GSth}$ current starts increasing.

Define the following terms with respect to rectifier:
(i) Ripple factor
(ii) Rectification efficiency (η)
(iii) Transformer Utilization Factor (TUF)
(iv) Peak Inverse Voltage (PIV)

(i) Ripple factor: The factor which represents ac component present in the rectifier output, with respect to dc component is called Ripple Factor.

OR

The ratio of r.m.s. value of a.c. component to the d.c. component in the rectifier output is known as ripple factor.

Mathematically,

$$\gamma = \frac{rms\ value\ of\ ac\ component}{dc\ component}$$

$$\gamma = \frac{V_{rms}}{V_{dc}} = \frac{I_{rms}}{I_{dc}}$$

(ii) Rectification efficiency (η): This is defined as the ratio of dc power delivered to the load to the ac input power from the secondary winding of the transformer. Mathematically,

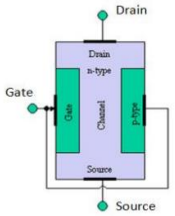
$$\eta = \frac{dc\ power\ delivered\ to\ the\ load}{ac\ input\ power\ from\ the\ transformer\ secondary} = \frac{P_{dc}}{P_{ac}}$$

(iii) Transformer Utilization Factor (TUF): It is the ratio of dc power delivered to the load and the ac rating of the transformer secondary.

$$TUF = \frac{dc\ power\ delivered\ to\ the\ load}{ac\ rating\ of\ the\ transformer\ secondary} = \frac{P_{dc}}{P_{ac\ (rated\ )}}$$

(iv) Peak Inverse Voltage (PIV): The maximum value of reverse voltage (for the diode in a rectifier) occurring at the peak of the negative cycle of the input cycle is called Peak Inverse Voltage.

Draw and explain the construction of N-channel JFET.



Construction Details:

A JFET consists of a p-type or n-type silicon bar containing two PN junctions at the sides as shown in fig. The bar forms the conducting channel for the charge carriers. If the bar is of p-type, it is called p-channel JFET and if the bar is of n-type, it is called n-channel JFET as shown in fig. The two PN junctions forming diodes are connected internally and a common terminal called gate is taken out. Other terminals are source and drain taken out from the bar as shown in fig.1.Thus a JFET has three terminals such as, gate (G), source (S) and drain (D).

Transducer	Sensor
Converts one form of energy into another form.	Senses physical quantities and converts them into signals read by an instrument.
Converts electricity to electromagnetic waves	Senses physical quantity and converts it into an analog quantity
Examples of Transducers: Antenna, microphones, loudspeakers	Examples of a Sensor: LED, touch sensors in automobiles, pressure switches.
Converts the measured quantity into a standard electrical signal like -10 to +10V DC	Measures voltage, capacitance, inductance, and ohmic resistance

Explain:
(i) Seebeck effect (ii) Peltier effect

(i) Seebeck effect:

Seebeck effect states that whenever two dissimilar metals are connected together to form two junctions out of which, one junction is subjected to high temperature and another is subjected to low temperature then e.m.f is induced proportional to the temperature difference between two junctions.

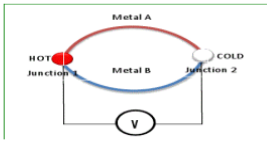
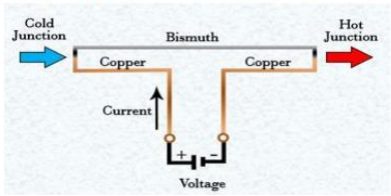


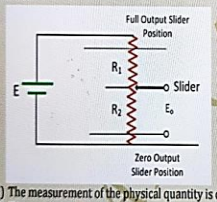
Fig. Seedback effect

(ii) Peltier effect: Peltier effect state that for two dissimilar metals closed loop, if current forced to flow through the closed loop then one junction will be heated and other will become cool.



11. Draw a sketch and describe the working of resistive transducer.

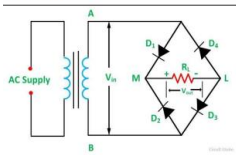
Answer:



1) The measurement of the physical quantity is quite difficult.
2) The resistive transducer converts the physical quantities into variable resistance which is easily measured by the meters.
3) The process of variation in resistance is widely used in the industrial applications.
4) The resistive transducer can work both as the primary as well as the secondary transducer.
5) The primary transducer changes the physical quantities into a mechanical signal, and secondary transducer directly transforms it into an electrical signal
6) The resistive transducer element works on the principle that the resistance of the element is directly proportional to the length of the conductor and inversely proportional to the area of the conductor.

$$R = \frac{\rho L}{A}$$

Draw circuit diagram of bridge rectifier. Draw its input output waveforms and describe its operation.



Working: - The four diodes labelled D1 to D4 are arranged in "series pairs" with only two diodes conducting current during each half cycle.

During the positive half cycle of the supply: - diodes D1 and D3 conduct in series while diodes D2 and D4 are reverse biased and the current flows through the load for the period o to π.

During the negative half cycle of the supply:- diodes D2 and D4 conduct in series, but diodes D1 and D3 switch "OFF" as they are now reverse biased. The current flowing through the load is the same direction as before for the period π to 2π.

Waveform: