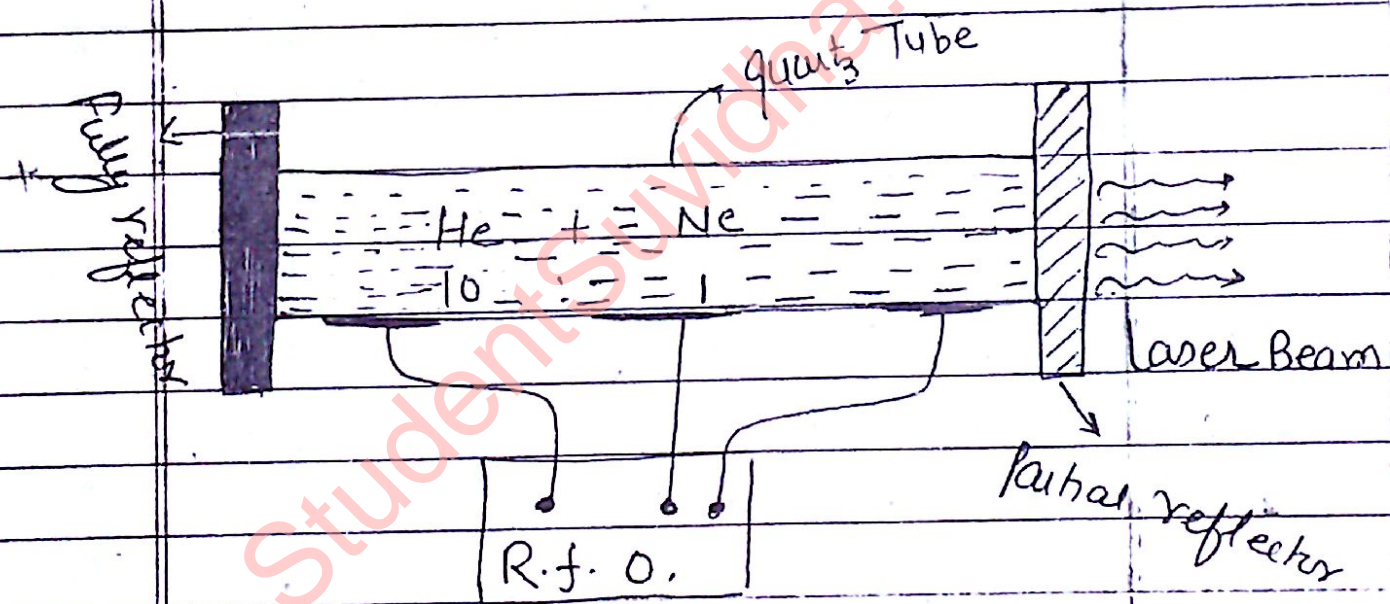


He-Ne laser:

The main drawback of ruby laser is that the output beam is not continuous beam but comes out in the form of pulse. In order to overcome this disadvantage in 1961 Dr. Hertz developed a gaseous laser that is He-Ne laser.

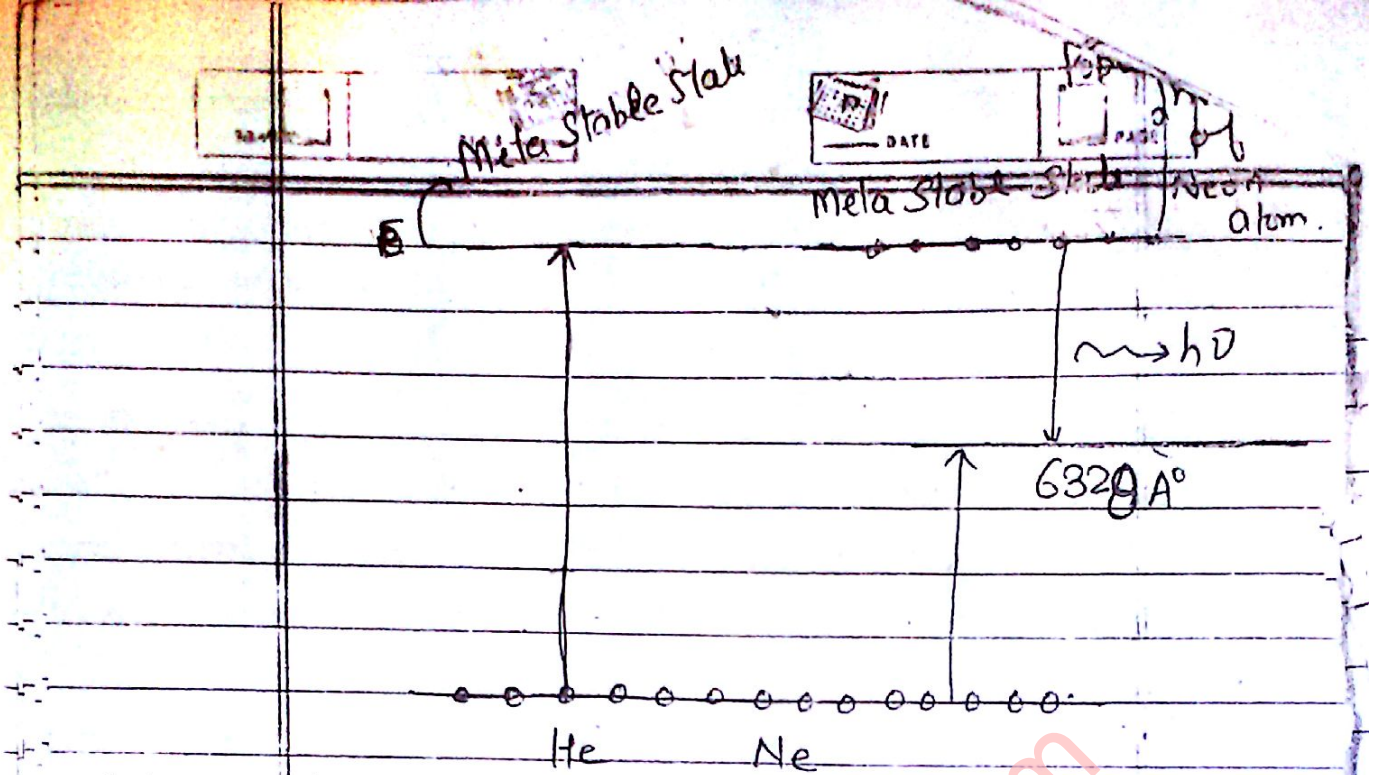
Construction:-

He-Ne laser consists of a long quartz tube in a length 80 cm and diameter about 1.5 cm. At one end of tube there is a perfect reflector, while on the other end there is a partial reflector is attached.



The tube is filled with a mixture of Helium and neon gas in the ratio 10:1. This means that Helium are in the majority and Neon atoms are in minority.

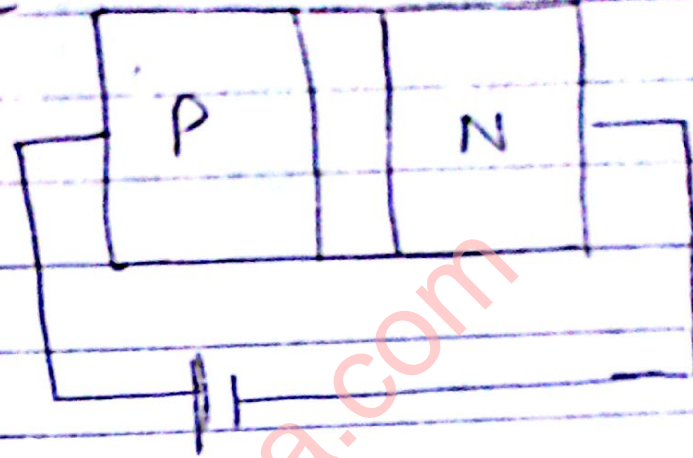
Working:- When a discharge is passed through the gas with the help of radio frequency oscillator.



Then Both Helium atom and Neon atom acquire that discharge. After acquiring that discharge He-atom have a sufficient energy to jump from the ground energy level to the meta stable state from which there are no allowed transitions take place. But when Neon atom acquire that discharge they do not have a sufficient energy to jump from ground energy state to meta stable state. but they have a sufficient energy to jump from ground energy to energy level having energy 6328 Å. But in the tube helium are in the majority and Neon atom are in minority. When Helium atom are jump from ground energy state to meta stable state those Neon atom come in the way they collide with the Helium atom. Thus after collision Neon atom Helium atom transfers its energy to the Neon atom. Thus after acquiring that energy Neon atom jump to the meta stable state. Hence Population Inversion of Neon atom take place.

In the metastable state. When excited Ne-atom passes spontaneously from metastable state to the lower state having energy 6328 \AA , it emits a photon. This photon travel through the gas mixture of it is moving parallel to the axis of the tube. It is reflected back and forth by the mirror ends until it stimulates an excited Ne atom and cause it to emit a fresh photon. This process continued till a beam of coherent radiation builds up in the tube and portion of that beam is escape out through the semi silvered end of the tube.

Semi Conductor Laser:- First Semi conductor laser based on the GaAs. First of all discuss the P-N junction.



P-region contains majority of hole

and n-region contains majority of electron.

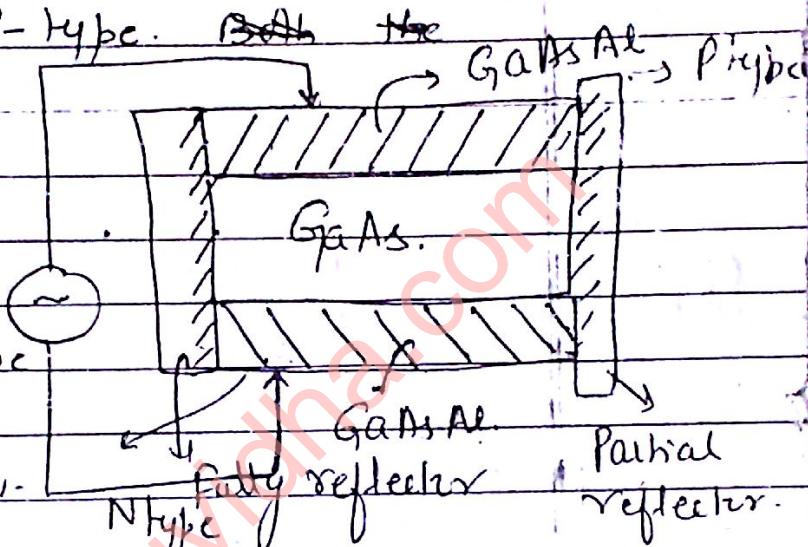
Both the two region are joined together to form a P-N junction. When P-N junction made forward biased. hole's are moves from P region to N-region and electron are moves from N-region to P-region then electron hole recombine take place. And depletion layer is produced which contains no charge carrier.

Thus first semiconductor laser is based on GaAs. GaAs crystal cut into the form of plates. In the first plate Penta valent impurities are add. for example Arsenic. Then P-type N-Semiconductor are made. In the second plate when Tri valent impurities are dopped for example Al, Si, Then such type of a Semiconductor are P-type. ~~Both~~ the

N-type when the GaAs crystal is sandwich between the N type and P-type Semiconductor.

And the semiconductor is connected

through the battery. and the junction are made forward biased.



When very small current is flow through the circuit then only few electron and hole recombine with each other (when hole and electron are recombine with each other then photon are released.) If quantity of current is very small then in such a case intense light does not build up. When the quantity are increased then more and more hole and electron recombine with other and a very high intense beam of light is build up and a part of light is escape out from the semi Altered surface.

Concept of coherence:-

Coherence is a measure of the degree of phase correlation that exist in the radiation field of a light source at different location and different times.

A laser beam has a very high degree of coherence as compared to the incoherent sources.

It becomes possible due to the usage of stimulated emission. Due to this kind of emission the photons are emitted in same phase.

There are two concepts of coherence

(1) Spatial (2) Temporal coherence.

(1) Spatial coherence:- The spatial coherence is also known as lateral coherence. It describes how far apart two sources or two portions of the same source can be located along a transverse direction with respect to the direction of observation.

(2). Temporal coherence:-

The temporal coherence is related to the relative phase of two waves at two separate locations along the direction of propagation of two beams. It is also known as the longitudinal coherence.