EXPERIMENT NO. 4

STUDY OF V-I CHARCTERISTICS OF GUNN DIODE

Aim: Study of V-I Characteristics of GUNN diode.

Prerequisite: Basics of waveguide components and microwave test bench

Equipments:

1. Gunn power supply
2. Gunn Oscillator
3. PIN modulator
4. Isolator
5. Frequency meter
6. Variable Attenuator
7. Detector mount
8. CRO, VSWR meter
9. BNC cable
10. Matched termination, and Cooling fan.

Theory: Some bulk semiconductor materials such as Gallium arsenide (GA As), Indium phosphide (InP) and Cadmium Telluride (CdTe) have two closely spaced energy bands in the conduction band. At lower electric field strengths in the material, most of the electrons will be transmitted into higher energy band. In the higher energy band the effective electron mass is longer and hence the electron mobility is lower than what it is in the lower energy band.

Since the conductivity is directly proportional to the mobility there is an immediate range of electric field strengths for which the fraction of electrons that are transferred into higher energy low mobility conduction is such that the average mobility and hence conductivity decreases with an increase in the electric field strength. Thus there is a range of voltage over which the current decreases with the increasing voltage and a negative instrumental of resistance is displayed by the device.

A Gunn device is also called a transferred electronic device since the negative resistance arises from the transfer of electrons from the lower to higher energy band. The oscillations that occur in the material with energy band structure noted above was discovered by J.B.GUNN. The probability of obtaining negative differential resistance had been predicted earlier by Ridley and Watkins.

Block Diagram

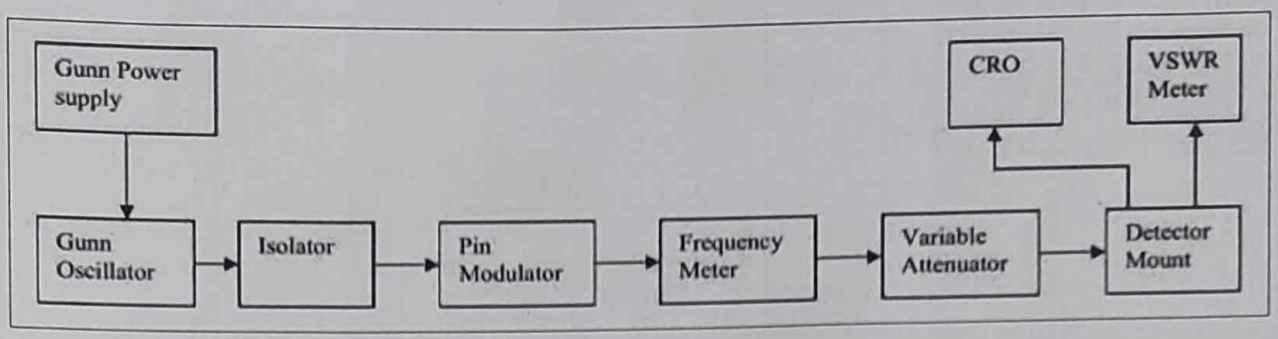


Fig. 9.1 Experimental Setup

Basic Precautions:

1. Do not keep Gunn bias knob at threshold position for more than 10-15 seconds.
2. Reading should be obtained as fast as possible, otherwise excess heating may burn Gunn diode.

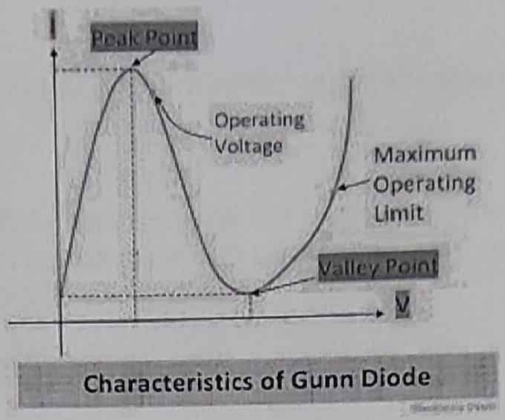
Experimental Procedure:

Step1: Connect the components and equipments as shown in experimental setup.
Step2: Keep control knob of Gunn power supply as below;
ON/OFF switch – OFF
Gunn diode bias knob - fully anti-clockwise to keep the bias voltage to 0 to start with
PIN bias knob - fully anti-clockwise to keep the bias voltage to 0 to start with
PIN mode frequency - middle position to keep frequency approx. to 1 kHz.
Step3: Do not apply any bias to PIN diode throughout the experiment.
Step4: Set the micrometer of Gunn oscillator cavity for required frequency of operation.
Step5: Switch on the Gunn power supply.
Step6: Measure the Gunn diode current corresponding to the various Gunn bias voltages in steps of 0.5 volts controlled by Gunn bias knob through the panel meter and DMP's switch. Do not exceed the bias voltage above 10 V.
Step7: Plot the voltage reading and current reading on the graph.
Step8: Read the threshold voltage V_T that corresponds to maximum current from Read the threshold voltage V_T that corresponds to maximum current from the graph.

Observation Table:

Sr. No.	Voltage in (volts)	Current in (Amps)

Graph:



Characteristics of Gunn Diode

Conclusion: