SNS COLLEGE OF TECHNOLOGY

An Autonomous Institution

Coimbatore-35

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DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

19ECB311- OPTICAL AND MICROWAVE ENGINEERING

III YEAR/ VI SEMESTER

UNIT II-MICROWAVE PASSIVE DEVICES

TOPIC 8-TRAVELLING WAVE TUBE

CONTENTS

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- Principle Of Operation
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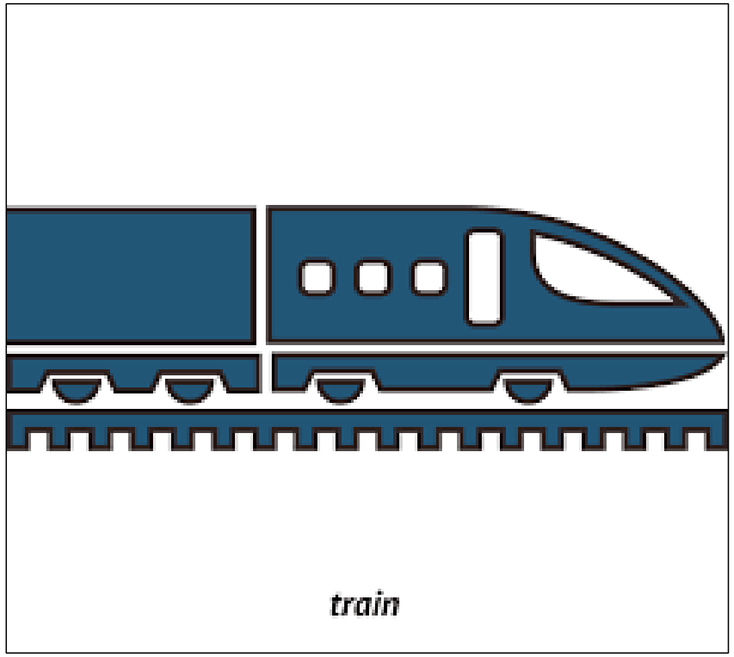
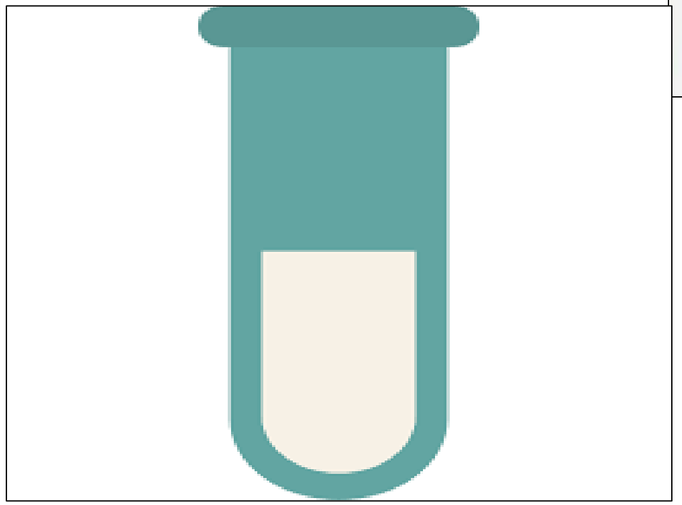
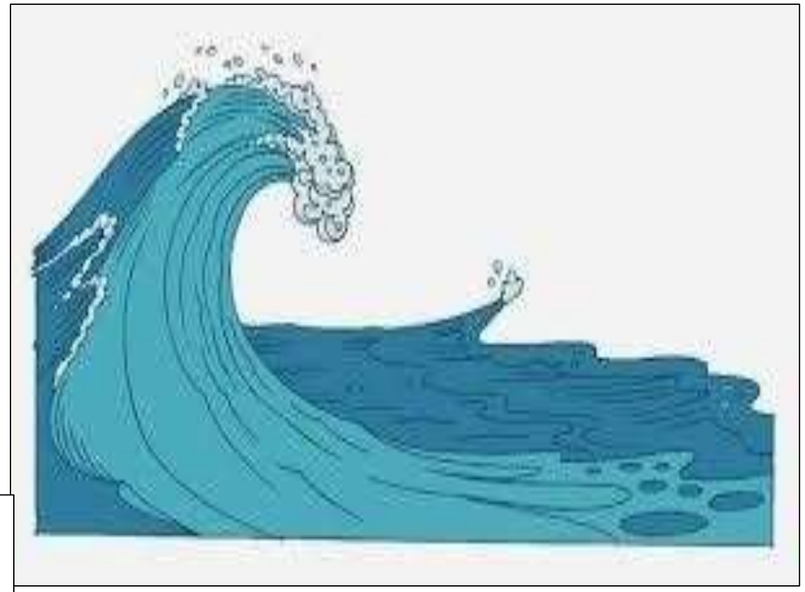
GUESS THE TOPIC





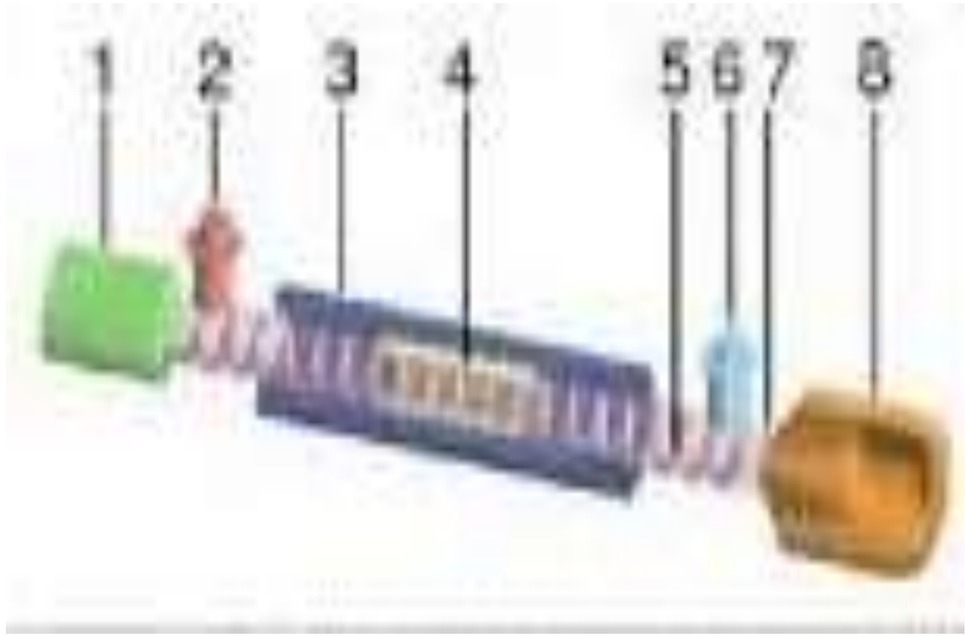


Travelling Wave Tube

A **traveling-wave tube** or **traveling-wave tube amplifier** (**TWTA**)is a specialized vacuum tube that is used in electronics to amplify radio frequency (RF) signals in the microwave range.

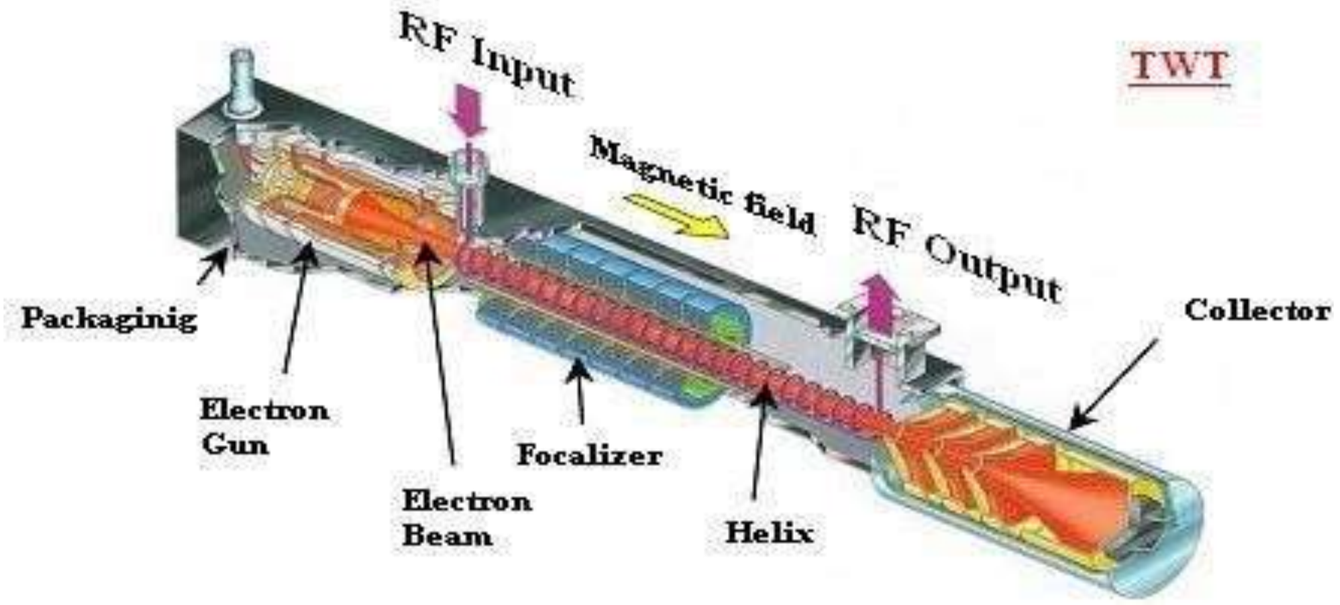
Travelling Wave Tube

1.Electron Gun
2.RF Input
3.Magnets
4.Attenuator
5.Helix Coil
6.RF Input
7.Vacuum Tube
8.Collector

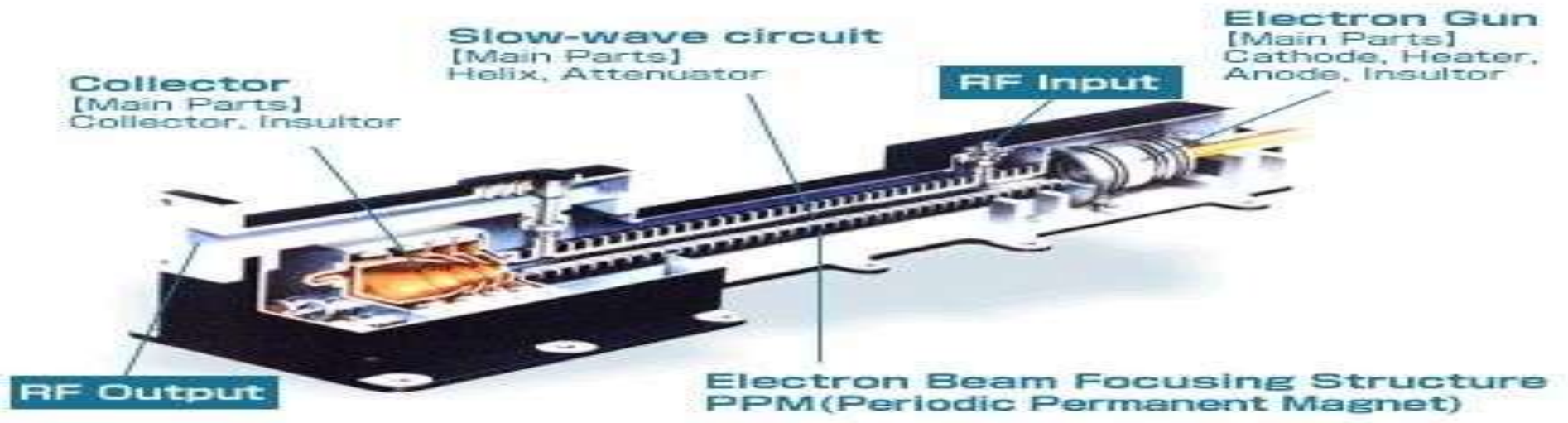


OPERATION

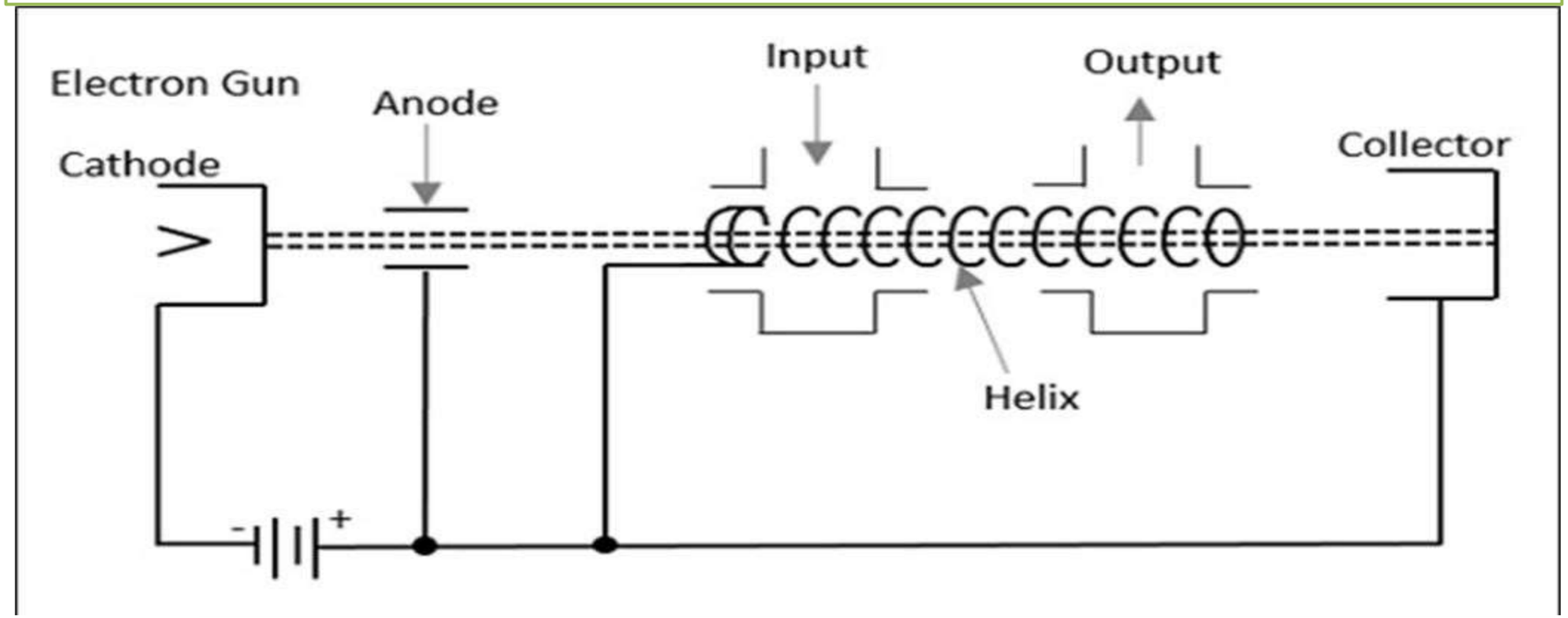
An electron gun focuses an electron beam with the velocity of light. A magnetic field guides the beam to focus, without scattering. The RF field also propagates with the velocity of light which is retarded by a helix. Helix acts as a slow wave structure. Applied RF field propagated in helix, produces an electric field at the center of the helix.



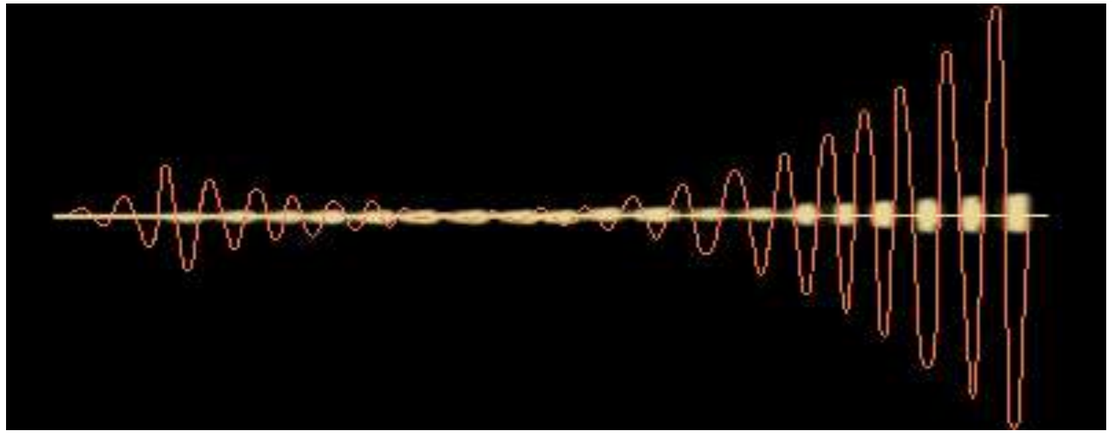
Electric field due to applied RF signal, travels with the velocity of light multiplied by the ratio of helix pitch to helix circumference. The velocity of electron beam, travelling through the helix, induces energy to the RF waves on the helix.



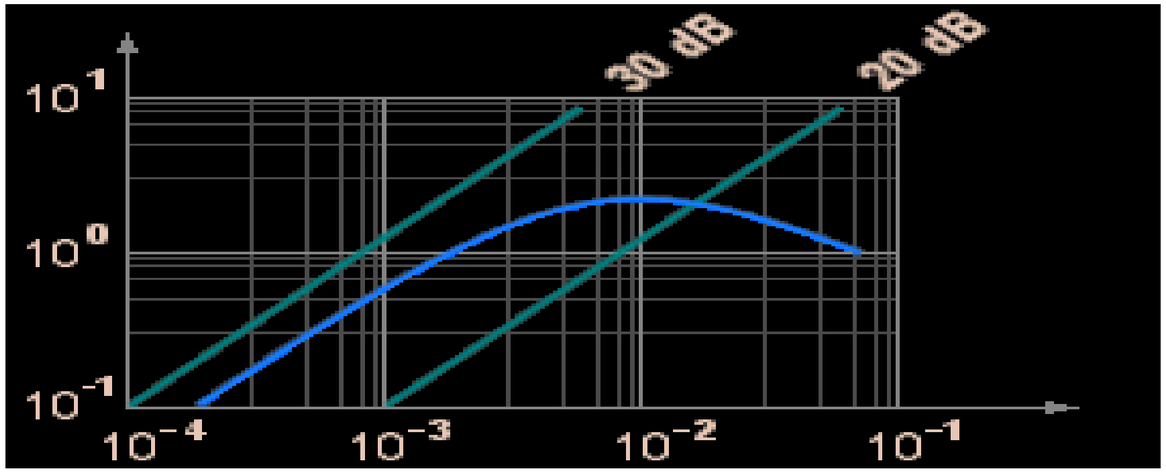
The anode plates, when at zero potential, which means when the axial electric field is at a node, the electron beam velocity remains unaffected. When the wave on the axial electric field is at positive antinode, the electron from the electron beam moves in the opposite direction. This electron being accelerated, tries to catch up with the late electron, which encounters the node of the RF axial field.



Since the electron beam into the tube must obviously travel slower than the speed of light, there must be some means of slowing down the forward velocity of the electromagnetic wave. The electron beam speed of a TWT is about 10 to 50 percent of the speed of light. The speed depends on the cathode voltage that may be between 4 to 120 Kilovolts. The slowdown is done by means of a slow wave structure, on which the electromagnetic wave propagates.



There are two different main types of TWT:
low-power Helix TWT
high-power Coupled-Cavity TWT



Application

- Amplifiers in satellite transponders,
- Electromagnetic compatibility (EMC) testing industry
- Aviation SSR microwave transponders.

THANK YOU