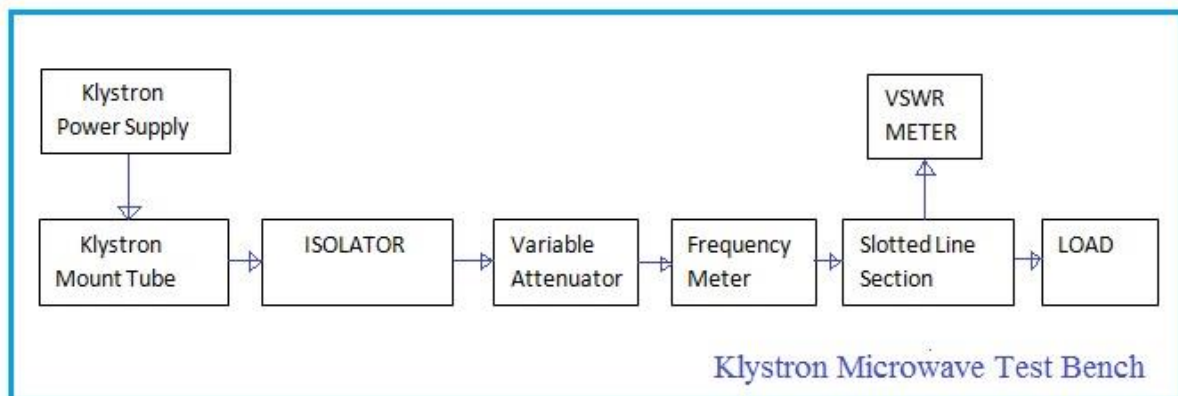# 1. *MICROWAVE TEST BENCH*

Introduction:

The typical microwave test bench are precision microwave systems. It consists of rectangular microwave waveguide components. They are used for test and measurement of various microwave modules in the lab. Let us understand klystron and Gunn oscillator based microwave test benches.

Block diagram with components:

Klystron Microwave Test Bench

The figure-1 depicts klystron microwave test bench. It consists of klystron power supply, klystron mount tube, isolator, variable attenuator, frequency meter, slotted line section, VSWR meter and load. Let us understand functions of each in brief.

• Klystron power supply: It helps in operating low power klystron (e.g. 2K25). It houses AM modulation, FM modulation and external modulating signal functionalities. It usually provides display for beam voltage, beam current and repelled voltage.

• Klystron mount tube: This consists of reflex klystron. It uses velocity modulation in order to transform continuous electron beam into corresponding microwave power.

• Isolator: It passes microwave signal only in one direction and blocks signal going in the other direction.

• Variable attenuator: It is used to attenuate microwave signal with variable attenuation settings as made by the user. The different attenuation can be set.

• Frequency meter: It is used for frequency measurement.

• Slotted line section: It should cover desired frequency and should be equipped with accurate scale/indicator.

• VSWR meter: It is used for standing wave measurement with suitable detector and slotted line (or waveguide) section. It is used to measure VSWR or SWR. It is designed such that it avoids harmonics of line frequency.

• Load: It is microwave matched termination at desired characteristic impedance either 50 or 75 ohm. It is used to absorb microwave power.

Application of Microwave Test Bench:

These products are well suited for conducting various experiments. Further, our Klystron Microwave Test Bench is best choice for the experiments of study of reflex klystron, measure SWR, reflection co-efficient, measure frequency, impedance measurement & guide wavelength.

2. *MOTORIZED ANTENNA TRAINER*

Introduction:

The desktop Antenna Training System Scientech 2261 has been specially designed for engineering colleges and training canters. It is very useful for introducing practical verification of antenna operation to the students. The work book provides theoretical concepts and detail procedure of experiments with different type of antennas. The training system includes set of modular mechanical elements forming various antennas, a transmitter unit and a detector unit. All the accessories are packed in a convenient carrying case.

Features of Motorized Antenna Trainer:

- Self-contained simple and student friendly platform
- Hands on set-up for measuring and plotting radiation
- Patterns of 22 different types of Antennas
- Built in RF & Modulation Generators
- Antenna Characteristics and SWR Measurement
- On board RF & Tone generators
- Antenna matching stub
- Transmitting and receiving levels observed on built- in
- meters
- Polar graphs (2 types)
- "Antenna kit" for fabricating special antenna
- Microcontroller based high precision DC stepper motor
- Automatic home position setting
- Instant & real time plotting of radiation pattern
- Antenna rotation resolution 1°
- PC Interface - RS232 (Serial port)
- Radiation pattern plotting software (Windows
- compatible)
- Compact design
- Lightweight

Application of Motorized Antenna Trainer:

Motorized Antenna Unit is design for automate the recording of the radiation pattern of the antennas. The Motorized Antenna Unit is Microcontroller based PC interface system for capturing, displaying and printing of Antenna radiation pattern. A Window based software plots the radiation pattern which displayed on PC screen. The PC communication is via Serial port.

3. *CST Studio Suite 3D EM simulation and analysis software*

CST Studio Suite® is a high-performance 3D EM analysis software package for designing, analyzing and optimizing electromagnetic (EM) components and systems. Electromagnetic field solvers for applications across the EM spectrum are contained within a single user interface in CST Studio Suite. The solvers can be coupled to perform hybrid simulations, giving engineers the flexibility to analyze whole systems made up of multiple components in an efficient and straightforward way. Co-design with other SIMULIA products allows EM simulation to be integrated into the design flow and drives the development process from the earliest stages.Common subjects of EM analysis include the performance and efficiency of antennas and filters, electromagnetic compatibility and interference (EMC/EMI), exposure of the human body to EM fields, electro-mechanical effects in motors and generators, and thermal effects in high-power devices. CST Studio Suite is used in leading technology and engineering companies around the world. It offers considerable product to market advantages, facilitating shorter development cycles and reduced costs. Simulation enables the use of virtual prototyping. Device performance can be optimized, potential

compliance issues identified and mitigated early in the design process, the number of physical prototypes required can be reduced, and the risk of test failures and recalls minimized

4. Ansys HFSS 3D High Frequency Simulation Software

Ansys HFSS is a 3D electromagnetic (EM) simulation software for designing and simulating high-frequency electronic products such as antennas, antenna arrays, RF or microwave components, high-speed interconnects, filters, connectors, IC packages and printed circuit boards. Engineers worldwide use Ansys HFSS software to design high-frequency, high-speed electronics found in communications systems, advanced driver assistance systems (ADAS), satellites, and internet-of-things (IoT) products.