The Bombay Salesian Society's
DON BOSCO INSTITUTE OF TECHNOLOGY

Premier Automobiles Road, Kurla West, Mumbai – 400070

IEEE-DBIT MTT-S STUDENT CHAPTER

Title: **"VISIT TO RADAR LAB AT S.A.M.E.E.R.", Mumbai**

Date: 22nd March, 2024

Time : 2pm to 5:30 pm

Venue: SAMEER

Target Audience: TE EXTC

No. of Participants present: 9 IEEE student members, 2 IEEE professional members including and 1 non IEEE member

No. of girl participants: 5

No. of boy participants:7

Faculty Coordinator: Dr. Ashwini Kotrashetti and Ms. Freda Carvalho

Objectives:

- Understanding RADAR Technology: To learn about the principles, components, and applications of RADAR technology, including how it works, its various types and its use in different fields.
- To gain hands-on experience with RADAR equipment and understand the limitations and capabilities of the technology.
- To develop interest in the field of RADAR.
- To gain insights in the design and development of RADAR

Outcomes:

- Development of interest in the field of RADAR.
- To understand and explain design and development of RADAR

Detailed Report:

Dr. Raymond Pinto introduced SAMEER, "Society for Applied Microwave Electronics Engineering & Research" to the students. He then explained the research focus at the Mumbai center.

SAMEER Mumbai, is known for research and development in the fields of optoelectronics, medical electronics, radar-based instrumentation, atmospheric remote sensing & meteorology,

RF & microwave systems and components, navigational electronics, etc. Many of its R&D outputs and spin-offs have found applications and acceptance in the industry.

Dr. Raymond Pinto showed us their in-house developed transceiver modules that have been fully tested in all environmental conditions that the module may face. A tested module is also called "Yellow banded." They showed us, Radar systems as big as a tiffin box and as small as the size of a human thumb, both of which work under the same conditions, but their applications may differ according to their size.

Dr. Raymond Pinto also introduced the students to their team of scientists, after which demonstration of two experiments was done. One involved a delay line and demonstrated how modulation takes place in the frequency domain. The second experiment involved target detection using a Horn Antenna. Here, the research associates explained the limitation of a targeted antenna, which can only detect the distance between two stationary targets and will interpret different targets as one if kept at the same length or one behind the other. Here, FMCW Radar's come into the picture, where they can detect the slightest change in the target position. SAMEER, Mumbai, specializes in the development of FMCW radars and Synthetic Radars, where increasing the range and target detection of the radar is done along a fixed axis.

The FMCW Synthetic Radar was being used at a coal pit where the deposits are periodically scanned for any faults. If any fault is detected, the radar will alert the user accordingly. The system was built to detect millimeter changes over a distance of around 2 km by scanning a structure as large as a plateau.

Dr. Raymond Pinto then took the students to the LINEAC center in SAMEER, where research and development of Linear Electron Accelerators are done to cure Cancer. The LINEAC works on the principle of accelerating electrons to high speeds and then concentrating a beam of these electrons onto the patient's tumour to nullify it.

The Principle behind the LINEAC structure is that an ion source gives a bunch of electrons which are then accelerated towards the first drift tube because of their negative potential and the drift tube's positive potential. When electrons come inside the tube, at that moment, the RF source shifts its polarity. The first drift tube then becomes negatively charged and the second drift tube becomes positively charged. Electrons come out of the tube because of its inertia and at that moment, they are pushed by the first drift tube and attracted by the second one in the same direction.

The LINEAC can deliver high-velocity electrons to a 1x1 cm area, which makes them very precise for their application. A major advantage of this type of radiotherapy is that no cobalt is included in the process, hence the patient does not suffer from the after-effects of the treatment

unlike chemotherapy, and the LINAC is highly efficient in eliminating cancer as compared to chemotherapy.

Dr. Raymond Pinto then took the students to the MRI testing and Development facility of SAMEER, where we were introduced to Mr. Rajesh Harsh (Programme Director Science and Technology). Development of MRI, DMLC for beam shaping of LINEAC for precise treatment of Cancer, RF based Heating/Drying technology for agro/food products.

Rajesh sir introduced the students to the MRI machine that was built in-house with a 1.5 Tesla magnet that can generate a uniform magnetic field. The magnetic field is generated by cooling the 1.5 Tesla coil with the help of 2000 liters of liquid helium, which is continuously present inside the structure. The liquid cooling then makes the copper coil into a Superconducting Magnet. The temperature needed to cool the copper coil is -273° C. The MRI machine that was shown to the students was entirely made in India.

Rajesh Sir also showed the students a new type of MRI machine that is DRY COOLED which uses a vacuum to freeze the copper coil and regulates the temperature accordingly. The prototype that was shown to the students could achieve the previously mentioned temperature in 7 days of cooling after which it will keep itself on the threshold automatically. He then showed the students a Vacuum Assisted RF Dryer System. The vacuum dryer operates at 27mhz and uses a vacuum to evaporate the water at lower temperatures, i.e., 40-50° C. The vacuum also produces a pressure of around 100-150 mbar after which an RF signal of 40khz is transmitted through the structure which dries the bamboo/wood in 45 seconds. This technique provides a high yield rate at lesser manpower, and the time consumed is also low.

The visit concluded at 5:00 pm with a commemorative picture of the team with the scientists.

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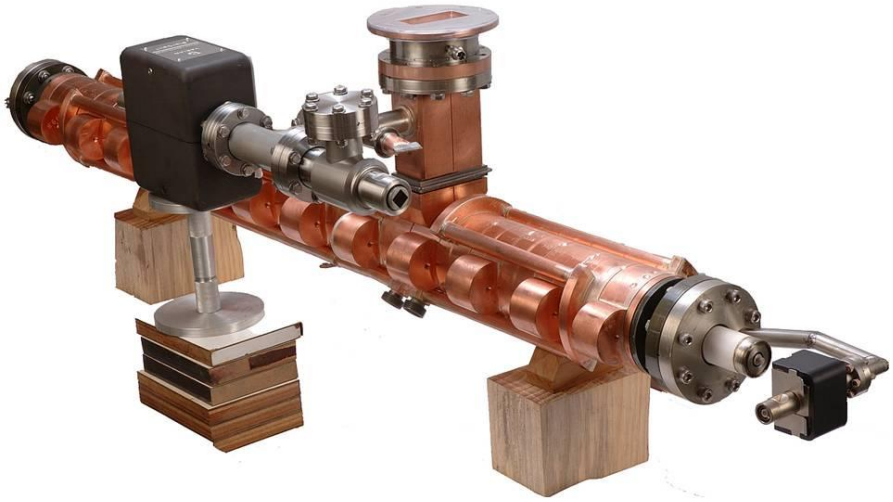
Pictures of the event:



15 cavity LINAC shown to the students at SAMEER

6 Cavity LINAC used for Radio Therapy

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DRY Cooled MRI machine shown to the students

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Student team photo with faculty members

Commemorative photo with the Project Directors of SAMEER

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S.No.	Name	Branch
1	Mohd Raza Ansari	TE EXTC
2	Aditya Ajay Jadhav	TE EXTC
3	Mayuri Sanjay Kadam	TE EXTC
4	Girish Vikas Sangare	TE EXTC
5	Shafik Shaikh	TE EXTC
6	Dibyarupa Pradhan	TE EXTC
7	Rutvik Kiran Patil	TE EXTC
8	Premkumar Pradeep Singh	TE EXTC
9	Ann Vincent Chittilappilly	TE EXTC

Feedback from the event after making an analysis from inputs of participants:

The event provided valuable insights into the design and development of RADAR systems. Participants gained an understanding of the engineering principles behind RADAR technology, as well as the various considerations involved in its design, optimization, and implementation. The discussions on real-world applications and case studies offered practical insights into the challenges and opportunities in RADAR development.

Report Prepared By: Aditya Ajay Jadhav **Name of the Student:** Aditya Ajay Jadhav **Post of the Student:** Reporting Head IEEE-DBIT	**Report Approved By:** **Name of the Faculty:** Dr. Ashwini Kotrashetti **Post of the Faculty:** Associate Professor & Dean, EXTC Dept, DBIT