



## **FDP Summary**

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**M.Tech VLSI Design**

As an **M.Tech VLSI** student, I attended the **AICTE ATAL-sponsored six-day online Faculty Development Programme (FDP)** organized by the **Department of Electrical, Electronics, and Communication Engineering, GITAM School of Technology, Bengaluru**. The event, held from **3rd to 8th February 2025**, focused on **"Emerging VLSI and Antenna Technologies for Secure Communication in Defense Systems and Enhanced Radiation Protection in Space Environments."**

## **Session-1: Key Insights (5th February 2025)**

The session featured a talk by **Dr. Dominic George, Scientist/Engineer SF at ISRO, Vikram Sarabhai Space Centre, Thiruvananthapuram**. His discussion covered **VLSI Technology, FinFET, Radiation Testing, Multi-Valued Logic, and Memristors**. The session took place from **6:00 PM to 7:30 PM** and provided in-depth insights into advanced semiconductor technologies crucial for space and defense applications.

### **Memristors and Their Significance in VLSI**

One of the key topics discussed was **memristors**, a promising emerging technology in VLSI. Memristors are **non-volatile resistive switching devices** that store data by changing their resistance based on the amount and direction of charge passing through them. These devices are particularly important for:

- **Neuromorphic Computing:** Mimicking biological synapses for artificial intelligence (AI) and deep learning applications.
- **Radiation-Hardened Memory:** Offering high resilience to radiation effects, making them ideal for **space applications** where conventional memory suffers from soft errors.
- **Energy-Efficient Storage:** Consuming less power than traditional SRAM and DRAM, making them a viable alternative for **low-power IoT and edge computing devices**.
- **High-Density Data Storage:** Providing an alternative to flash memory with **faster read/write speeds and improved endurance**.

This FDP was an **enriching experience**, providing exposure to the latest trends in **radiation-tolerant VLSI circuits, emerging nanoelectronic devices, and secure communication technologies**. Learning about **memristors, FinFETs, and Multi-Valued Logic** broadened my understanding of **next-generation semiconductor advancements** and their applications in **defense and aerospace systems**.

## **Session – 2 :**

### **Topic : "DEVELOPMENT OF WEARABLE SENSOR DEVICES FOR SPACE AND DEFENSE APPLICATIONS"**

- **Overall Programme Significance:**

- The AICTE ATAL sponsorship indicates the importance placed on this program by the Indian government's technical education authority. ATAL FDPs are designed to promote quality technical education and enhance faculty skills in emerging areas.
- The program's focus on VLSI and antenna technologies for secure communication and radiation protection highlights the growing need for advanced engineering solutions in defense and space, which are strategic sectors.

- **Session Focus - Wearable Sensor Devices:**

- This session is particularly relevant in today's technology landscape. Wearable sensors have a broad range of applications, and their adaptation for space and defense presents unique challenges and opportunities.
- **Space Applications:**
  - Wearable sensors could be used to monitor the health and physiological parameters of astronauts during space missions, providing real-time data on their vital signs, exposure to radiation, and stress levels.
  - They might also be incorporated into spacesuits to enhance communication, provide situational awareness, or monitor the environment.
- **Defense Applications:**
  - In defense, wearable sensors can be used to track the health and performance of soldiers in the field, providing critical information for medical support and mission planning.
  - They can also be used to enhance soldier communication, navigation, and situational awareness, improving their effectiveness and safety.

- **Speaker's Expertise:**

- Dr. M. Arun Kumar's position as an Associate Professor in EECE at GITAM suggests expertise in relevant areas such as:
  - Electronics
  - Sensors
  - Embedded systems
  - Possibly biomedical engineering (given the wearable sensor focus)

## Session - 3

**Date:** 4th February 2025

**Session Number:** Session-2

**Title:** Nanostructure Thermoelectric Material for Space & Defense Application

**Speaker:** Prof. M. Arivanandhan, Professor, Anna University

**Time:** 7:30 PM to 9:00 PM

### **Expanded Details and Inferences:**

#### **Program Theme Significance:**

The FDP focuses on highly relevant and cutting-edge technologies crucial for strategic sectors like defense and space.

"Emerging VLSI and Antenna Technologies" suggests that participants will gain insights into the latest developments in microelectronics and communication systems.

"Secure Communication in Defense Systems" indicates a focus on technologies that ensure reliable and confidential data transmission in military applications.

"Enhanced Radiation Protection in Space Environments" highlights the importance of developing materials and systems that can withstand the harsh conditions of space.

#### **Session Topic - Nanostructure Thermoelectric Material for Space & Defense Application:**

This topic delves into the use of advanced materials for energy conversion and thermal management.

**Nanostructure Materials:** These materials possess unique properties due to their nanoscale dimensions, making them suitable for high-performance applications.

**Thermoelectric Materials:** These materials can convert heat energy into electrical energy and vice versa. This property is valuable in space and defense applications where energy efficiency and thermal control are critical.

#### **Space Applications:**

Thermoelectric materials can be used for power generation in spacecraft, utilizing waste heat to produce electricity.

They can also be used for thermal management, maintaining optimal temperatures for sensitive electronic components.

#### **Defense Applications:**

Thermoelectric materials can be used in portable power generation systems for soldiers.

They can also be used for thermal camouflage and heat dissipation in electronic warfare systems.

**It is likely that the session will cover:**

The fundamentals of thermoelectric materials and their properties.

The synthesis and characterization of nanostructured thermoelectric materials.

Applications of thermoelectric materials in space and defense.

The challenges and opportunities in developing advanced thermoelectric materials.

The current research that is being conducted in this field.

## **Session – 4**

- **Theme:** Emerging VLSI and Antenna Technologies for Secure Communication in Defense Systems and Enhanced Radiation Protection in Space Environments.
- **Dates:** February 3rd - 8th, 2025
- **Session Information:**
  - Session Number: Session-2
  - Date: February 5th, 2025
  - Title: Semiconductor Memories for Space Applications

- Speaker: Dr. Balwinder Raj, Associate Professor, NIT, Jalandhar
- Time: 7:30 PM to 9:00 PM (India Time)

## **Expanded Details and Inferences:**

- **Program Theme Significance:**

- The overarching theme of the FDP centers on advanced technologies that are vital for both defense and space sectors. This indicates a focus on high-reliability and high-performance electronic systems.
- "Emerging VLSI and Antenna Technologies" suggests that the program will cover the latest advancements in very-large-scale integration (VLSI) and antenna design, which are fundamental to modern communication and electronic systems.
- "Secure Communication in Defense Systems" indicates that the program will address the critical need for robust and secure communication technologies in military applications.
- "Enhanced Radiation Protection in Space Environments" highlights the challenges of operating electronic systems in the harsh radiation environment of space and the importance of developing radiation-hardened technologies.

- **Session Topic - Semiconductor Memories for Space Applications:**

- This session focuses on a crucial aspect of space electronics: the reliability of semiconductor memory devices.
- Semiconductor memories are vital components in spacecraft, satellites, and other spaceborne systems.
- "Space Applications" implies that the session will cover the unique challenges of using semiconductor memories in space, such as:
  - Radiation effects (e.g., single-event upsets, total ionizing dose)
  - Extreme temperature variations
  - Vacuum conditions
  - High reliability requirements
- It's highly likely that the session will discuss:
  - Different types of semiconductor memories (e.g., SRAM, DRAM, flash memory)
  - Radiation-hardening techniques for semiconductor memories
  - Error detection and correction codes
  - Testing and qualification of semiconductor memories for space applications

- The latest research and development in space-grade memory technologies.
- **Speaker's Credentials:**
  - Dr. Balwinder Raj, Associate Professor at NIT Jalandhar, indicates that the session will be led by an expert with a strong background in semiconductor devices and related fields.
  - NIT Jalandhar is a reputable institute in India.
- **Target Audience:**
  - As an ATAL FDP, the primary audience is likely to be faculty members from engineering colleges.
  - However, the session would also be relevant to researchers, postgraduate students, and industry professionals involved in space electronics and related areas.
- **Expected Session Content (Inferences):**
  - Given the speaker's expertise and the session topic, it's probable that the session will include:
    - Theoretical background on semiconductor memories and radiation effects.
    - Practical examples of space-grade memory designs and applications.
    - Case studies of past space missions and their memory-related challenges.
    - Discussion of future trends in space memory technology.

**Certificate :**

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***Certificate***

*It is certified that **Mr. Atigadda Madhankumar Chetty, PG Scholars** of **Gitam University** has successfully participated & completed AICTE Training And Learning (ATAL) Academy Faculty Development Program on **Emerging VLSI and Antenna Technologies for Secure Communication in Défense Systems and Enhanced Radiation Protection in Space Environments** at **GANDHI INSTITUTE OF TECHNOLOGY AND MANAGEMENT GITAM CAMPUS BENGALURU** from **03/02/2025** to **08/02/2025**.*

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