

## Major Unit: code UE tdb

### Radiation Effects on electronic systems & complex devices

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#### *Learning Outcomes:*

The objective of this course is to train students in the field of radiation effects on complex components such as memory, microcontrollers, FPGAs, etc.

The concepts of fault tolerance, the architectures of different components and their sensitivity to radiation, as well as the impact of embedded AI are covered.



#### *Description :*

- Dependability and Fault Tolerance
  - Basic Concepts
  - Obstacles to dependability
  - Fault tolerance techniques
- Fault-tolerant structures
  - Information, hardware, temporal software redundancy
  - Mixed redundancies
- Single Event Transient
  - SET Current and Voltage Pulse Formation, masking effects
  - Single Event Transient with Frequency
  - Gate-level SET Mitigation
  - SET and Timing Error Protection: Razor
- Memories
  - Introduction: Structure and function
  - Overview on technology
  - Soft errors and hard errors in memories
  - Radiation test strategies for memories
  - Bitmap statistical analysis
- Reliability issues and hardening of Microcontrollers and FPGA
  - Architecture of Microcontrollers and FPGAs
  - Technology impact
  - Low observable systems/devices
  - Enhanced observability features
- Artificial Intelligence and Reliability
  - Self-resilience features of CNN
  - AI accelerator modules versus reliability
  - Impact of Radiation-Induced Soft Errors on the Reliability of Approximate Computing Systems