20VL020 - MEMORY DESIGN AND TESTING

Course Objectives:

To acquire knowledge about different types of semiconductor memories.

- To study about architecture and operations of different semiconductormemories.
- To comprehend the low power design techniquesand methodologies.

Course Outcomes:

Analysis the different types of RAM, ROM designs.

- Analysis the different RAM and ROM architecture andinterconnects.

- Analysis about design and characterizationtechnique.

- Analysisofdifferentmemorytestinganddesignfortestability.

- Identification of new developments in semiconductormemory design.

SKILLS:

In-depth understanding of volatile and nonvolatile SRAMs, DRAMs. Analyse and test the advanced memorydesigns.

UNIT - I

Random Access Memory Technologies: Static Random Access Memories(SRAMs):SRAM cell structure- MOS SRAM architecture, MOS SRAM cell and peripheral circuit operation, bipolar SRAM technologies, silicon on insulator(SOI) technology, advanced SRAM architectures and technologies, application specific SRAMs.

Dynamic Random Access Memories (DRAMs): DRAM technology development, CMOS CRAMs,DRAMscelltheoryandadvancedcellstructures-BiCMOSDRAMs-softerrorfailureinDRAMs,Advanced DRAM designs and architecture, application specificDRAMs.

UNIT – II

Nonvolatile Memories: Masked Read, only memories (ROMs): High density ROMs, programmable read-only memories (PROMs)- bipolar PROMs, CMOSPROMs, erasable (UV)- Programmble read- only memories (EPROMs)-Floating Gate EPROM cell- one, time progammable (OTP) Eproms Electrically Erasable PROMs (EEPROMs), EEPROM technology and architecture, nonvolatile SRAM- Flash memories (EPROMs or EEPROM), Advanced flash memory architecture.

UNIT – III

Memory fault modeling, testing and memory design for Testability and fault tolerance, RAM fault modeling, electrical testing, Peusdo random testing, megabit DRAM testing nonvolatile memory modeling and testing, IDDQ fault modeling and testing, application specific memory testing.

UNIT – IV

Semiconductor memory reliability and radiation effects: General Reliability issues, RAM failure modes and mechanism, nonvolatile memory reliability, reliability modeling and failure rate prediction, design for reliability, reliability test structures, reliability screening and qualification.

Radiation effects, single event phenomenon (SEP)- radiation hardening techniques, radiation hardening process and design issues, radiation hardened memory characteristics, radiation hardness assurance and testing, radiation dosimetry, water level radiation testing and test structures.

UNIT – V

Advanced memory technologies and high-density memory packaging technologies: Ferroelectric Random Access Memories (FRAMs), Gallium Arsenide (GaAs)FRAMs, Analog memories magnetoresistive random access memories(MRAMs), Experimental memory devices.

MemoryhybridsandMCMs(2D),MemorystacksandMCMs(3D),MemoryMCMtestingandreliability issues- memory cards- high density memory packaging futuredirections.

TEXT BOOKS

1. Ashok K.Sharma, Semiconductor Memories Technology, testing and reliability, Prentice hall of India Private Limited, New Delhi1997.

2. Ashok K Sharna, Advanced Semiconductor Memories – Architecture, Design and Applications, Wiley2002.

REFERENCEBOOKS

1. AnjanGhosh,HighSpeedSemiconductorDevices,NPTELCourseware,2009.