



**FIRST SEMESTER 2021-2022**

Course Handout

Date: 07-08-2021

In addition to part-I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

Course No.	: MEL G626
Course Title	: VLSI Test & Testability
Unit	: 5 (3 0 5)
Instructor-in-Charge	: Saroj Mondal
Lab Teaching Assistant	: Arun Mohan B

**Scope and Objective of the Course:**

The course describes the theoretical and practical aspects of VLSI Testing and verification. Starting from the basic concepts of verification and testing to advance processor level verification and testing are going to discuss in this course. In addition to that, SoC testing strategy will also be discussed in this course.

The objective of this course is to deal with the study of VLSI design flow, Functional verification, verification flow, simulator architecture and operation, assertions, need for electronic testing, fault modeling, test generation for combinational circuits, test generation for sequential circuits, fault simulation, Built-In Self-Test (BIST), Memory testing, Design for Testability (DFT), SoC test, fault diagnosis, and Analog/RF test.

**Textbooks:**

1. William K. Lam, Hardware Design Verification: Simulation and Formal Method-Based Approaches- Prentice Hall (2008).
2. Michael. L. Bushnell, and Vishwani. D. Agrawal, Essentials of Electronic Testing for Digital, Memory and Mixed Signal VLSI Circuits, Kluwer Academic Publishers, Third Edition, 2004.

**Reference books**

1. B. Wile, John C. Goss and W. Rosner, Comprehensive Functional Verification” Morgan Kaufmann, 2005
2. Chris Spear, “System Verilog for Verification,” Springer Publications, second edition 2008.
3. Stuart Sutherland, Simon Davidmann, Peter Flake “System Verilog for Design,” Springer Publications, second edition 2006.
4. M Abromovici, M A Breuer & A. D. Friedman "Digital Systems Testing and Testable Design “, Jaico Publications, Paperback Impression, 2001.
5. H. Fujiwara, “Logic Testing and Design for testability” MIT Press, 1985.
6. Pallab Dasgupta, “A roadmap for formal property verification” Springer (2006)



**Course Plan:**

<b>Lecture No.</b>	<b>Learning objectives</b>	<b>Topics to be covered</b>	<b>Chapter in the Text Book</b>
1 – 2	An Introduction to Design Verification	VLSI Design flow, Verification principle, and verification methodology	T1 – Ch. 1
3 – 6	Simulator Architectures and operation	The compilers, simulators, simulator taxonomy, operations and applications.	T1 – Ch. 2
7 - 9	Test Scenarios and Coverage	Hierarchical verification, Test plan, and Verification coverage	T1 – Ch. 5
10 – 12	Assertions	Basic temporal operator, logics for temporal specification, system Verilog assertions	T1 – Ch. 5, R6 – Ch. 2,3
13 – 15	Symbolic Representation of Logic and State Spaces	Binary decision diagram (BDD), decision diagram variants, decision diagram-based equivalence checking	T1 – Ch. 8
16 – 17	Formal property verification	Property checking, CTL model checking	T1 – Ch. 9
18 – 19	VLSI Fault Modeling	Defects, errors and faults; structural testing and stuck-at faults	T2 – Ch. 4
20 – 22	Combinational circuit test generation	Test generation algorithms: D, PODEM	T2 – Ch. 7
23 – 25	Sequential circuit test generation	Time-Frame Expansion Method, sequential circuit ATPG	T2 – Ch. 8
26 – 28	Memory Test	Memory fault modeling and testing	T2 – Ch. 9
29 – 31	Delay and IDDQ Test	Delay Test Methodologies, IDDQ testing Methods	T2 – Ch. 12,13
32 – 34	Digital DFT and SCAN design	Scan Design, partial-scan design	T2 – Ch. 14
35 – 37	Built-in-self-test	BITS process, pattern generation, response compaction, etc.	T2 – Ch. 15
38 - 40	Boundary Scan Test	Boundary scan method and standards	T2 – Ch. 16

### Evaluation Scheme:

Component	Duration	Weightage (%)	Marks (200)	Date & Time	Nature of Component
Mid-Sem	90 min	30	60	TBA	Open Book
Quizzes	40 min	10	20		Open Book
Lab	-	15	30		Open Book
Project	-	10	20		Open Book
Comprehensive Exam	120 min	35	70	20/12 AN	Open Book

**Chamber Consultation Hour:** To be announced in the class.

**Notices:** CMS

**Make-up Policy:** Make-up only to those who apply before start of test. Those who apply after the start of test will not be granted any make-up. No make-up for Comprehensive test.

**Academic Honesty and Integrity Policy:** Academic honesty and integrity are to be maintained by all the students throughout the semester and any mode of academic dishonesty will not be acceptable.

**INSTRUCTOR-IN-CHARGE**  
**MEL G626**

