



**C-DAC & Gujarat Technological University M.E.  
Electronics & Communication Engineering  
(VLSI & Embedded Systems Design)  
Gandhinagar**

**Semester –III  
(Elective – IV & V)**

**2735201: Design for Testability**

**UNIT – I**

Introduction: The need for testing, Fabrication, Assembly and Test Process Flows.

**UNIT – II**

Scan Testing: Using additional primary inputs and outputs to improve controllability and observability, Scan-based testing. Design rules, Ways to overcome rule violations. Automated Test Pattern Generation for scan testing. Scan test protocol, Full-scan and partial scan, Automated scan design systems, Scan design flow, Scan design overhead: area, timing, power considerations.

**UNIT – III**

Built-in self testing (BIST): BIST architecture, Test compression methods, Random and weighted random pattern testability, BIST Pattern generator and response analyzer, Theory of Linear feedback shift registers (LFSR), Generating test vectors and Signature analysis, Scan-based BIST architecture, Built-in Logic Block Observation (BILBO), Test point insertion for improving random testability, Memory IC BIST and Built-In self repair.

**UNIT – IV**

Boundary Scan Testing: Boundary scan technique. JTAG standard (IEEE 1149.1), Application of Boundary scan for PCB testing, Boundary scan instructions, Boundary Scan Description Language (BCDL), Boundary scan Test access port (TAP), TAP controller, Boundary scan instructions, Instruction register, Test data register. Boundary scan register, TAP controller state diagram, Testable design flow, Using Boundary scan TAP for IC internal circuit testing.

**References:**

- 1.B. Friedman. Digital Systems Testing and Testable Design. Jaico Publishing House. 2005. 670p.
- 2.M. L. Bushnell and V. D. Agrawal. Essentials of Electronic Testing, Kluwer Academic Publishers, 2000, 709p.
- 3.M. Abramovici, M.A. Breuer, A.D. Friedman. Digital Systems Testing and Testable Designs. 1998.
- 4.Neil H.E. Waste, K. Eshraghian. Principles of CMOS VLSI Design. Addison Wesley; 2nd edition, 1994. 735p.