GUJARAT TECHNOLOGICAL UNIVERSITY

M.E.in VLSI System Design

Semester: I

Subject Name: **Advanced MOSFET Modeling**
Subject Code: **714203**

Sr. No	Course Content	Total Hrs.
1.	**Introduction** Semiconductors, Conduction, Overview of MOS Transistor	5
2.	**Two-Terminal MOS Structure** Introduction, Flat-band voltage, Potential and Charge balance, Effect of Gate-Substrate Voltage on Surface Condition, Regions of Inversion and Analysis, Small-Signal Capacitances	8
3.	**Three-Terminal MOS Structure:** Introduction, Contacting the Inversion layer, Body effect, Regions of Inversion and Mathematical Analysis, Study of MOS Structure from "VCB" Control Point of View	9
4.	**Four-Terminal MOS Structure:** Transistor Regions of Operation, General Charge Sheet Models, Strong Inversion, Weak Inversion, Moderate Inversion, Interpolation Models, Source Referenced versus Body Referenced Modeling, Effective Mobility, Temperature Effects, Breakdown, p-channel MOS Transistor, Enhancement-Mode and Depletion-Mode Transistors, Model Parameter Values, Model Accuracy, Model Comparison	12
5.	**Small-Dimension Effects:** Introduction, Channel Length Modulation, Barrier Lowering, Two-Dimensional Charge Sharing, Threshold Voltage, Punch-through, Carrier Velocity Saturation, Hot Carrier Effects, Scaling, Effects of Surface and Drain Series Resistances, Effects due to Thin Oxides and High Doping	12
6.	**The MOS Transistor in Dynamic Operation – Large-signal Modeling:** Introduction, Quasi-static Operation, Terminal Currents in Quasi-static Operation, Evaluation of Charges in Quasi-static Operation, Transit Time under DC Conditions, Limitations of the Quasi-static Modeling, Non-Quasi-Static Modeling	10
7	**MOSFET Modeling for Circuit Simulation:** Introduction, Types of Models, Combining Several Effects into One Physical Model, Parameter Extraction, Accuracy, Properties of Good Models, General Considerations, Benchmark Tests, Nontechnical Considerations.	9

Reference Books:

1. Operation and Modeling of The MOS Transistor, Y. Tsividis
2. S.M. Kang and Y. Leblebici, CMOS Digital Integrated Circuits: Analysis and Design, Third Edition, MHI
3. 2. S. M. Sze, Physics of Semiconductor Devices, (2e), Wiley Eastern
4. N. D. Arora, MOSFET Models for VLSI Circuit Simulation, Springer