NIRMA UNIVERSITY
SCHOOL OF TECHNOLOGY, INSTITUTE OF TECHNOLOGY
M.Tech. in Electronics & Communication Engineering (VLSI Design)
M.Tech. Semester - II
Department Elective I

L	T	Practical component				C
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Course Code	**3EC12D103**
Course Title	**Characterization of Semiconductor Materials and Devices**

Course Learning Outcomes (CLOs):

At the end of the course, students will be able to -
1. Comprehend the concept of material science and impact on device current voltage characteristic.
2. Perform the device characterization.
3. Apply the techniques to reduce the device parasitic.

Syllabus: **Teaching Hours:45**

UNIT I: Resistivity **10**
Resistivity, four point probe method, resistivity profiling, contact less methods

UNIT II: Carrier and Doping Density **10**
Introduction, Capacitance-Voltage (C-V), Current-Voltage (I-V), Measurement Errors and Precautions, Optical Techniques, Secondary Ion Mass Spectrometry (SIMS), Rutherford Backscattering (RBS), Lateral Profiling, Strengths and Weaknesses, capacitance measurement, current voltage measurements

UNIT III: Contact Resistance and Schottky Barriers **10**
Introduction, Metal-Semiconductor Contacts, Contact Resistance, Measurement Techniques, Comparison of Methods optical techniques, Contact resistance and Schottky barrier height, metal semiconductor contacts, contact resistance measurement techniques

UNIT IV: Series Resistance Channel Length and Threshold Voltage **05**
MESFETs and MODFETs, Pseudo MOSFET Schottky Diode Current-Voltage Equation

UNIT V: Defects **05**
Introduction, Generation-Recombination Statistics, Capacitance Measurements, Current Measurements, Charge Measurements, Deep-Level Transient Spectroscopy (DLTS), Thermally Stimulated Capacitance and Current Positron Annihilation Spectroscopy (PAS) Strengths and Weaknesses, Deep level impurities

UNIT VI: Characterization **05**
Chemical and physical characterization, Electron beam techniques, ion beam techniques, X-ray and gamma ray techniques, Failure Times and Acceleration Factors, Reliability Concerns, Failure Analysis Characterization Techniques

Self-Study:
The self-study contents will be declared at the commencement of Semester. Around 10% of the questions will be asked from self-study contents.

Suggested Readings:

1. Dieter K. Schroder, Semiconductor Material and Device characterization, John Wiley & Sons
2. S. M. Sze, Modern Semiconductor Device Physics, John Wiley & Sons
3. D. Nagchoudhuri, Microelectronic Devices, Pearson Education