1.	Title of the course	Physics and Modeling of Semiconductor Devices
2.	Course number	EE5039
3.	Status of the course	Elective
4.	Structure of credits	3-0-0-3
5.	Offered to	PG
6.	New course/modification to	New course
7.	To be offered by	Department of Electrical Engineering
8.	To take effect from	July 2020
9.	Prerequisite	Nil
10.	Whether approved by the Department	Yes
11.	**Course Objective(s):** To introduce semi-classical bulk transport in semiconductor devices. To introduce device modeling and develop various models for MOSFET and BJT.	
12.	**Course Content:** Semi-classical bulk transport: transport equation, momentum relaxation, energy relaxation, drift-diffusion model, hydrodynamic model, generation-recombination, characteristic times and lengths; Types of device models: analytical/numerical, DC/AC, small-signal/large-signal, low frequency/high frequency, quasi static/non-quasi static, sub-circuits, and compact models for circuit simulation; MOSFET physics and modeling: review of MOSCAP and MOSFET operation, energy band diagram, IV/CV models, threshold and surface potential based models, intrinsic and extrinsic models, parasitic elements, high-voltage MOSFET modeling; BJT physics and modeling: review of BJT operation, terminal characteristics, Gummel-Poon model.	
13.	**Textbook(s):** 1. Fjeldly T A, Ytterdal T and Shur M S, *Introduction to Device Modeling and Circuit Simulation*, 1st Edition, Wiley (1998). 2. Lundstrom M, *Fundamentals of Carrier Transport*, 2nd Edition, Cambridge University Press (2000).	
14.	**Reference(s):** 1. Tsividis Y, Mcandrew C, *Operation and Modeling of the MOS Transistor*, 3rd Edition, Oxford University Press (2012). 2. Tyagi M S, *Introduction to Semiconductor Materials and Devices*, 1st Edition, John Wiley & Sons (2012).	