

Department Elective Course-1 (DEC-1)

EC307: Semiconductor Device Electronics

Details of course:-

Course Title	Course Structure			Pre-Requisite
	L	T	P	
Semiconductor Device Electronics	3	1	0	Analog Electronics

Course Objective: To develop basic semiconductor physics concepts for better understanding of current and future devices so that their applications to electronic and optoelectronic device based circuits can be appreciated.

Course Outcomes:

- CO1: Describe the Short Channel Effects in Semiconductor Devices.
- CO2: Elucidate the Silicon on Insulator Technology (SOI) Technology.
- CO3: Classify and describe Multigate devices based on FETs.
- CO4: Explain Ferroelectric Field Effect transistor and their operation.
- CO5: Elucidate the Reliability issues in Emerging Devices.

S. No.	Content	Contact Hours
Unit 1	Short Channel Effects: CMOS scaling theory, Velocity Saturation, Mobility effects, Temperature effects, Channel Length Modulation, Subthreshold conduction, High-k dielectric, DIBL, GIDL, Hot carrier effects	8
Unit 2	SOI Technology: Requirements of high-performance nanoscale devices, Silicon-oninsulator: FDSOI and PDSOI, Subthreshold swing	8
Unit 3	Multi-gate Transistors: Fin-FET, Gate-all-around, Mobility in Multigate MOSFETs, Radiation effect in multi-gate FETs	8
Unit 4	Ferroelectric Transistors and Stacked Transistors: Feature, Principle and Development of Ferroelectric transistors, Doped-ferroelectric layer, Fe-FET memory, Idea of Negative Capacitance FET. Concept of area scaling and channel stacking, General properties, and ideas about Nanosheet and Fork-sheet FET, Complementary FET, and their circuit applications	10
Unit 5	Reliability issues in Emerging Devices: Self-heating effect, Work function variations, Metal grain granularities (MGG), Random dopant fluctuation (RDF), Line edge roughness, Early aging	8
Total		42

Books:-

S. No	Name of Books/Authors/Publisher
1	Operation and Modelling of MOS Transistor/ Tsividis Y. and McAndrew C, / 3rd Ed. 2011, Oxford Univ. Press, ISBN 978-0-19-517015-3
2	FinFET and Other multi-gate transistor/ Colinge J. P., / 2008, Springer, ISBN 978-0-387-71751-7
3	Ferroelectric gate Field effect transistor, device physics and application/ Yoon S. M,/ 2020, Springer
4	High -K materials in Multi-gate FET Devices/ CRC press, Taylor and Francis
5	Advance Theory of Semiconductor Devices / Karl,Hess,PrenticeHall(India)
6	Semiconductor Physics &Devices / Neamen / Donald A/Tata McGraw-Hill..
7	Semiconductor Devices Modeling &Technology /DasGupta,N. /PrenticeHall (India)