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| 1. | Title of the course | Physics and Modeling of Semiconductor Devices |
| 2. | Course number | EE542L |
| 3. | Structure of credits | 3-1-0-4 |
| 4. | Offered to | PG |
| 5. | New course/modification to | Modification To EE5039/16 |
| 6. | To be offered by | Department of Electrical Engineering |
| 7. | To take effect from | July 2022 |
| 8. | Prerequisite | Nil |
| 9. | **Course Objective(s):** To provide in-depth understanding of semiconductor device physics and operation. | |
| 10. | **Course Content:** Semiconductors: energy bands, thermal equilibrium carrier concentration, excess carriers, quasi Fermi levels, recombination of carriers, carrier lifetime; Carrier transport: drift, mobility, diffusion, continuity equation, diffusion length; Quantitative theory of PN junctions: equilibrium analysis, steady state I-V characteristics under forward bias, reverse bias and illumination, capacitances, dynamic behavior under small and large signals, breakdown mechanisms; Bipolar junction transistors: physics and characteristics; Hetero junctions and HBT; Metal-semiconductor junctions: Schottky diode, Ohmic contact; Theory of Field Effect Transistors: analysis of MOS capacitor, calculation of threshold voltage, static I-V characteristics of MOSFETs and their models; Other devices: LEDs, solar cells. | |
| 11. | **Textbook(s):**<br>1. Streetman B G and Banerjee S K, *Solid State Electronic Devices*, 5th Edition, Prentice Hall India (2000).<br>2. Tyagi M S, *Introduction to Semiconductor Materials and Devices*, 1st Edition, Wiley (2008). | |
| 12. | **Reference(s):**<br>1. Pierret R F, *Advanced Semiconductor Fundamentals, Vol. VI in the Modular Series on Solid State Devices*, 2nd Edition, Pearson Education (2003).<br>2. Sah C T, *Fundamentals of Solid State Electronics*, 1st Edition, World Scientific (1991).<br>3. Sze S M and Kwok K Ng, *Physics of Semiconductor Devices*, 3rd Edition, Wiley (2006).<br>4. Taur Y and Ning T H, *Fundamentals of Modern VLSI Devices*, 2nd Edition, Cambridge University Press (2009). | |