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| NITM.jpg | **National Institute of Technology Meghalaya**An Institute of National Importance | CURRICULUM |
| Programme | **Master of Science in Physics** | Year of Regulation | 2019 |
| Department | **Physics** | Semester | III |
| Course Code | Course Name | Credit Structure | Marks Distribution |
| L | T | P | C | INT | MID | END | Total |
| **PH 531** | **Nanoelectronics** | **3** | **0** | **0** | **3** | **50** | **50** | **100** | **200** |
| Course Objectives | To introduce the (i) electron dynamics in nanoscale devices and (ii) concepts of single-electron tunnelling and its application. | Course Outcomes | CO1 | Understand the nanoelectronics concepts using quantum mechanics  |
| CO2 | Analyse theelectron transport phenomena at the nanoscale level |
| CO3 | Understand the working mechanismof single-electrontunneling |
| CO4 | Acquire the ability to degign the circuit and simulation in nanoelectronics |
| SYLLABUS |
| No | Content | Hours | COs |
| 1 | **Quantum Theory for Nanoelectronics** Review of electronic technology, mathematics for nanoscale systems,free electrons in quantum mechanics, current and tunnel current, energy in circuit theory, two-capacitor circuit. | 6 | CO1 |
| 2 | **Electron Dynamics in Nanoscale Devices** Introduction to electron transport, equilibrium Green’s function in electron transport, electric current under linear response, General Kubo conductivity, non-equilibrium electron transport, electron propagation- physics of Green’s function, device current formalism. | 10 | CO2 |
| 3 | **Single Electron Tunneling**Tunneling capacitor, Coulomb blockade, quantum dot circuit, double junction system, Single-Electron Transistor (SET), impulse circuit model for SET: Zero and non zerotunneling time SET circuit examples.  | 10 | CO3 |
| 4 | **Circuit Design and Simulation**Challenges of circuit design, signal amplification, biasing and coupling, SPICE model, the introduction of fuzzy logic and neural networks for circuit design. | 10 | CO4 |
| **Total Hours** | 36 |  |
| **Essential Readings** |
| J. Hoekstra, “Introduction to Nanoelectronic Single-Electron Circuit Design”, Pan Stanford Publishing Pte. Ltd.S. G. Tan and Mansoor B. A. Jalil, “Introduction to the physics of nanoelectronics”, Woodhead Publishing Limited.G. W. Hanson, “Fundamentals of Nanoelectronics”, Pearson India. |
| **Supplementary Readings** |
| 1. Joachim Knoch, “Nanoelectronics:Device Physics, Fabrication, Simulation”, De Gruyter Oldenbourg. |