**19SH41O1- NANOTECHNOLOGY**

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| **Course Category:** | Open Elective | **Credits:** | 3 |
| **Course Type:** | Theory | **Lecture -Tutorial-Practical:** | 3-0-0 |
| **Pre-requisite:** | Basics of semiconductors | **Sessional Evaluation:**  **External Evaluation:**  **Total Marks:** | 40  60  100 |

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| **Course**  **Objectives** | Students undergoing this course are expected to: | |
| 1. Learn the basic concepts of semiconductor nano devices. 2. Learn about types of photonic and molecular materials 3. Develop & design thermal and gas sensors 4. Learn about bio sensors and DNA based bio sensors 5. Learn about criteria for the choice of materials 6. Learn about protein based biosensors | |
| **Course Outcomes** | Upon successful completion of the course, the students will be able to: | |
| **CO1** | Understand various types of nano devices and nano mechanics |
| **CO2** | Develop nano technology based LED,LASER…etc |
| **CO3** | Develop the electroluminescent organic materials |
| **CO4** | Develop the different thermal sensors |
| **CO5** | Evaluate the response various materials |
| **CO6** | Design different types of bio sensors |
| **Course**  **Content:** | **UNIT –I**  **Semiconductor nanodevices-I:** Single electron devices, nano scale MOSFET, resonant tunneling transistor, single-electron transistors, single-electron dynamics, nanorobotics and nano manipulation.  **UNIT-II**  **Semiconductor nanodevices -II:** Mechanical molecular nano devices, nano computers- theoretical models, optical fibers for nano devices, photochemical molecular devices,DNA, based nano devices, gas-based nano devices, micro and nano mechanics.  **UNIT-III**  **Electronic and photonic molecular materials:** Preparation, electroluminescent organic materials, laser diodes, quantum well lasers, quantum cascade lasers, cascade surface, emitting photonic crystal laser, quantum dotlasers, quantum wire lasers, white LEDs, LEDs based on nanowires, LEDs based on nanotubes, LEDs based on nanorods high efficiency materials for OLEDs, high efficiency materials for OLEDs, quantum well infrared photo detectors.    **UNIT-IV Thermal sensors:** Thermal energy sensors, temperature sensors, heat sensors, electromagnetic sensors electrical resistance sensors, electrical current sensors, electrical voltage sensors, electrical power sensors, magnetism sensors, mechanical sensors, pressure sensors, gas and liquid flow sensors, position sensors, chemical sensors, optical and radiation sensors.  **UNIT-V Gas sensor materials:** Criteria for the choice of materials, experimental aspects, materials, properties, measurement of gas sensing property, sensitivity, discussion of sensors for various gases, gas sensors based on semiconductor devices.    **UNIT-VI**  **Biosensors:** Principles, DNA based biosensors, protein based biosensors, materials for bio sensor applications, fabrication of biosensors, future potential. | |
| **Text books & Reference books:** | **Text books:**  1. “Nano Electronics and Information Technology”, by W. Ranier, Wiley, (2003).  2. “Nano systems “, by K.E. Drexler, Wiley, (1992).  **Reference books:**  1. “Introduction to Molecular Electronics”, by M.C. Petty,1995. | |