



**INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS**

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Programme of Study : **Ph.D.**

Thesis Title: Analytical and Simulation Modeling of Terahertz Waveguides and Sensors based upon Plasmonic and Metamaterial Structures

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SHORT ABSTRACT

Plasmonics and metamaterials have emerged as one of the most fascinating areas in photonics because of their significance in developing next generation miniaturized high speed components and sensitive devices. In the thesis work, the focus has been made in investigating the potential of plasmonic and metamaterial structures in the design and construction of terahertz waveguides and thin film sensors.

We have proposed a planar plasmonic terahertz waveguide comprising of one-dimensional array of sub-wavelength scale periodically arranged tilted pillars, where the propagation properties of the terahertz modes can be controlled through the bending of pillars. In plasmonic terahertz waveguides, we have also investigated the role of internal corrugations in altering the propagation properties of the guided terahertz modes. We further investigate the potential of planar plasmonic terahertz waveguides as thin film sensors. In this novel study, we designed a plasmonic waveguide comprising of periodic rectangular grooves and filled them with analytes of different refractive indices.

The potential of planar terahertz metamaterials as thin film sensors has been widely investigated in last few years. In this context, several metamaterial configurations have been devised to effectively sense an analyte. We have examined the role of fundamental and higher-order resonances as thin film terahertz sensor. For this purpose, we have used a single split ring resonator (SRR) based terahertz metamaterial, which exhibits fundamental and higher order resonance modes subject to the polarization of electric field vector of incident terahertz radiation with respect to the gap of SRR.

In order to understand and analyze the numerical observation in our study, we have modeled plasmonic and metamaterial structures with a semi-analytical transmission line approach.