



INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
PhD-17 SHORT ABSTRACT OF THESIS

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Programme of Study : Ph.D.

Thesis Title : Design of Multi-Diagnostic POCT Devices for Early Diagnosis of NCDs at Low Resource Rural Settings

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Key words for description of Thesis Work : Point-of-Care Testing (POCT); Non-Communicable Diseases (NCDs); Portable Diagnostics; Spectrophotometric Analysis; Multi-Parameter Detection; Clinical Biochemistry; Optical Biosensor; Beer-Lambert Law; Point-of-Care Device; Resource-Limited Settings; Rural Healthcare; Smartphone-Based Diagnostics; Clinical Validation; Centrifugal Microfluidics; Lab-on-a-Disc; Multiplexed Diagnostics; 3D Printing; Digital Health; Healthcare Innovation; Decentralized Diagnostics.

SHORT ABSTRACT

Non-communicable diseases (NCDs), including diabetes, cardiovascular diseases, and chronic kidney disease (CKD), require early and accessible diagnosis, which remains challenging in resource-limited settings due to dependence on centralized laboratories. This thesis presents the development and clinical validation of a portable multi-diagnostic point-of-care testing (POCT) platform for decentralized NCD screening. The platform integrates spectrophotometric sensing, controlled incubation, digital connectivity, and low-cost microfluidics to enable quantitative biochemical analysis. Clinical validation demonstrated strong agreement with standard laboratory analyzers for key biomarkers, achieving high diagnostic performance. Additionally, a 3D-printed centrifugal microfluidic system with smartphone-based detection was developed for multiplexed analysis. Overall, the proposed POCT ecosystem provides an affordable, portable, and reliable solution for early NCD diagnosis in low-resource settings and supports future expansion toward connected healthcare systems.