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

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| Programme of Study | : | Ph.D. |

Thesis Title: Electric Field Mediated Instabilities for On-Demand Microfluidic Mixing and Separation

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| Name of Thesis Supervisor(s) | : | Dr. Dipankar Bandyopadhyay & Dr. Partho Sarathi Gooh Pattader |
| Thesis Submitted to the Department/ Center | : | Yes |
| Date of completion of Thesis Viva-Voce Exam | : | 09.09.21 |
| Key words for description of Thesis Work | : | Fluid Mechanics, Microfluidics, Electrohydrodynamics |

**SHORT ABSTRACT**

The thesis deals with the study of the effects of externally applied electric field in some selected microfluidic phenomena with the aid of micro and mesoscale model set-ups. Experiments as well as theoretical studies shed light on the physics governing the phenomena along-with demonstrating the feasibility of the same for various practical applications.

Microfluidic Mixing: The characteristics of electric field induced instabilities triggered due to ion injections in stratified miscible microflows for prospective applications of mixing, micro-reactions and enhancement of heat and mass transfer operations are studied. A complete linear stability analysis and numerical simulations of the phenomena reveal the finer details of such instabilities.

Particle Laden Flows: Th salient features of the electric field induced assemblies of microparticles suspended in an insulating liquid have been studied. With the use of a mesoscale set-up, the charge transfer dynamics associated with the field induced multi-particle oscillations have been studied experimentally. Numerical simulations have been carried out to explore the physics associated with the phenomena.

Droplet Laden Flows: The dynamics associated with the electric field driven migrations of an aqueous droplet across the interface between liquid pairs with very low interfacial tensions between them have been studied. A combined experimental and numerical study explores the various modes of such active migrations along-with characterising the idiosyncrasies associated with them. In another study, the asymmetric contact dynamics during electric field induced drop non-coalescence in an insulating oil have been explored with the help of experiments and numerical simulations.