



Project Proposal for Ph.D.

Project Details	
Project Title	Development of Microfluidic Devices for Efficient Cell Sorting and Separation
Project Summary (Minimum 500 and maximum 2000 characters)	Efficient and rapid cell sorting and separation plays a vital role in advancing molecular and cellular biology, biotechnology, and medicine. While traditional approaches offer effective sorting/separation within short timeframes, recent developments in microfluidics have facilitated the creation of compact devices with comparable capabilities, leveraging various physical principles. These technologies can be categorized as either active or passive. Active systems typically utilize external fields (e.g., acoustic, electric, magnetic, and optical) to exert forces that relocate cells for sorting, while passive systems rely on inertial forces, filters, and adhesion mechanisms to refine cell populations. Microchip-based cell sorting offers numerous advantages over conventional methods, including reduced equipment size, elimination of potentially hazardous aerosols, and streamlining of complex sorting protocols. Moreover, microchip devices are conducive to parallelization, enabling the development of complete lab-on-a-chip systems for cellular isolation, analysis, and experimental processing. This project deals with the development of efficient microfluidic platform with integrated magnetic and/or acoustic actuation for cell sorting and drug screening/delivery applications. The project involves design, modelling, micro-fabrication and microfluidic as well as biological characterization of the complete lab-on-a-chip system.

Ph.D. Supervisors			
Role	Name of Faculty	Academic Unit in IITD/Institute/University	Email ID (Official)
Supervisor 1	Prof. Dhiman Mallick	EE, IITD	dhiman@ee.iitd.ac.in
Supervisor 2	Prof. Prashant Mishra	DBEB, IITD	pmishra@dbeb.iitd.ac.in

Project requirements (Student qualifications, experience required, etc) *The candidate will be shortlisted based on common shortlisting criteria decided by ScRC (SIRe)
Candidate should have the qualification of B.Tech in Electrical, Electronics, Mechanical, Biochemical, Biotechnology or Materials Engineering, Or MSc. in Physics, Physical Chemistry, and Electronics. Students qualified CSIR/UGC JRF are strongly encouraged to apply. Candidates with any prior knowledge on instrument interfacing by LabView, Python related software, or experience on electric motors, materials synthesis or experience in nanofabrication will be given preference although not mandatory.

Source of fellowship/funding (CSIR/UGC/DBT/ICMR/ICAR/NEET-PG/DST-INSPIRE/IRD/FITT Project details, if any)
Candidate with his/her own fellowship /institute assistantship

Role of Faculty Members involved:	
Supervisor-1	In the proposed project two faculty members (Prof. Mallick and Prof. Goswami) have few overlap areas of research and have broad complementary expertise. The student assigned for this project will have access to both EE and DBEB departmental facilities and various central facilities of IITD. Prof. Mallick’s experience and expertise is in functional material integration, design, modelling, fabrication of MEMS and microfluidics devices, electrical, electromechanical and microfluidic characterization etc. (Interdisciplinary Microsystems Lab)
Supervisor-2	Prof. Prashant Mishra’s expertise is synthesizing drug loaded biodegradable nanoparticles for targeted and enhanced drug delivery, self-assembly based nanopatterning and development of nanodevices for biosensing applications. (Prof. Mishra’s Lab Webpage)