



Project Proposal for Ph.D.

| Project Details                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
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| Project Title                                                    | Development of Integrated Lab-on-a-Chip System for On-chip Cell/Molecule Handling and Analysis                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Project Summary<br><br>(Minimum 500 and maximum 2000 characters) | We are developing compact and integrated Lab-on-a-Chip systems capable of precisely manipulating cells, molecules, and fluidic chemical species for efficient sample preparation and analysis. Our approach integrates multiple transduction mechanisms, such as magnetic and acoustic forces, to enable multiple functionalities including manipulation, separation, patterning, streaming, mixing, sensing, and heating, into a unified system. This allows for seamless sample preparation, concentration, cell lysis, and data collection, streamlining the entire process for rapid and comprehensive diagnostics. This technology is poised to significantly impact life sciences and clinical applications. The project is heavy on design, modelling and cleanroom micro-fabrication aspects of microfluidic devices which is ideal for students coming from Electronics/Electrical/Mechanical Engineering or Physics background or having relevant background. The project also involves drug loading experiments and biological characterization of the complete lab-on-a-chip system. Hence, selected student should be interested to work in those areas as well for successful implementation of the interdisciplinary project. |

| Ph.D. Supervisors |                       |                                            |                                                                      |
|-------------------|-----------------------|--------------------------------------------|----------------------------------------------------------------------|
| Role              | Name of Faculty       | Academic Unit in IITD/Institute/University | Email ID (Official)                                                  |
| Supervisor 1      | Prof. Dhiman Mallick  | EE, IITD                                   | <a href="mailto:dhiman@ee.iitd.ac.in">dhiman@ee.iitd.ac.in</a>       |
| Supervisor 2      | Prof. Prashant Mishra | DBEB, IITD                                 | <a href="mailto:pmishra@dbeb.iitd.ac.in">pmishra@dbeb.iitd.ac.in</a> |

| Project requirements (Student qualifications, experience required, etc)                                                                                                                                                                                                                                                                                                                                                                             |
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| <b>*The candidate will be shortlisted based on common shortlisting criteria decided by ScRC (SIRe)</b>                                                                                                                                                                                                                                                                                                                                              |
| Candidate should have the qualification of B.Tech and M.Tech in Electrical, Electronics, Mechanical, Nanotechnology or allied areas, Or MSc. in Physics, Nanoscience, and Electronics. Students qualified CSIR/UGC JRF are strongly encouraged to apply. Candidates with any prior experiences in cleanroom device fabrication, microscopy experiments and/or device design on COMSOL Multiphysics will be given preference although not mandatory. |

| Source of fellowship/funding<br>(CSIR/UGC/DBT/ICMR/ICAR/NEET-PG/DST-INSPIRE/IRD/FITT Project details, if any) |
|---------------------------------------------------------------------------------------------------------------|
| Candidate with his/her own fellowship/ Institute Fellowship                                                   |

| Role of Faculty Members involved: |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Supervisor-1                      | In the proposed project two faculty members (Prof. Mallick and Prof. Mishra) 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. ( <a href="#">Interdisciplinary Microsystems Lab</a> ) |
| 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. ( <a href="#">Prof. Mishra’s Lab Webpage</a> )                                                                                                                                                                                                                                                                                                 |