



Project Proposal for Ph.D.

Project Details (The research problem must clearly indicate the need for an interdisciplinary approach)

Project Title	Developing a high-throughput drug screening platform with impedance based single cell-in-droplet analysis.
Project Summary	The project aims to develop an instrument capable of quantifying the effects of drugs, antibodies, and other biomolecules on target cells in a label-free manner. The student will contribute by designing and developing the instrument, performing data acquisition, and analyzing single-cell responses to therapeutic agents. The student will primarily work with human cancer cell lines and will gain exposure to drug response profiling and therapeutic screening in oncology. These cells will be encapsulated within picolitre droplets that traverse through microfluidic channels at high speeds [1]. The overarching aim is to deploy impedance spectroscopy for quantifying drug responses by analyzing the cell's morphology and membrane integrity in addition to the existing fluorometric analysis [2][3]. This multidisciplinary project combines expertise from fluid dynamics, microfabrication, instrumentation, electronics, electrical engineering and biotechnology to generate high-resolution data correlating cellular response with external agents while also addressing the cellular heterogeneity. The candidate will contribute to strengthening cancer therapeutics, drug discovery, immunology etc. and could contribute significantly to strengthening the healthcare infrastructure in India. Droplet generation Impedance signal acquisition Data analysis [1] <i>Integrated Field's metal microelectrodes based microfluidic impedance cytometry for cell-in-droplet quantification</i>; J Panwar, R Roy. Microelectronic Engineering, 2019 ([2] <i>Single-cell microfluidic impedance cytometry: a review</i>; T Sun and H Morgan - Microfluidics and Nanofluidics, 2010 [3] <i>Design and construction of a microfluidics workstation for high-throughput multi-wavelength fluorescence and transmittance activated droplet analysis and sorting</i>; J Panwar, A Autour, CA Merten, Nature Protocols, 2023

Ph.D. Supervisors*
(Supervisor 1 and Supervisor 2 cannot be from the same department of IITD)

Role	Name of Faculty	Academic Unit in IITD/Institute/University	Email ID (Official)
Supervisor 1*	Jatin Panwar	DBEB	jatinpanwar@iitd.ac.in
Supervisor 2	Sarvesh K. Srivastava	CBME	sksr@iitd.ac.in

*Supervisor 1 must be from IIT, Delhi.

+All cells in this table are mandatory fields that need to be filled by faculty for consideration of proposal.

\$The date of superannuation of supervisors should be at least three years from the date of registration of selected candidates.

Project requirements (Student qualifications, experience required, etc)
*The candidate will be shortlisted based on common shortlisting criteria decided by ScRC (SIRe)

- BTech with 60% or above in Electrical, Electronics, Mechanical, Instrumentation, Chemical or related Fields
- Experience or interest in developing devices and instrumentation

Source of fellowship/funding and project number
(CSIR/UGC/DBT/ICMR/ICAR/NEET-PG/DST-INSPIRE/IRD/FITT Project details, if any)

Institute funded

Role of Faculty Members involved:

Supervisor-1	Responsible for primary supervision, research guidance, and providing necessary laboratory resources and infrastructure. Expertise in: Bioinstrumentation, Microfluidics and Chemical Engineering
Supervisor-2	Responsible for co-supervision, contributing interdisciplinary expertise, and supporting experimental design and data interpretation. Expertise in: Microfabrication, Gastroenterology and Molecular Biology.

Note :-

1. Approval from the respective DRC/CRC/ScRC of your Department/Centre/School will be required for using the "Full-time Institute Assistantship (Category-wise) (FIA)" for selecting the students in SRe.
2. Declaration:- Faculty members, please ensure that you have at least 3 years of service left before superannuation along with adequate sitting space & lab facilities for the SRe student.
3. PI/s are also encouraged to submit joint proposals with AIIMS, NII, JNU and institutes with which IITD has an existing MoU. If the Co-PI (Supervisor 2) is from outside IITD, kindly share his/her detailed CV.
4. If a research scholar is to be considered for selection under the project fellowship, then the project should have a minimum of two-year duration remaining.
5. A candidate applying with a valid JRF/INSPIRE/any national level fellowship should have at least two-year validity from the date of joining the Ph.D. program.
6. The third supervisor's name (if required) can be added only after the formation of Student Research Committee (SRC) subject to a strong recommendation of SRC and subsequent approval from the competent authority.
7. If Institute fellowship is being sought, then DRC approval of the parent department of Supervisor 1 is required at the time of selection.