



Project Proposal for Ph.D.

| Project Details                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
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| Project Title                                                    | Energy harvesting and Sensing using Piezoelectric and Triboelectric Nanogenerators                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Project Summary<br><br>(Minimum 500 and maximum 2000 characters) | In the era of green energy harnessing, electrical energy from mechanical vibration is indispensable. Triboelectric effect, one of the oldest effects known to mankind, has recently emerged in the last decade as a potential and promising energy harvesting mechanism where energy can be harnessed by friction between any two dissimilar materials. Further harnessing energy using hybrid piezoelectric/triboelectric systems can highly improve the energy conversion efficiency. Here in this project, we would like to explore energy harnessing by novel materials that possess both piezoelectric and triboelectric conversion capabilities. The project deals with the material synthesis, cleanroom fabrication and electrical/mechanical characterization of hybrid energy harvesting/sensing devices for smart wearable applications in real-time health monitoring. We would also like to investigate the method of charge generation by surface probe techniques and explore its opportunities in such devices. |

| 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. Ankur Goswami  | DMSE, IITD                                 | agoswami@mse.iitd.ac.in |

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| <b>Project requirements (Student qualifications, experience required, etc)</b><br><b>*The candidate will be shortlisted based on common shortlisting criteria decided by ScRC (SIRe)</b>                                                                                                                                                                                                                                                                                               |
| Candidate should have the qualification of B.Tech in Electrical, Electronics, Mechanical, 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. |

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| <b>Source of fellowship/funding</b><br>(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: |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
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| 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 DMSE 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 and electromechanical characterization etc. ( <a href="#">Interdisciplinary Microsystems Lab</a> ) |
| Supervisor-2                      | Prof. Ankur Goswami’s expertise is largely in materials synthesis and micro/nano-fabrication, nanomechanical devices characterizations, characterizations of materials (HRXRD, SEM, and various modules of AFM such EFM, KPFM, MFM) and electrical transport measurements. ( <a href="#">Advanced Electronic Materials and Systems Laboratory</a> )                                                                                                                                                                                                                 |