Indian Institute of Technology Delhi

School of Interdisciplinary Research (SIRe)

Project Proposal for Ph.D.

SIRe Project Number

2026-01-16

(will be assigned by SIRe)

Project Details (The research problem must clearly indicate the need for an interdisciplinary approach)	
Project Title	Radical and plasma-controlled sputtered metal doped hydroxyapatite coatings for in-vitro study of antibacterial efficacy of dental biofilms and biocompatibility
Project Summary (Minimum 500 and maximum 2000 characters)	Students with backgrounds in biotechnology, nanotechnology, and biomedical sciences are especially encouraged to apply, as this project provides a valuable opportunity to engage in cutting-edge research on plasma-based biomaterial development for dental care applications. Plasma, an ionized state of matter composed of electrons, ions, neutrals, radicals, and radiation including UV light, plays a pivotal role in advanced material processing. In particular, non-equilibrium low-temperature and low-pressure plasmas (NELPP), utilized through magnetron sputtering (MS) techniques, have enabled a wide range of industrial and societal applications, especially in nanoscience, biology, and medicine. This proposal focuses on the development of plasma-assisted processes for the deposition of biomaterials aimed at enhancing dental implant performance. One of the major clinical challenges in this area is the occurrence of bacterial infections following implant procedures. Although hydroxyapatite (HA) is widely used due to its excellent biocompatibility and structural similarity to natural bone, it suffers from limited antibacterial properties. To overcome this drawback, silver (Ag), known for its broad-spectrum antimicrobial activity, will be incorporated into HA coatings. Using NELPP-based devices, biocompatible coatings such as HA and multilayer Ag/HA with varying thicknesses will be synthesized and systematically optimized. The project involves comprehensive characterization of these coatings to achieve an optimal balance between antibacterial efficacy and biocompatibility. Plasma parameters and reactive species will be precisely controlled using in-situ plasma monitoring tools to optimize the deposition process. Additionally, the study will assess in vitro antibacterial activity and cytotoxicity of the developed coatings, along with their effectiveness in suppressing biofilm formation, a primary cause of dental diseases. With the combined expertise of IIT Delhi and AIIMS, this interdisciplinary project aims to advance plasma-enabled healthcare solutions and explore their commercialization potential in Indian healthcare, offering a promising and impactful research pathway for a full-time JRF candidate.

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*	Bibhuti Bhusan Sahu	Department of Energy Science and Engineering, IITD	bbsahu@dese.iitd.ac.in
Supervisor 2	Dr. Prabhat K. Chaudhari	Centre for Dental Education and Research, AIIMS, New Delhi-110029	dr.prabhatkc@gmail.com

*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)**

- **Qualifications:** Master in Physics/Material Science, M.tech. in relevant discipline, MBBS, etc.
- **Experience:** Student should have the experience in Material science/Solid State Physics, etc.

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

GATE, candidate with ICMR fellowship, CSIR/UGC or any national level fellowships or part time candidate

Role of Faculty Members involved:

Supervisor-1	Design and development of plasma process and supervise for Plasma processing of material
Supervisor-2	Supervision of bioanalysis and healthcare study.

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 SIRe.**

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 SIRe 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.**