



Project Proposal for Ph.D.

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

Project Title	Development of an ion beam extraction system for mini-ELNIBS, a large area plasma device.
Project Summary (Minimum 500 and maximum 2000 characters)	Ion beam extraction from a large volume hydrogen plasma ($\sim 100 - 1000 \text{ m}^3$) for neutral beam injectors (NBI) for fusion application is a challenging task. The plasma needs to meet certain attributes like high plasma number density ($n \sim 10^{16} - 10^{18} \text{ m}^{-3}$), good plasma uniformity ($\Delta n / n \sim 1-5 \%$), and high system efficiencies to ensure uniform ion beam profile for efficient fusion plasma heating. Plasma Lab, IIT Delhi has been associated in developing a prototype ECR-based large area plasma source (mini-ELNIBS) and its characterization for the past few years. The lab has recently obtained a relatively large area uniform (40-60 cm diameter), high density ($n \sim 10^{17} \text{ m}^{-3}$) hydrogen plasma in mini-ELNIBS. This proposal expects the student to utilize the mini-ELNIBS plasma device and develop a large area ion beam extraction system for large-area plasma-based ion beam applications. Plasma and beam characterization will be a part of the project.

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) & Contact Number
Supervisor 1*	Prof. Ramesh Narayanan	Department of Energy Science and Engineering, Indian Institute of Technology Delhi	rams@dese.iitd.ac.in
Supervisor 2	Prof. Mainak Bandyopadhyay	(Professor in Homi Bhabha National Institute [HBNI], DAE) Scientific Officer- H, DNB Group, ITER-India, Institute for Plasma Research (IPR), Bhat, Gandhinagar, India, PIN 382428.	Email: mainak@ipr.res.in mainakband@gmail.com mainak@iter-india.org mainak.bandyopadhyay@iter-india.org

*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)

- M. Tech. in Electrical Engineering or M. Tech. Electronics and Instrumentation Engineering or B. Tech. in Electrical Engineering. M. Sc. (Physics) students may also be considered, if found suitable.
- An exposure to high power supplies and / or vacuum systems may be preferable.
- Some knowledge of design and fabrication of electrical and electronic circuits is preferable.

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

Candidate with his/her own fellowship/ Institute Fellowship (FIA)

Role of Faculty Members involved:

Supervisor-1	Prof. Ramesh Narayanan will mentor the student in planning the beam plasma experiments and their characterization for optimal H-ion extraction in the experimental system already available at IIT Delhi.
Supervisor-2	Prof. Mainak Bandyopadhyay has experience working on the beam extraction grid in the Institute for Plasma Research (IPR), Gandhinagar. The development and integration of this grid will be the most crucial part of this research proposal. Hence, Prof. Bandyopadhyay will mentor the student for the same. The visit of the student to IPR, Gandhinagar, to obtain exposure and training may be needed, or a visit of Prof. Bandyopadhyay may be needed from time-to-time.

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.**