



Project Proposal for Ph.D.

(will be assigned by SIRe)

Project Details

Project Title	Optimum Design of Fiber-Reinforced Polymer Composites for Blast Response Mitigation
Project Summary (Minimum 500 and maximum 2000 characters)	Lightweight and high-strength fibre-reinforced polymer (FRP) composites are useful in enhancing the resistance of reinforced concrete (RC) members subjected to blast loading. A typical challenge for an engineer is to design the RC members applied with the FRP composites from the available materials and options for their placement. Apart from the composite behaviour and dynamic loading, uncertainty in material and loading parameters also have a significant influence in the design. The conventional procedure of tackling uncertainty by using partial safety factors yields a non-optimal design. Hence, in the proposed doctoral research, optimum design of the FRP composites under uncertainty for maximized blast response mitigation has been planned. To address the curse of dimensionality associated with uncertainty quantification and optimization under uncertainty problems, machine learning-based efficient methods for solving design under uncertainty problems will be developed. The optimization problem will be treated as a multi-scale optimization problem and will involve design variables from multiple scales. The outcome of this project will be a reliable, uncertainty insensitive FRP composite for blast mitigation.

Ph.D. Supervisors

Role	Faculty	Academic Unit in IITD/Institute/University	Email ID (Official)
Supervisor 1	Prof. Souvik Chakraborty	Applied Mechanics (AM)	souvik@am.iitd.ac.in
Supervisor 2	Prof. Vasant Matsagar	Civil Engineering (CE)	matsagar@civil.iitd.ac.in

Project requirements (Student qualifications, experience required, etc)

- M.Tech. or Master of Science (MS) by Research students.
- Post-graduate (PG) degree with specialization in Structural Engineering/Mechanical Designs
- Applicants with strong fundamental understanding of solid mechanics, structural dynamics, and finite element analysis are most suited. Programming skills in Python/ MATLAB environments will be important. Exposure to optimization techniques and uncertainty quantification will be added advantage.

Source of fellowship/funding

(CSIR/UGC/DBT/ICMR/ICAR/NEET-PG/DST-INSPIRE/IRD/FITT Project details, if any)

Project matching slots Prof. Vasant Matsagar [Civil Engineering (CE)].

Role of Faculty Members involved:

Supervisor 1: Souvik Chakraborty [Applied Mechanics (AM)] → Optimum design under uncertainty. Supervisor 2: Vasant Matsagar [Civil Engineering (CE)] → Blast engineering and engineered materials.