



(will be assigned by SIRe)

Project Details	
Project Title	Optimum Design of Fiber-Reinforced Polymer Composites for Blast Response Mitigation
Project Summary	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.

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

Project requirements (Student qualifications, experience required, etc.)
<ul style="list-style-type: none">M.Tech. or Master of Science (MS) by Research students.Post-graduate (PG) degree with specialization in Structural Engineering/Mechanical Designs.

Source of funding (IRD/FITT Project details, if any)
Industrial Research and Development (IRD) Unit matching slots to Vasant Matsagar [Civil Engineering (CE)].

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.

The doctoral research project will involve modeling and simulation of civil engineering structural elements under blast-induced loading and investigation of practical approaches for mitigating the response through design of appropriate fiber-reinforced polymer (FRP) material composite is the major objective of the research work.

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.