



Project Proposal for Ph.D.

Project Details (The research problem must clearly indicate the need for an interdisciplinary approach)	
Project Title	Fluid–Structure Interaction Modeling of Flow-Induced Vibrations in Dam Gates
Project Summary (Minimum 500 and maximum 2000 characters)	Dam gates are prone to flow-induced vibrations (FIV), which pose serious operational and structural challenges. Such vibrations may restrict gate functionality at certain openings, accelerate fatigue, or cause cracks in welded joints and structural members. The onset and severity of these vibrations are governed by several interdependent factors, including inertia, damping, gate geometry (e.g., opening ratio, lip design, seal configuration), and hydraulic conditions. At the core of this problem lies the Fluid–Structure Interaction (FSI) phenomenon, where unsteady hydrodynamic forces and structural vibrations are tightly coupled, producing complex, nonlinear dynamic behavior that remains difficult to predict with existing approaches. This research focuses on modeling and analyzing the FSI mechanisms governing dam gate vibrations. It aims to characterize fluctuating hydrodynamic loads, capture the dynamic response of gates, and investigate the mutual interactions between flow turbulence and structural vibration modes. The multidisciplinary nature of the study stems from the integration of hydrodynamics (unsteady turbulent flow analysis), structural mechanics and vibration theory (dynamic response evaluation), and computational FSI modeling (numerical simulations and advanced computational techniques). By bridging these domains, the research seeks to establish a robust predictive framework for understanding, modeling, and mitigating FIV in dam gates, ultimately contributing to enhanced structural safety, service life, and operational reliability of hydraulic structures.

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*	Narsing Kumar Jha	Applied Mechanics Department	narsingjha@am.iitd.ac.in
Supervisor 2	Deepanshu Shirole	Department of Civil & Environmental Engineering	dshirole@civil.iitd.ac.in

*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)
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• Educational Background Pursuing M.Tech / M.E. / Ph.D. in Mechanical Engineering, Civil Engineering (Hydraulics/Water Resources), Applied Mechanics or Aerospace Engineering. Strong academic foundation in Fluid Mechanics, Structural Dynamics, and Numerical Methods. • Core Knowledge Areas Fluid Dynamics & Turbulence: Understanding vortex shedding, unsteady wakes, and hydraulic flow over/through gates. Structural Dynamics & Vibrations: Knowledge of natural frequencies, damping, modal analysis, fatigue, and resonance. FSI Fundamentals: Coupled interaction of fluid loading and structural response. Research/Experimental Skills (optional but valuable) Familiarity with PIV (Particle Image Velocimetry) or Laser Doppler Anemometry (LDA) for flow field measurements. Any Professional working experience of industry etc.

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

Role of Faculty Members involved:	
Supervisor-1	Providing supervision on the core domain of Fluid Dynamics & Turbulence, FSI Fundamentals etc. Also, provide guidance for PIV measurements and data analysis.
Supervisor-2	Provide supervision on material characterization at multiple time- and length-scales and its measurement techniques. Guidance on Imaging Procedures and data processing.

- Note :-**
- 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 SRe.**
 - 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 SRe student.**
 - 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.**
 - 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.**
 - 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.**
 - 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.**
 - If Institute fellowship is being sought, then DRC approval of the parent department of Supervisor 1 is required at the time of selection.**