



Project Proposal for Ph.D.

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

Project Title	3D Printing of Patient-Specific Lattice Orthopedic Implants for Enhanced Functional Performance
Project Summary (Minimum 500 and maximum 2000 characters)	Orthopedic implants play a critical role in restoring mobility and function for patients suffering from bone defects, fractures, or degenerative conditions. Conventional implants are often standardized in shape and size, which can result in suboptimal fit, stress shielding, and reduced long-term performance. This project aims to address these challenges by developing patient-specific orthopedic implants using advanced 3D printing technologies. The primary focus is two-fold: personalization and functional enhancement. Firstly, medical imaging data (e.g., CT/MRI scans) will be utilized to design implants tailored to the unique anatomical features of each patient, ensuring improved fit, biomechanical compatibility, and comfort. Secondly, the project will integrate lattice structures into the implant design. Lattices not only reduce implant weight but also enable controlled stiffness, improved load transfer, and enhanced osseointegration due to their interconnected porous architecture. By leveraging the flexibility of additive manufacturing, the project will explore optimized lattice geometries that balance mechanical strength with biological performance. The research will involve computational modeling, design optimization, and experimental validation of printed implants using biocompatible materials. Performance will be assessed in terms of mechanical properties, bone-implant interaction, and potential for clinical translation. The outcomes of this project are expected to provide a pathway toward next-generation orthopedic solutions that are both patient-specific and functionally superior, offering significant benefits in terms of recovery, durability, and quality of life.

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*	Kusum Meena	Mechanical	Kusum@iitd.ac.in
Supervisor 2	Priya Vashisth	Centre of Biomedical	pvashisth@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)

- M.Tech degree in Mechanical Design, Manufacturing, Materials Science, or allied areas. A strong background in additive manufacturing, computational modeling, biomaterials, and mechanical testing will be desirable.

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	Guides implant design, lattice optimization, and mechanical performance evaluation. Oversees 3D printing process parameters and material characterization.
Supervisor-2	Ensures anatomical accuracy from patient imaging. Biocompatibility analysis of implants. Guides assessment of osseointegration, bone-implant interaction, and clinical feasibility.

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.