

DESIGN PORTFOLIO

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About Me



I am a Mechanical Design Engineer and Researcher with a strong foundation in design, simulation, and automation. I recently completed my Master's in Mechanical Engineering from University of Illinois at Chicago. My expertise spans finite element analysis (FEA), CAD modelling, and machine learning applications in mechanical systems, with hands-on experience in biomechanics, robotics, and manufacturing design.

At Dr. Amirouche's Biomechanics Lab at UIC, I conduct FEA simulations using ANSYS to study stress distributions and mechanical behaviour in human bone models, particularly in the spine and shoulder. My research focuses on understanding the effects of orthopaedic diseases and surgical procedures on bone mechanics and implant performance. Through computational modelling and failure analysis, I contribute to surgical improvements and medical device innovation.

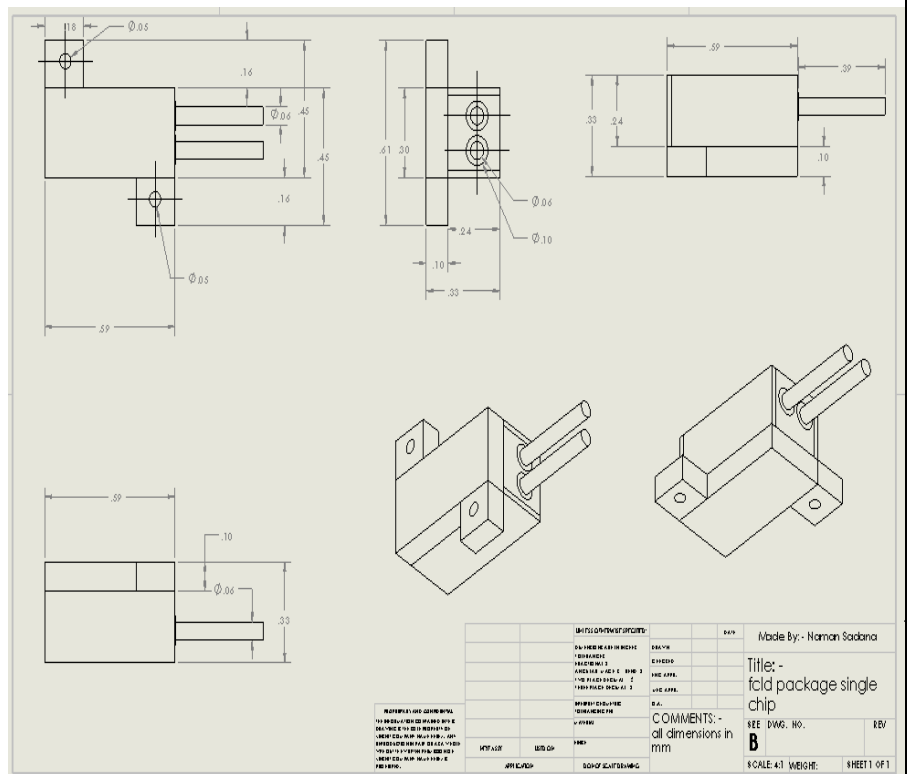
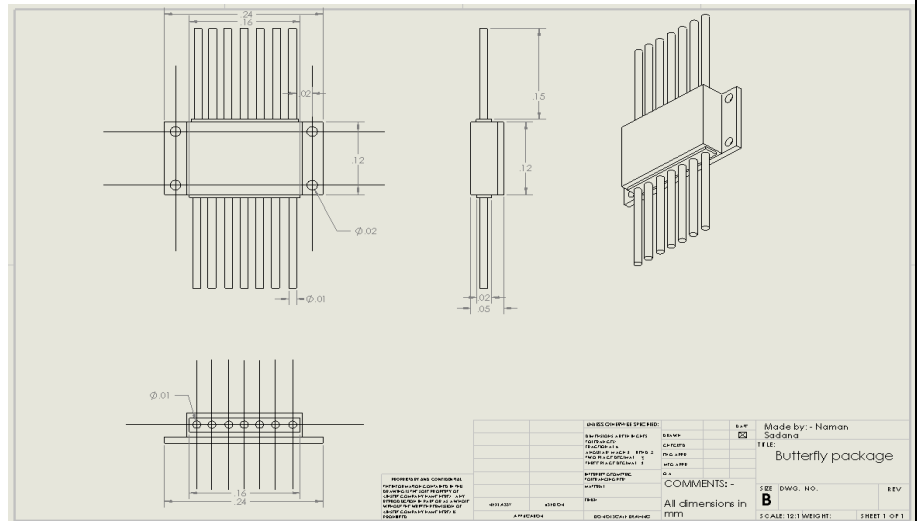
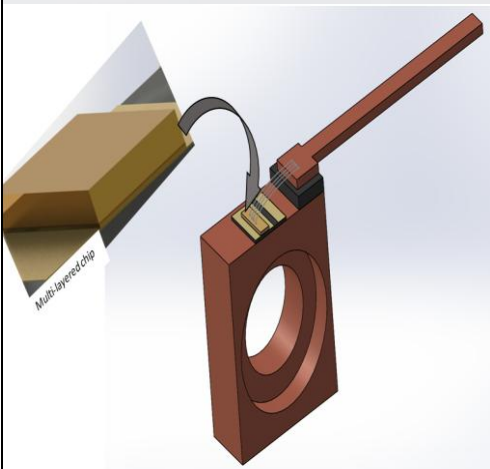
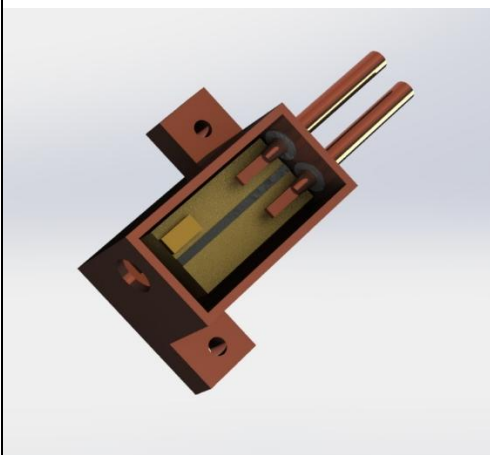
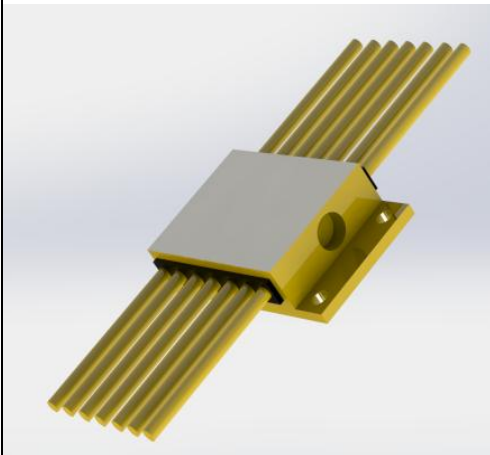
Beyond biomechanics, I also gained hands-on experience in precision design and manufacturing during my internship at Solid State Physics Laboratory (SSPL), DRDO (Ministry of Défense, India), where I designed jigs and packaging structures for laser chip manufacturing using SolidWorks and AutoCAD. Additionally, I conducted thermal analysis in ANSYS to optimize heat dissipation and structural integrity, improving chip reliability.

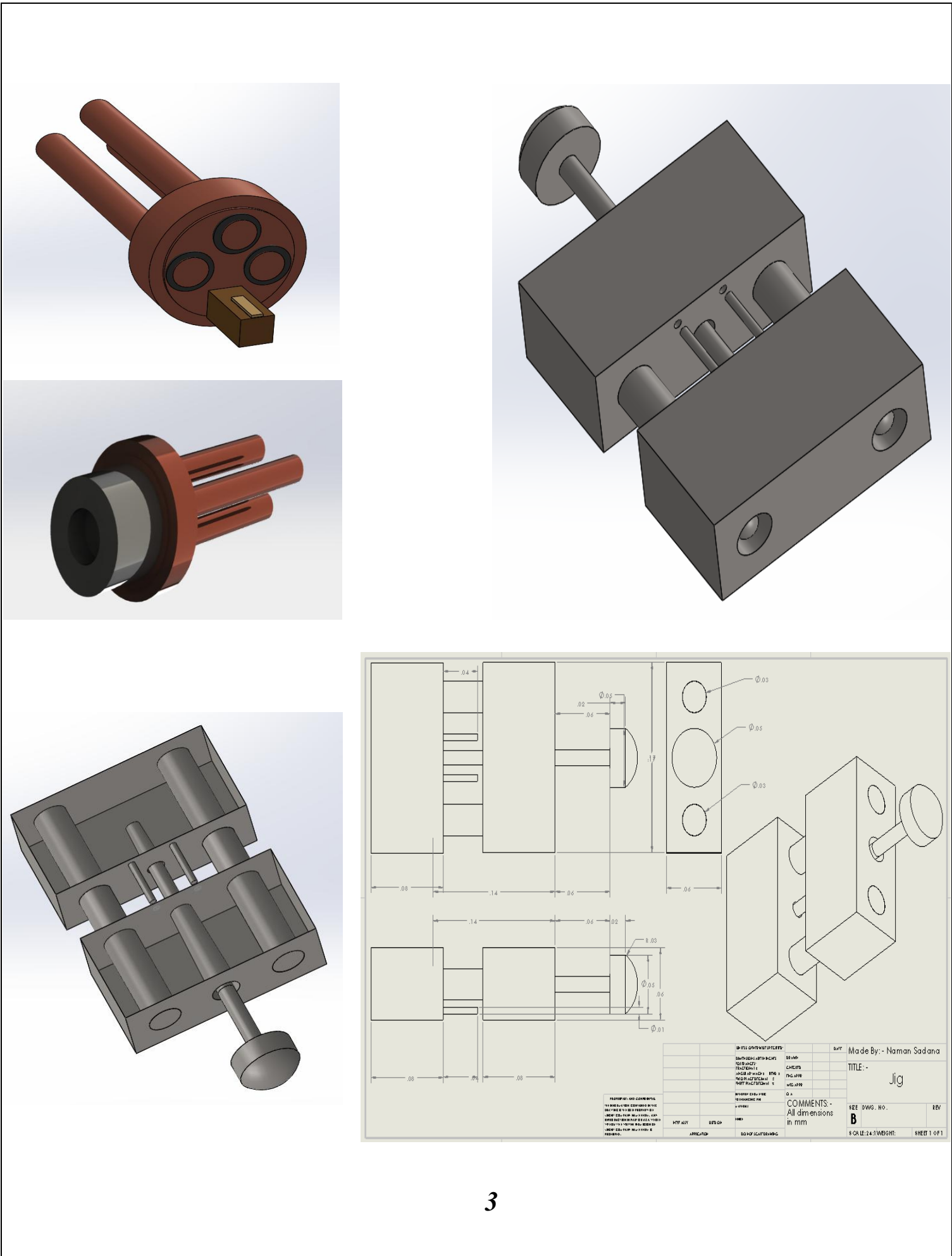
In addition to my research and industrial experience, I have led several engineering design projects, including the development of Curl the Weight integrating CAD, 3D printing, and Arduino-based circuitry. In a Punjab State Government project, I conceptualized and optimized the Jaws of Life—a hydraulic-powered vehicle extraction tool for first responders, designing its structure with SolidWorks and FEA simulations in ANSYS to ensure durability and efficiency in emergency scenarios.

With expertise in SolidWorks, AutoCAD, ANSYS, MATLAB, and Python, I strive to create better and mindful designs that can make a tangible difference in the world. My goal is to push the boundaries of engineering innovation and develop solutions that enhance functionality, sustainability, and human well-being.

Solid State Physics Laboratory, DRDO, Ministry of Défense, India

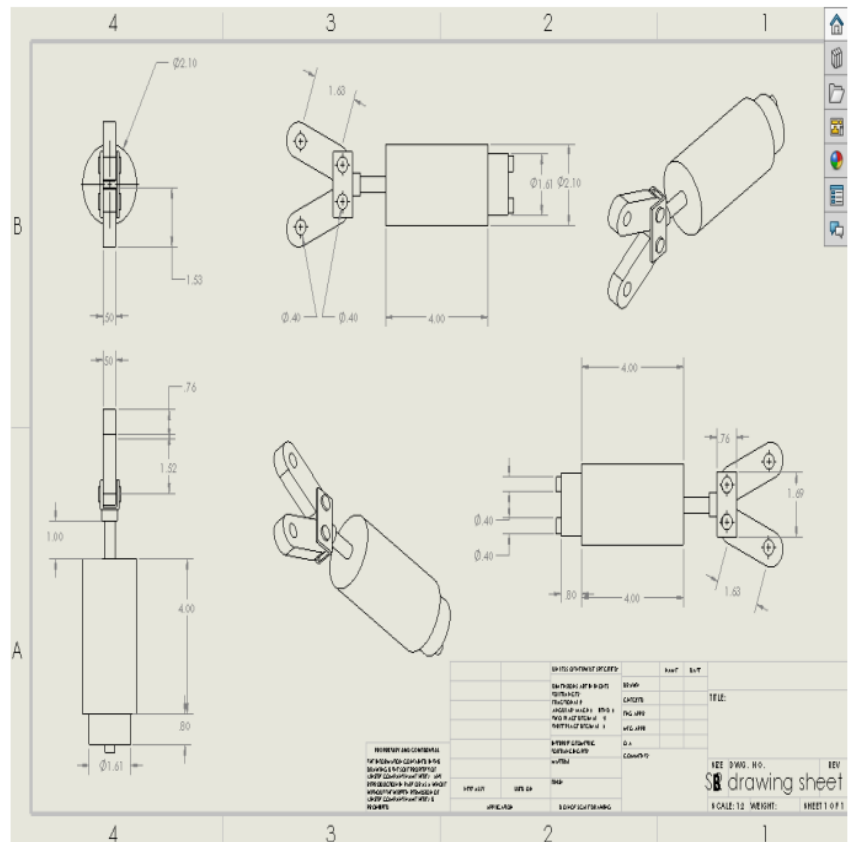
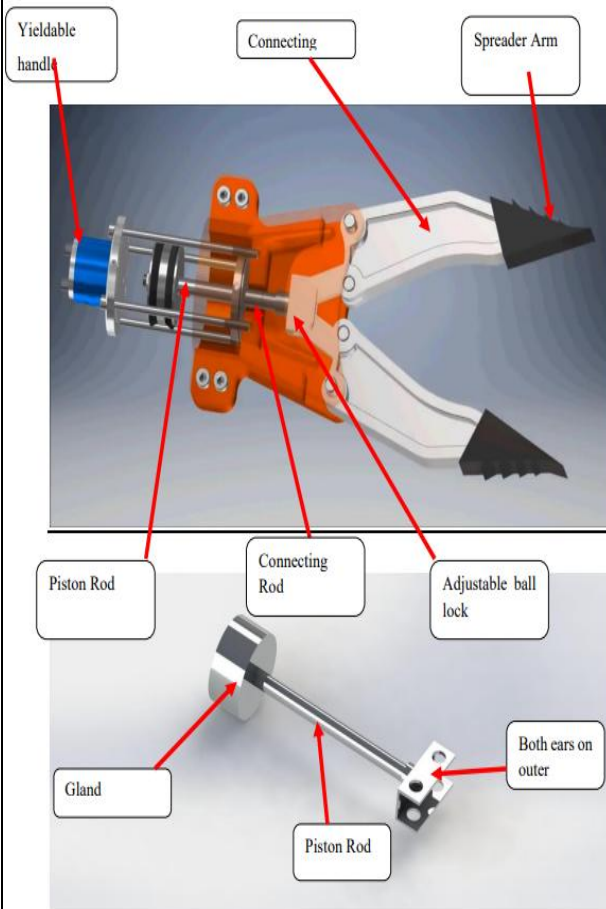
During this training, designed precision-engineered packages and jigs for laser diodes using SolidWorks, ensuring optimal alignment, thermal management, and structural integrity. Focused on manufacturability, ease of assembly, and performance efficiency to support high-precision laser applications. Gained hands-on experience in precision engineering, semiconductor technologies, and manufacturability considerations for Défense applications.

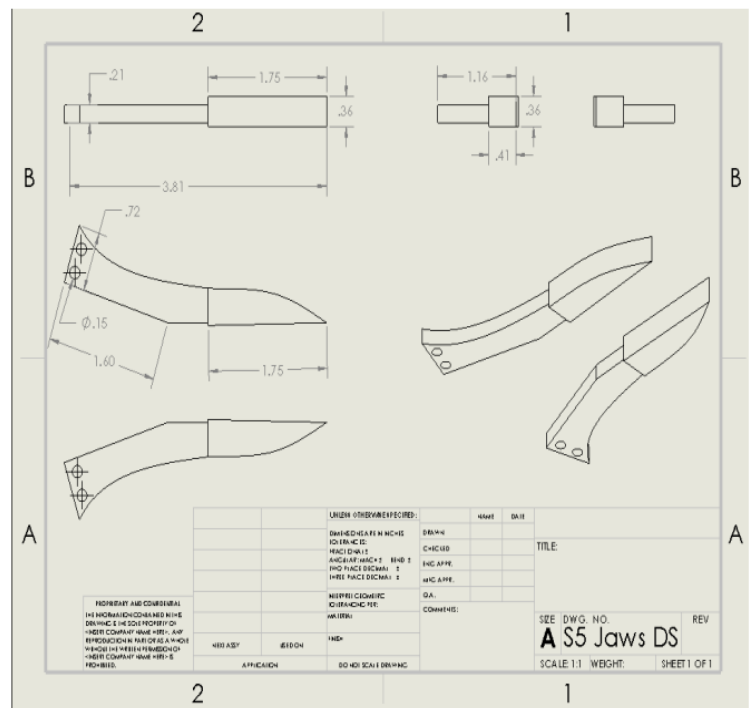
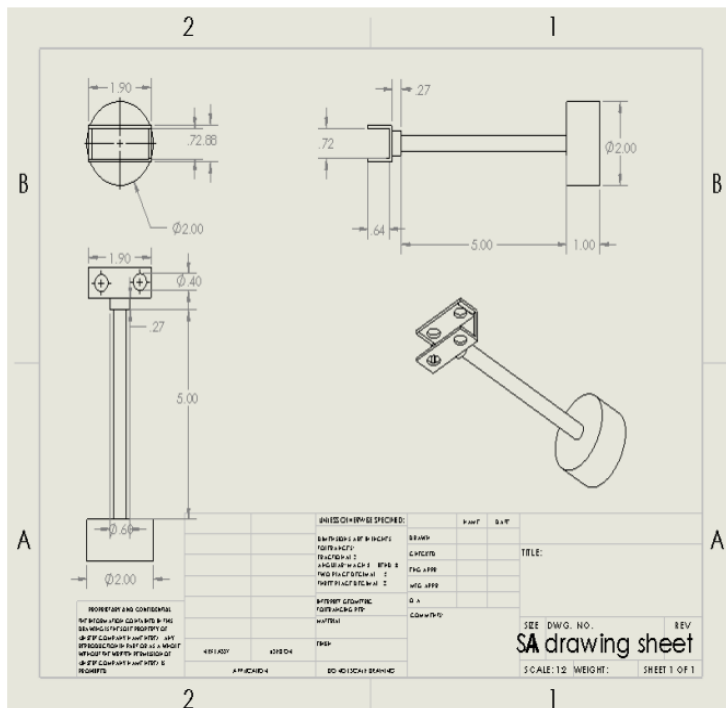
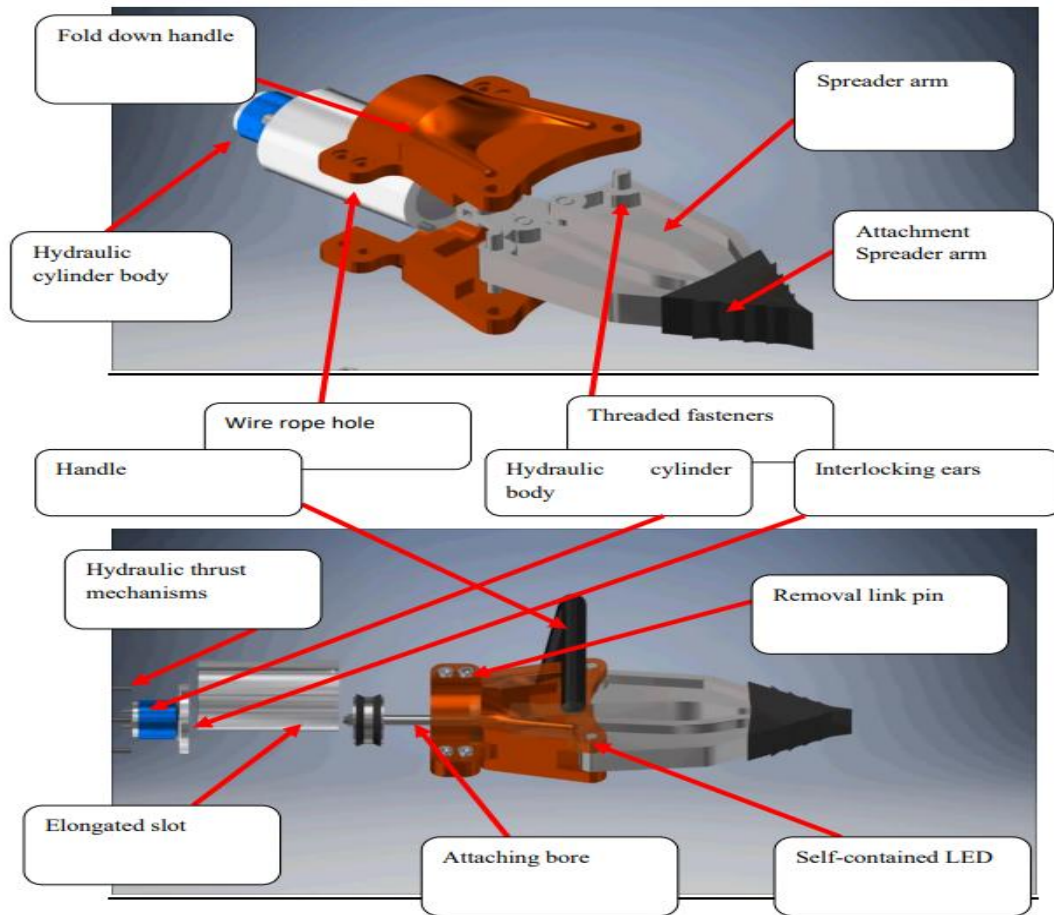




Jaws of Life – Punjab State Government Project

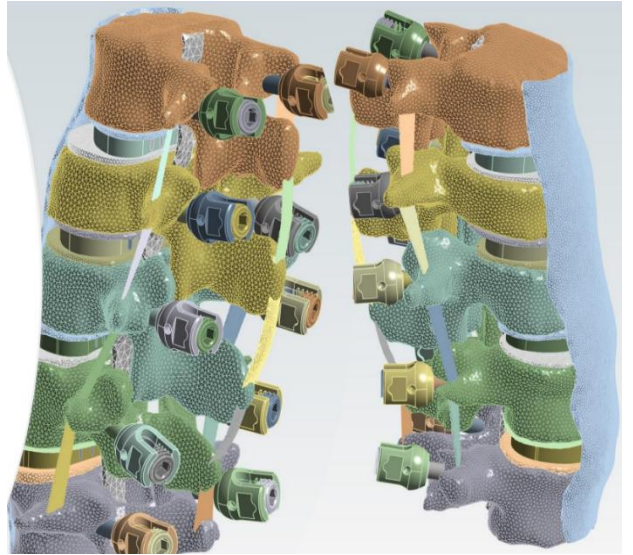
Designed and developed a life-saving vehicle extraction tool prototype using SolidWorks, aimed at enabling rapid cutting and extraction of accident victims in emergency situations. Engineered the mechanical components with a focus on strength, durability, and ergonomics by selecting high-strength alloys and optimizing cutting mechanisms for enhanced performance and reliability. Collaborated closely with emergency responders and engineers to refine the design, ensuring it met real-world operational requirements and seamlessly integrated into existing rescue protocols. This project demonstrated expertise in mechanical design, material selection, and user-centered engineering for critical applications.





Biomechanics Lab, UIC:

I researched lumbar spine anatomy and designed patient-specific implants, including intervertebral cages, pedicle screws, and connecting rods, using SolidWorks to meet precise dimensional requirements. Developing a comprehensive workflow, I converted CT scan data into lumbar spine models using Mimics, ensuring seamless integration of material selection while considering manufacturing constraints. To enhance model accuracy, I utilized Abaqus to assign materials to different vertebrae and performed finite element analysis in ANSYS to simulate mechanical behavior under various loading conditions, validating implant designs for medical applications. Additionally, I studied and analyzed shoulder data to identify injury patterns and trends, contributing to a deeper understanding of musculoskeletal conditions.



Lumbar Spine with Pedicle screws



Lumbar Spine with Pedicle screws and Connecting rods

4-Link Solid Axle Suspension – Personal Project:

This project showcases a complete suspension assembly I designed using Autodesk Inventor as a personal exploration into off-road vehicle dynamics. The system features a 4-link solid axle layout with dual coilover shocks and external reservoirs, built for enhanced articulation and durability under rugged conditions. I modeled and assembled nearly 25 individual components—including the axle, control arms, shocks, mounts, and wheel hubs—ensuring accurate fitment and realistic motion behaviour. This project strengthened my proficiency in part modelling, assembly design, and system-level integration within a professional CAD environment.

