

Letter of Intent

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Whether it is to “develop energy efficient technologies to cater to a world getting rich and developed” or “build bioengineered devices to stop a virus”, concepts of Mechanical engineering are indispensable. As promoters of avant-garde, they hold the key to ground-breaking research in the technology of tomorrow and as a student of Mechanical Engineering, passionate about Design & Manufacturing, I yearn to be a part of that.

At my college, the right guidance and ambiance served to bring out the best in me. This, coupled with a plethora of experiences such as exposure to research projects and laboratory courses, instilled in me a desire to dive deeper into the core fundamentals of my subject.

Due to my keen interest and curiosity in the working of a research centre, I decided to spend my summer break of 2019 training at Variable Energy Cyclotron Centre (VECC), Department of Atomic Energy, Government of India under the mentorship of Senior Scientist Dr. Pranab Bhattacharyya. It gave me first-hand knowledge about the application of engineering design in the industry through designing and simulation various components of cyclotron. It was exciting to gain knowledge on manufacturing and inspection of cyclotron components and their cooling system as well from the great minds themselves.

My first tryst with research was during the winter break during my junior year when I worked as a Research Intern in the Laser Laboratory of IIT Kharagpur under the counsel of Prof. Dr. Asimava Roy Choudhury. Since Titanium alloys cannot be used for bearing surface applications due to their relatively poor wear resistance, I tried to tackle this problem by surface modification technique thereby developing a powder mixture containing SiC, B₄C, and hBN which was coated on Ti-6Al-4V by Laser Cladding. This allowed me to achieve surface hardness more than the substrate as well as greater wear resistance.

As the pandemic plagued the world, my parents’ businesses were shut down as a result of which I found myself working two part-time jobs alongside my education. Nevertheless, my interest in research motivated me to explore the domain of computational contact mechanics. Under the direction of Prof. Dr. Sachin Singh Gautam, IIT Guwahati, I simulated different contact algorithms using ANSYS. The numerical study produced results that agreed with the analytical data.

While reading an article on optimization, I came across the applications of Genetic Algorithms in Mechanical Engineering. Luckily, I got a chance to apply Genetic Algorithm in the kinematic analysis of 5- bar linkage under the supervision of Prof. Dr. Sajan Kapil, IIT Guwahati.

For any industry to function, heat, ventilation, and air conditioning (HVAC) play an important role and without delving into this area of HVAC, my training as an engineer would have been incomplete. Hence, I made up my mind to work on the development of a cooling system for solid target of the cyclotron at VECC with the help of my mentors, Dr. Pranab Bhattacharyya and Prof. Dr. Arijit Dutta. I have been simulating different designs of the system for given physical conditions to check their effectiveness in protecting the target from

melting under the effect of a concentrated proton beam. Eventually, the designs are experimentally verified at VECC and shall be used by the organization in the future.

In the meantime, I got interested in the analysis of multi-layered composite materials. Under the supervision of Prof. Dr. Kalyan Kumar Singh, IIT ISM Dhanbad, I experimentally analyzed the mechanical properties of fiber-reinforced polymer composites and the results are also validated using finite element analysis in ANSYS (ACP) software. The fatigue analysis of composite laminates is also observed. I am still exploring this domain.

All these research experiences provided me with a well-rounded exposure to almost all the major disciplines of Mechanical Engineering— this encouraged me to venture into the research area of mechanical design. The Ph.D. program in Mechanical Engineering at your esteemed institution fits my aspiration as it provides a perfect blend of academic rigor, state-of-the-art lab facilities, and a diverse environment to interact and learn. Moreover, the Department of Mechanical Engineering leads a multitude of high-quality research projects, in collaboration with the industry. I believe this will help me to emerge as a pragmatic mechanical Engineer adept in recent technologies and experimental methodologies.

I believe that indulging in extracurricular alongside studying carves a way toward mental well-being, thereby increasing productivity in the long run. Hence, I have been energetically playing badminton and cricket since middle school and would love to participate in the athletic clubs at your esteemed institution. It will provide me an opening to socialize and appreciate the multicultural environment of the University as well. This will help me to develop holistically, preparing me on both personal and professional levels.

Being a disciplined and diligent student, I recognize the perseverance necessary to perform at this Institute and the noble ideals that have been the cornerstone of this hallowed academy. Given an opportunity to demonstrate my research capabilities, I can confidently assert that I have “high tolerance” and will be a “perfect fit” for the dynamic research atmosphere at your esteemed institution.