The latest revolutionary technologies aim to make our regularly used devices smaller and more compact, and this miniaturization of our devices has led to an increased demand for skilled professionals in various domains. In this scenario, the importance of Material Scientists cannot be stressed enough because when the size of semiconductor materials is reduced to the nanolevel, their physical and chemical properties are altered drastically. A good understanding of the changes induced in materials by subjecting them to various parameters is the backbone of most design and manufacturing processes and the development of novel materials for various applications can lead to increased efficiency and performance in tools and methodologies. An important application of this field is in healthcare, where biosensors are designed for purposes of disease progression, treatment, environment and food control, and nanotechnological applications. My exposure to Material Science has mostly been in a research-based environment and I aim to specialize in the field of Material Science and Engineering to make valuable contributions in various sectors using my knowledge and skills.

My deep interest in semiconductor devices and new technologies related to it, including its analytical and logical-based projects, prompted me to pursue my undergraduate studies in Electronics and Instrumentation Engineering. This program helped me encounter the practical aspects of science and the latest techniques in electronic instruments. I particularly enjoyed learning about Electronic and Digital Controls, Electrical Machines, Semiconductor Devices, Virtual Instrumentation, Digital Signal Processing, IC Fabrication Technology, Robotics, Computer Control in Process Application, Biomedical Technology, and Computer-Assisted Measurements. These courses covered all the basic concepts that were extremely useful to me in my subsequent projects. I also gained considerable practical knowledge through my courses IC Fabrication Laboratory, Microprocessor and Microcontroller Laboratory, and Virtual Instruments Laboratory.

My undergraduate coursework helped me branch out in terms of related fields and their scope and I was eager to understand how my acquired knowledge was useful at the industrial level. Hence, I decided to take up a project where I designed a gesture recognition-based wheelchair, using which physically challenged people could control the wheelchair through hand gestures. I used a number of sensors for the development of this system, and in the process gained in-depth knowledge of sensors, their design, functions, and numerous applications. I also understood how to use designing software and how to fabricate models based on specifications.

This experience in designing was very useful to me in my next project where I designed a virtually controlled petrol dispenser. For this project, I used the National Instruments (NI) LabVIEW software which had a very interactive user interface and it helped me choose among the various functions of dispensing petrol. This project helped me strengthen my design concepts and gave me the experience of learning and familiarizing myself with a new software.

My work with sensors had given me sufficient practice in their appropriate design and usage, and so I took up another project where I designed a turn-on fluorescence sensor based on Molybdenum Disulfide quantum dots for enzyme-free sensitive and selective detection of Hydrogen Peroxide. This project helped me understand the design and functions of a sensor in detail and how they can be manipulated to suit our needs. I also learnt how to use different materials for the fabrication of various components to achieve desired physical and chemical characteristics. Based on this project, I expect to publish a paper titled ‘Enzyme-Free Sensitive

and Selective Detection of H2O2 Using Turn-On Fluorescence of Molybdenum Disulfide Quantum Dots' in the near future.

Despite my hands-on experience in various projects, I felt that there was something missing in my knowledge acquisition and I realized that my cumulative experience was incomplete unless I understood how various electronics and their components were deployed in big companies. This led me to undertake an internship at the Diesel Locomotive Works, Indian Railways, Varanasi, where I worked in the Electrical and Electronics Laboratory at their technical training centre. Here, I understood how sensors were used for the enhanced functioning of train engines and I was able to compare my previous knowledge of the applications of sensors with information acquired during this training period. I realized the versatility of sensors and how these are used in different ways to achieve different purposes.

My coursework on Virtual Instrumentation had introduced me to a whole new computer-based instrument design approach, and I was eager to gain more knowledge about this area. Hence, I attended a training session on Virtual Instrumentation LabVIEW Programming conducted by the AKGEC NI LabVIEW Academy, Ghaziabad. Here, I learnt the graphical programming approach for the design of smart machines and industrial equipment, and understood the importance of automation for manual design-related tasks which can be both accurate and cost-effective.

During the course of my undergraduate studies, I took every opportunity to attend seminars and symposiums in order to get a feel of the current state of the industry and to meet other like-minded people who shared my passion for Material Science. I participated in a conference titled 'Mechanical Engineering in Green Technologies' and in a national-level student symposium where I presented a poster on 'Nanotechnology on Photovoltaics'. I have served as a mentor for a Robotics workshop, where I covered the topic 'Manual and Autonomous Line Follower Robot'. This experience helped me gain knowledge in the field of Robotics and sharing this knowledge helped me deepen my concepts in this domain. I was the leader of my group for my final year undergraduate project, where I managed the entire project work meticulously, avoided breakdowns as much as I could, and successfully completed my project before time.

As I had gained in-depth knowledge of sensors and design of various instruments using different approaches, I jumped at the opportunity to work as a Research Trainee at the Nanomaterials Laboratory, in Banaras Hindu University, after completing my undergraduate studies. Here, I worked on a project where I fabricated a lithography-free photodetector based on a synthesized MoSe2 nanosheet using a hydrothermal route. I successfully synthesized the material and performed characterization studies, following which I fabricated the photodetector and checked the I-V characteristics. Through this project, I became familiar with a number of techniques and instruments such as hydrothermal synthesis, spin coating, metallization, transmission electron microscopy, scanning electron microscopy, atomic force microscopy, Raman spectroscopy, PL spectroscopy, and UV-Vis spectroscopy. Apart from this project, I gained a complete overview of the synthesis of transition metal dichalcogenides (TMDs) from the family of 2D materials such as MoS2, MoSe2 nanosheets, ZnO, and MoOx quantum dots using hydrothermal methods or sol-gel methods. This experience gave me an in-depth knowledge of atomic characteristics of materials along with their various applications, and provided me with a strong framework for my future.

As I attempted to acquire information about the advancement of electronic devices in modern technologies and the challenges in trying to make these devices compact, I realized that the field of Material Science is overbearing the field of Electronics and that further miniaturization of devices can only be achieved through a very strong foundational knowledge of various materials. Also, my experience as a Research Trainee has helped me discover my love for research and has ignited my passion for working in the semiconductor sector for the incorporation of semiconductors in various emerging electronics. I am also interested in the biomedical industry where I aim to fabricate instruments which are used by doctors for the diagnosis and treatment of patients. I want to gain enough experience in the research department so that I can achieve the position of a Senior Scientist and I can eventually establish my own laboratory where I will carry out research projects for the benefit of the industry and the society.

Having realized my passion in the field of Material Science and Engineering, I want to take an important step towards my future by opting for a postgraduate specialization in this field from your University. I look forward to gaining exposure to the entire spectrum of materials and nanoscience, so that my advanced knowledge of the field can aid my future progress. I look forward to undertaking complex research projects in your conducive and competitive environment where I can get the opportunity to perform both theoretical research work as well as implementation studies. I am quite aware of the quality of research work that is regularly published from your University and I have long dreamed of being a part of a skilled team for carrying out groundbreaking research in Material Science.

My research experience and hands-on training in several essential techniques has helped me better understand the technicalities of the field, and I now look forward to building a diverse skill set through your postgraduate program.