ABEKA ACADEMY

MECHANICAL AND NUCLEAR ENGINEERING

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BY

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MECHANICAL AND NUCLEAR ENGINEERING

THESIS: There are many different types of engineering, but mechanical and nuclear are some of the most prominent and beneficial categories.

I. The study of mechanical engineering.
   A. What exactly do mechanical engineers do?
   B. What school or training is required to be a mechanical engineer?
   C. What are some applications of mechanical engineering?

II. The study of nuclear engineering.
   A. What do nuclear engineers do?
   B. What is required to become a nuclear engineer?
   C. What applications does nuclear engineering have?

III. How do both of these fields benefit society?
   A. How are these fields related?
   B. What is the necessity of engineering?
   C. What is the job demand for these types of engineers?
   D. The history of mechanical/nuclear engineering.

MECHANICAL ENGINEERING

Mechanical Engineering, along with Nuclear Engineering, are two fields that have a large impact on society. Without Mechanical and Nuclear engineers, most of the things as we know would not exist. Engineers are basically modern-day inventors. Engineers create new ideas that either improve existing technology or replace it with something better. Not only do engineers create things, they also fix existing things. Some of the biggest engineering feats in the world include the Great Pyramids of Giza, the Panama Canal, the Eiffel Tower, the Transatlantic Cable, the Large Hadron Collider, and the Internet (The History Channel). Engineers play a vital role in every person's life, and also in society as a whole. Engineering requires a lot of mathematics and sciences. There are many different types of engineering, including the following: Mechanical Engineering, Nuclear Engineering, Chemical Engineering, Electrical Engineering, Systems Engineering, Manufacturing Engineering, Civil Engineering, Biomedical Engineering, Industrial Engineering, Environmental Engineering, and Aerospace Engineering, to name a few (Google). One thing that all types of engineering have in common is that they are always working with some of the most advanced technologies and concepts in the world. There are many different types of engineering, but mechanical and nuclear are some of the most prominent and beneficial categories.

Mechanical engineering is one of the broadest and most well-known types of engineering. On a day-to-day basis, mechanical engineers will "research, design, develop, build, and test mechanical and thermal devices, including tools, engines, and machines" (Wikipedia). They use extensive mathematics, physics, and many other principles to accomplish this. Mechanical engineers work with products and systems that meet the needs of humans (Michigan Tech). Since this field is very diverse, there are several different subfields associated

with mechanical engineering. So many different processes and technologies need mechanical engineers. These engineers have the ability to create anything that moves. To become a mechanical engineer, at least a bachelor's degree is required. During a four-year bachelor's program, different classes including but not limited to: computer-aided drafting (CAD), statics, dynamics, fluid mechanics, materials, and thermodynamics are fundamental for mechanical engineering (onlineengineeringprograms.com). Once a bachelor's degree is obtained, there are a few options. If desired, a master's degree may be earned for an additional two years of school. This will make a way to earn more money right after college; approximately $90,000 per year rather than approximately $70,000 per year with a bachelor's degree (Professor Phongikaroon, VCU). Other options rather than a master's degree are entering the workforce and obtaining experience to get certifications, or obtaining a PhD. A doctorate degree in mechanical engineering is for teaching mechanical engineering as a college professor. After school, regardless of the degree earned, certifications are a great way to boost a career as an engineer. After four years of experience, an engineer can earn the Professional Engineer (PE) license. "For mechanical engineers, PE licensure can indicate a high level of competence to clients, supervisors, and colleagues, although this credential is not always necessary to work in the field. Graduates of mechanical engineering schools should check with their state licensing board for more details on regional requirements. It's essential to add that only licensed PEs can work as consulting engineers or private practitioners, and the PE designation is also necessary for employment in many governmental positions where the safety and welfare of the public is concerned" (onlineengineeringprograms.com). The prerequisites to take the PE exam are to take the Fundamentals of Engineering test near the completion of a degree, and to have four years of experience. Mechanical engineers can work in so many different fields, including aerospace, automotive, manufacturing, biomedical, and much more. There are mechanical

engineers in every industry, and they have their hand in almost every product imaginable (Institution of Mechanical Engineers).

"Nuclear engineering is a multidisciplinary field that goes beyond providing nuclear power for electrical production. Nuclear technology touches our lives in many ways and nuclear engineers solve everyday problems and contribute to our health and safety. Nuclear engineers may apply radiation in disease treatment and food supplies, operate nuclear energy systems, develop regulations to ensure safety, or facilitate space exploration" (PennState College of Engineering). Nuclear engineers do not just make nuclear bombs that can end the world, but instead, they mainly work on nuclear systems that either help improve daily life for millions of people, or save people's lives in hospitals. While this may sound interesting, there is a long journey to become a nuclear engineer. A bachelor's degree will allow one to become a nuclear engineer, but will not go very far in a nuclear career. Most employers would look for a master's degree. A typical bachelor's program for nuclear engineering would have classes focused on radiation, high levels of math, physics, plasma studies, and chemical classes (onlineengineeringprograms.com). For a master's degree in nuclear engineering, more in-depth courses such as nuclear fuel management, advanced physics courses, nuclear waste disposal, and nuclear technologies are required. Once a degree is earned, a nuclear engineer cannot work alone without proper certification and licensure. A state certification is required, and is obtained by taking the FE exam. After state certification, the engineer will be an Engineer in Training for four years until the PE license is obtained. Once the PE is earned, additional certifications for engineers with a master's or doctorate degree in nuclear engineering are required after eight years. Typically, nuclear engineers make around $120,000 per year, and about $65,000 right out of college (onlineengineeringprograms.com). Nuclear engineers have several industries where they can work in, including power generation, military, data centers, medical, and more. Nuclear radiation is used in the food and agriculture industry to be able to

kill bacteria, as an insecticide, and for plant breeding purposes (World Nuclear Association). In the medical world, nuclear power is used for screening machines such as X-rays, MRIs, and CAT scanners. Nuclear power is used across a wide variety of applications, and will continue to be increasingly used for years to come because nuclear power has no emissions, making it a clean energy source (Professor Phongikaroon, VCU).

Together, both mechanical and nuclear engineers are very valuable to society. These two categories of engineering are very closely intertwined. All nuclear engineers need mechanical engineers to be able to build reactors, power plants, medical devices, and much more. Both types of engineering use fluid mechanics, chemistry, statics, and dynamics (Professor Phongikaroon, VCU). For example, if a nuclear power plant needs a new reactor, mechanical engineers, civil engineers, and nuclear engineers will work closely together to design, construct, and begin operation of the reactor. All types of engineering are very beneficial to society, and always will be. Without engineers, life would be stuck in the early 1800s. Early inventors such as Thomas Edison, Nikola Tesla, John Deere, Alexander Graham Bell, and many more paved the way for modern engineering. Mechanical and nuclear engineers are prime examples of jobs that can never be replaced by AI or robots. Solving the problems that mechanical and nuclear engineers work on requires human brain power and thought, and will always be that way. These engineers will always have work to do. Because of this, the job demand will steadily increase throughout time. Historically, mechanical engineering has been around since simple machines were invented circa five thousand years ago. Some of the most notable mechanical engineering feats throughout time include: the water wheel- fourth century B.C., the first steam powered device- circa 10-70 A.D., a pendulum clock- 1657, Isaac Newton’s laws of motion and calculus- 17th century A.D., industrial revolution- early 19th century, and the foundation of American Society of Mechanical Engineers- 1880 (Wikipedia). Nuclear

engineering does not have quite the extensive history that mechanical engineering has, but still has had a major impact on the world. Nuclear engineering began in 1938, when nuclear fission was discovered. One of the earliest uses of nuclear power was in 1945, when America dropped the nuclear bombs on Hiroshima and Nagasaki. The first time nuclear power was used to generate electricity was in 1951 with the Experimental Breeder Reactor I. Nuclear power was first connected to a power grid in 1954, when the Obninsk Nuclear Power Plant was built (Wikipedia). Some more modern feats of mechanical and nuclear engineering include: the Hoover dam, the Channel Tunnel under the English Channel, the Transcontinental Railroad, the Netherlands North Sea Protection Works, the New York Subway System (The History Channel), the Large Hadron Collider, nuclear powered ships, nuclear power plants, micro nuclear reactors, MRI and X-Ray machines, and much more. Mechanical and nuclear engineering have made a huge impact on the world, and continue to create groundbreaking technologies.

While there are many different fields of engineering to explore, mechanical and nuclear engineering are some of the most widely used and innovative types of engineering. Engineering is one of the most important professions in the world today, and without engineers, nothing would be the same. The world needs more mechanical and nuclear engineers, and if you have a passion for designing, building, testing, and implementing systems, then this is the career for you!

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