March 24, 2017

President's Address for March Graduation Ceremony of Academic Year 2016

Yuji Oie, President, Kyushu Institute of Technology

Today brings all of us at Kyushu Institute of Technology great joy as we welcome everyone to the graduation ceremony for the year 2016. Let me begin by congratulating each of our graduates on turning this auspicious corner in your lives. Let me also offer my heartfelt congratulations to the proud parents, guardians and other family members whose emotional and material support has enabled these graduating students to reach this day.

As we celebrate your graduation from Kyutech, I would like to take the opportunity today to examine and reflect upon science and technology, engineering in particular, in terms of its achievements in the past and prospects for the future.

Let's begin by looking at the relationship between society and science and technology. As others have noted, "*The Oxford Encyclopedia of Economic History* cites that 'Ninety percent of income growth in the UK and US after 1780 was the result of technological innovation, not simple capital accumulation'" (Kaku Michio, *2100 nen no kagaku raifu*, NHK Shuppan). As this indicates, it is important that all engineers understand the significant impact and important role of science and technology upon society. Moreover, I hope you would take as great an interest as possible not only in your field but in other areas of science and technology, as well as in history, culture, global issues and the other various concerns that society faces. With that in mind, I would like to talk to you about two things.

The first is about "the goals of engineering." A moment ago, I mentioned the significant impact that science and technology have on society. A book about the history of MIT in the US has written the following about science and engineering: "Science is what provides a means to understand where we are now; engineering is what provides a means to get there" (Fred Hapgood, *Masachusettsu koka daigaku*, Shinchosha). In other words, engineering is a field of study that requires a sense of purpose; with it, engineering enables us to get where we should be. For this reason, it is important to properly understand the purpose of studying engineering as well as the purpose when applying it. Its purpose can be viewed broadly as a means to achieve a larger purpose, one that serves an even larger one. When a purpose is too big, we sometimes falter because we are unsure how to achieve it. Even so, as you find yourself working for a purpose in the future, I hope you will notice the larger overarching concerns, take an interest in them as well, and view the issues from a broad perspective. As you do so, your understanding of the issues and your approach to resolve them will be transformed. You will ultimately grow into the kind of an engineer who is capable of contributing to the needs of society. This is why it is important for an engineer not only to understand

and resolve problems using a high level of expert knowledge but also to understand our society with an overarching perspective. In thinking about the direction engineering should take, the following question posed in “The Engineer of 2020” by the U.S. National Academy of Engineering (National Academy of Engineering, 2004) is worth referring to. It asks: Will engineering reflect and celebrate the diversity of all the citizens in our society? This is a question I would suggest everyone ask themselves from time to time. I believe we will find varied answers if we seek not merely to understand where we are now but also pay attention to the past and future, learn about diverse cultures and different values, and learn to accept them.

The second thing I would like to talk about is “how we define engineering.” How does engineering solve problems to achieve certain purposes? What is engineering? A very simple definition is found in the book “The Engineer of 2020” that I mentioned a moment ago. It writes: "A most elegant description is that engineering is about design under constraint. Technology is the outcome of engineering." In the real world, any kind of purpose faces various constraints that must be observed or upon which it must be premised. It is up to engineers to solve problems and search for best options while working within those various constraints. Such constraints include time constraints, economic constraints, legal constraints, available technology constraints and not to mention constraints specific to particular problems. The constraints have a significant impact on the solutions we reach. For instance, circumstances are completely different when we are given just one day to provide a solution as opposed to a full year. Yet, for engineers, there is never a situation without constraints. To the contrary, it is within such constraints that each of us seeks to find better answers by leveraging our wide range of knowledge, experience and skills. To reach better answers requires not only that we expand and deepen our knowledge within our own field of specialization but also that we obtain knowledge from people outside our areas of expertise. If you are ever in the position of someone who defines what the problems are, I would like you to reflect on the very nature of the constraints. Ask if those constraints are appropriate. If you are able to relax the restraints—for instance, if you can extend the timeline from one day to a year, if you can increase the available budget, if you can relax legal regulations, or if you simply recognize the unnecessary constraints that limit your performance—you will be able to achieve things that you couldn't before. In other words, the range of solutions from which to choose will be expanded and you will be able to achieve even greater outcomes. Although the definition of engineering is a simple one I would like you to understand that it enables us to imagine a great many things. Use your imagination.

In recent years, remarkable progress has been made in the field of science and technology including in engineering. In computer science in particular, the pace has been accelerating to such a degree that some predict computers will surpass human intelligence thanks to faster computer processing speeds and artificial intelligence technology. "Under accelerating technological change and the enormous impact it is having, human society will be transformed beyond any point of return" (Ray Kurzweil, *Posuto-hyuman tanjo: konpyuta ga jinrui no chino wo koeru toki*, NHK Shuppan). When that happens, we will reach the point they call "the singularity." The fields of life science and bioengineering also warrant our attention. In April of this year, the Japan Prize will be awarded to two researchers in the fields of life science, Prof. Emmanuelle

Charpentier and Dr. Jennifer Doudna, for their "Elucidation of genome editing mechanism by the CRISPR-Cas." As the Award Citation explains, "CRISPR is a revolutionary technology with wide-ranging applications to genetic modification, due to its capacity to edit genomes at will, be they plants or animals," making it "a far more efficient technology for genetic modification" that "can be applied not only to the creation of genetically altered animals and the breeding of crops and livestock, but also to humans through means such as gene therapy." The technology to easily manipulate genes is developing even faster than experts or ordinary people like us ever imagined. It is fair to say that technology may very well produce the singularity.

You will build your careers in a new era. Advances in science and technology will enable us to analyze various things and elucidate their functioning. Moreover, such findings will further enable us to invent things to serve entirely new functions. By analyzing humans at the atomic, cellular and genetic level and elucidating the functions of our brains, we are deepening our understanding of humans and inventing devices that partly serve human functions. On the other hand, the "individual" as such is an indivisible unit of existence from a societal perspective. As our various forms of analysis evolve, we must also direct our thoughts anew toward understanding humanity in terms of our indivisible individual existence. Humans are not mere brains, not mere collections of cells and genes, and not even creatures that exist only to fulfill some particular purpose. It is vital now more than ever that we reflect on what humans are and build a future with sympathy and cooperation.

I ask all of you to apply the knowledge and skills you have learned here and make contributions to respect, celebrate and support our human diversity.

In closing, let me remind everyone that this is the season of cherry blossoms. Since ancient times, Japanese people have valued and responded in various ways to the changing of the seasons. The poet Matsuo Basho offers us this simple, honest verse. *Samazama no / koto omoidasu / sakura kana* (Many many things / do they bring my mind back to — / the cherry blossoms) As you turn this auspicious corner in your lives today, I hope that the many great relationships you built at Kyutech will serve you well and I wish you great success in the future. Congratulations once again.