Convocation Address

of

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His Excellency former President of India

at

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of
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SCIENCE IS RECIPROCATING

"When you wish upon a star,
Makes no difference who you are
Anything your heart desires
Will come to you"

I am delighted to participate in the 14th Convocation of IIT Guwahati. I congratulate the graduating students for their academic performance and the faculty members for shaping the young minds. My greetings to all of you. I am happy that IIT Guwahati has been empowering the students with quality technical knowledge, skill and ability and inculcates in them the right attitude and holistic values. Dear friends, today I would like to share with you a few thoughts on the topic *"Science is reciprocating".*

Important Technological Achievements in 2012

As you are aware, the nation is going through a difficult economic situation due to the international economic ambience.   In spite of this, India has the potential to come out of this difficult situation because of its inherent strength. They are; purchasing power of 400 million citizens in the middle class category and 600 million youth who are willing to take up challenging missions.   In this connection, we can see how during the last few months, we have succeeded in realizing major technological milestones. The scientists and technologists of Defence Research and Development Organization have successfully launched the Agni system with 5000 kms range. Agni missile system has world-class control and guidance system and advanced composite technologies and a robust multistage propulsion system. The second technological achievement is the design and development of RISAT with indigenous technologies and launched by well-proven Polar Satellite Launch Vehicle (19). I had an opportunity to see the high-resolution RISAT pictures. The third event is the first flight of the Naval Light Combat Aircraft, which has been built with unique technologies needed for take-off and landing in an aircraft carrier. In the health sector, recently we had a break through in the development, production and deployment of drug for treatment of Malaria in a shorter time and shorter dosage by Ranbaxy, in partnership with Department of Science and Technology. Our agriculture farmers and scientists indeed have worked hard and had produced a record 250 million tons of food grains this year which is 18 million tones more than last year. All this has been accomplished as national mission by our scientists, technologists, technicians, farmers and researchers. I am sure; the graduating students from IIT Guwahati will set more challenging goals to be achieved by our scientific research and production organizations.

Convergence of Technologies

The information technology and communication technology have already converged leading to Information and Communication Technology (ICT). Information Technology combined with biotechnology has led to bio-informatics. Similarly, Photonics is grown out from the labs to converge with classical Electronics and Microelectronics to bring in new high speed options in consumer products. Flexible and unbreakable displays using thin layer of film on transparent polymers have emerged as new symbols of entertainment and media tools. Now, nanotechnology has come in. It is the field of the future that will replace microelectronics and many fields with tremendous application potential in the areas of medicine, electronics and material science.

When Nano technology and ICT meet, integrated silicon electronics, photonics are born and it can be said that material convergence will happen. With material convergence and biotechnology linked, a new science called Intelligent Bioscience will be born which would lead to a disease free, happy and more intelligent human habitat with longevity and high human capabilities. Convergence of bio-nano-info technologies can lead to the development of nano robots.

Nano robots when they are injected into a patient, my expert friends say, it will diagnose and deliver the treatment exclusively in the affected area and then the nano-robot gets digested as it is a DNA based product. I saw the product sample in one of the labs in South Korea where best of minds with multiple technology work with a target of finding out of the box solution.

Science is reciprocating: Let me give an example. Recently, I was in the Harvard University where I visited laboratories of many eminent professors from the Harvard School of Engineering and Applied Sciences. I recall, how Professor Hongkun Park, showed me his invention of nano needles, which can pierce and deliver content into individual targeted cells. That's how nano particle sciences is shaping the bio sciences. Then I met Professor Vinod Manoharan, who showed on the other hand bio sciences are in turn shaping nano material science as well. He is using DNA material to design self assembling particles. When particular type of DNA is applied on a particle at the atomic level, he is able to generate a prefixed behavior and automatic assembly from them. This could be our answer to self assembly of devices and colonies in deep space without human intervention as envisioned by Dr K Erik Drexler. Thus, within a single research building, I saw how two different sciences are shaping each other without any iron curtain between the technologists. This reciprocating contribution of sciences to one another is going to shape our future and industry needs to be ready for it. Friends are you

ready to bring down the iron curtain existing between various technological groups.

Now, a new trend is emerging. The aspect being introduced is that of Ecology. Globally, the demand is shifting towards development of sustainable systems which are technologically superior. This is the new dimension of the 21st century knowledge society, where science, technology and environment will have to go together. Thus, the new age model would be a four dimensional bio-nano-info-eco based. I am sure the education system in IIT Guwahati is concentrating to build the curriculum which will emphasis the convergence of technologies and remove the inter-disciplinary barriers.

Friends, during my education, an important milestone was the final year project. I would like to narrate the technique used by my professor to inject necessity in completing our task in time.

Learning integrated system design

I was assigned a project to design a low-level attack aircraft together with six other colleagues. I was given the responsibility of system design and system integration by integrating the team members. Also, I was responsible for aerodynamic and structural design of the project. The other five of my team took up the design of propulsion, control, guidance, avionics and instrumentation of the aircraft. My design teacher Prof. Srinivasan, the then Director of MIT, was our guide. He reviewed the project and declared my work to be gloomy and disappointing. He didn't lend an ear to my difficulties in bringing together data base from multiple designers. I asked for a month's time to complete the task, since I had to get the inputs from five of my colleagues without which I cannot complete the system design. Prof. Srinivasan told me "Look, young man, today is Friday afternoon. I give you three days time. By Monday morning, if I don't get the configuration design, your scholarship will be stopped." I had a jolt in my life, as scholarship was my lifeline, without which I cannot continue with my studies. There was no other way out but to finish the task. My team felt the need for working together round the clock. We didn't sleep that night, working on the drawing board skipping our dinner. On Saturday, I took just an hour's break. On Sunday morning, I was near completion, when I felt someone's presence in my laboratory. It was Prof. Srinivasan studying my progress. After looking at my work, he patted and hugged me affectionately. He had words of appreciation: ***I knew I was putting you under stress and asking you to meet a difficult deadline. You have done great job in system design".***

Through this review mechanism Prof Srinivasan, really injected the necessity of understanding the value of time by each team member and brought

out engineering education has to lead system design, system integration and system management. I realized that if something is at stake, the human minds get ignited and the working capacity gets enhanced manifold. That's what exactly happened. This is one of the techniques of building talent. The message is that young in the organization, whatever is their specialization, be trained to systems approach and projects, which will prepare them for new products, innovation and undertaking higher organizational responsibilities.

Friends, you should get ready to acquire knowledge in an integrated way for using multiple disciplines towards product development and its management, right from the undergraduate engineering programme. I am sure IIT Guwahati is facilitating such inter-disciplinary projects experience to all the students. The programme on entrepreneurship generation, hydropower, making north eastern states carbon neutral can all become inter-disciplinary projects for future batches.

Now, let me describe my visualization of the distinctive profile of India by 2020.

Distinctive Profile of India by 2020
1. A Nation where the rural and urban divide has reduced to a thin line.
2. A Nation where there is an equitable distribution and adequate access to energy and quality water.
3. A Nation where agriculture, industry and service sector work together in symphony.
4. A Nation where education with value system is not denied to any meritorious candidates because of societal or economic discrimination.
5. A Nation, which is the best destination for the most talented scholars, scientists, and investors.
6. A Nation where the best of health care is available to all.
7. A Nation where the governance is responsive, transparent and corruption free.
8. A Nation where poverty has been totally eradicated, illiteracy removed and crimes against women and children are absent and none in the society feels alienated.
9. A Nation that is prosperous, healthy, secure, devoid of terrorism, peaceful and happy and continues with a sustainable growth path.
10. A Nation that is one of the best places to live in and is proud of its leadership.

Integrated Action for developed India

To achieve the distinctive profile of India, we have the mission of transforming India into a developed nation. We have identified five areas where India has a core competence for integrated action: (1) Agriculture and food processing (2) Reliable and Quality Electric power, Surface transport and Infrastructure for all parts of the country. (3) Education and Healthcare (4)

Information and Communication Technology (5) Self-reliance in critical technologies. These five areas are closely inter-related and if progressed in a coordinated way, will lead to food, economic and national security.

PURA as a sustainable development system

One of the key requirements towards achieving the distinctive profile of the nation would be the creation of sustainable enterprise driven models at the rural levels. One such system which I suggest is PURA (Providing Urban Amenities in Rural Areas). It is the creation of Physical, Electronic, Knowledge connectivities leading to the Economic Connectivity of the rural region. With this combined and planned intervention of infrastructure, digital technology, information and enterprise, we can select a cluster of about 20 to 50 villages, which share core competencies and empower those using local enterprises. I would like to suggest here, that the IIT Guwahati may like to pursue the implementation of one such PURA Complex covering around 50 to 100 villages on the outskirts of Guwahati utilizing the potential of the youth of IITG PURA institutions. This PURA will be called as IITG PURA which would empower local villages in this region. IITG PURA will facilitate faculty, Students an intensive programme in societal transformation entrepreneurship.

Employment generation through entrepreneurship

In present context, the education system has to be designed to see that we generate large number of employment generators and not employment seekers. For this, a three pronged strategy is needed to make education more attractive, make it skill imparting and simultaneously create employment potential – how do we do that?

Firstly, the educational system should highlight the importance of entrepreneurship and prepare the students to get oriented towards setting up of enterprises which will provide them creativity, freedom and ability to generate wealth. Diversity of skills, ability to handle difficult situations and sheer perseverance in work makes an entrepreneur. It should be taught to all the students. The IIT curriculum should emphasis on the importance of entrepreneurship so that some of the students after graduation can create their own industries which will provide large scale employment to skilled and semi skilled technicians.

Secondly, the banking system should provide venture capital to the graduates who have the aptitude and keenness to create their own new enterprises. When I studied the performance of ICICI Venture, I found few entrepreneurs have increased their profitability many times in less than seven years generating thousands of direct jobs and tens of thousands of indirect jobs.

We need a large number of such venture capital institutions who can share the risk and promote entrepreneurs, especially with the investment in micro financing band. The IIT placement services can bring out the success stories in the form of document highlighting venture capital funding and employment generation opportunities across the nation and the world.

Thirdly, entrepreneurs have to produce the competitive products for becoming successful in their missions. The IIT Curriculum should provide market research support for selection of right products and hold the hand of the entrepreneur during the incubation period till they can stand on their own legs. IIT Technology Incubation Centre can also enrich the product of the enterprise through feed back of research results.

Conclusion

Finally, I would like to ask you, what would you like to be remembered for? You have to evolve yourself and shape your life. You should write it on a page. That page may be a very important page in the book of human history. And you will be remembered for creating that one page in the history of the nation – whether that page is the page of invention, the page of innovation or the page of discovery or the page of creating societal change or a page of removing the poverty or the page of fighting injustice or planning and executing mission of networking of rivers.

I am sure, you would like to do something different – out of box missions, what are they?

1   *Will you be remembered for a visionary action for the nation, like Prof. Vikram Sarabhai or Homi Bhabha, Prof Satish Dhawan or Dr.DS Kothari in the field of space science, nuclear science and Defence Science?*

2   *Will you be remembered for introducing new industrial system product, which represents a convergence of technologies for low cost high efficiency products like bionic eye?*

3   *Will you be remembered for creating a company which finds a place in the top 100 of the Fortune 500 companies from India?*

4   *Will you be remembered for facilitating the creation of PURA complexes (Providing Urban Amenities in Rural Areas) in the neighbourhood of your work place?*

5   *Will you be remembered for working and creating a validated system for the production of 340 million tonnes of food grains and value addition through food processing by the year 2020?*

6   *Will you be remembered for modernization of SME's through application of new technology and innovation?*

7   *Will you be remembered as a discoverer or inventor of new phenomena in basic sciences?*

8   *Will you be remembered for promoting energy independence for the nation through the development of renewable energy system?*

9   *Will you be remembered for the action oriented – "Clean home, clean environment, clean state and clean nation"*

10   *Will you be remembered for evolving for smart waterway for the whole country, linking the major rivers?*

Once again, let me congratulate all the graduating students. My best wishes to all the members of IIT Guwahati for success in the mission of developing quality technological human resource for the nation.

May God bless you.

Oath for Graduating Students

1.   Engineering and Technology is a life time mission. I will work, work and work and succeed.

2.   Wherever I am, a thought will always come to my mind. That is what process or product I can innovate, invent or discover.

3.   I will always remember that "Let not my winged days, be spent in vain".

4.   I realize I have to set a great technological goal that will lead me to think high, work and persevere to realize the goal.

5.   My greatest friends will be great scientific and technological minds, good teachers and good books.

6.   I firmly believe that no problem can defeat me; I will become the captain of the problem, defeat the problem and succeed.

7.   I will work and work for removing the problems faced by planet earth in the areas of water, energy, habitat, waste management and environment through the application of engineering and technology.

8.   I will work for making the city or town, where I work as a carbon neutral city or town.

9.   My National Flag flies in my heart and I will bring glory to my nation.