Education Reforms at
Tokyo Institute of Technology

Yoshinao Mishima
President
Tokyo Institute of Technology

March 14, 2014
Outline of Talk

1. About Tokyo Tech’s Current Education System


3. New Education System

4. Expected Results after the Reforms
Overview of Tokyo Institute of Technology

1881  Founded as the Tokyo Vocational School
1929  Elevated to a degree-conferring university - Tokyo Institute of Technology

<table>
<thead>
<tr>
<th>As of May 1, 2013</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Undergraduate Students</td>
<td>4,790</td>
</tr>
<tr>
<td>(International Students)</td>
<td>180 (3.8%)</td>
</tr>
<tr>
<td>Graduate Students</td>
<td>5,123</td>
</tr>
<tr>
<td>(International Students)</td>
<td>[ M 3,611 + D 1,512 ]</td>
</tr>
<tr>
<td>Research Students</td>
<td>943 (18.4%)</td>
</tr>
<tr>
<td></td>
<td>90</td>
</tr>
<tr>
<td>Academic Staff</td>
<td>1,148</td>
</tr>
<tr>
<td>Administrative Staff</td>
<td>472</td>
</tr>
</tbody>
</table>
Tokyo Tech’s World University Rankings

- QS World University Ranking 2013/2014:
  Overall: 66th (4th in Japan)
  Engineering & Technology: 42nd (2nd in Japan)

- THE Ranking 2013:
  Overall: 125th (3rd in Japan)
  Engineering: 58th (3rd in Japan)
Structure of Undergraduate Schools and Graduate Schools (Number of Departments/School)

**Undergraduate Schools**
- School of Science: 5
- School of Engineering: 16
- School of Bioscience and Biotechnology: 2

**Graduate Schools**
- School of Science and Engineering: 20
- School of Bioscience and Biotechnology: 5
- School of Interdisciplinary Science and Engineering: 11
- School of Information Science and Engineering: 3
- School of Decision Science and Technology: 4
- School of Innovation Management: 2
Outline of Talk

1. About Tokyo Tech’s Current Education System


3. New Education System

4. Expected Results after the Reforms
Mission of Tokyo Institute of Technology
Contribute to the Development of a New and Vibrant Society

- Produce graduates with a broad understanding of science and technology who have the ability and determination to take on leading roles in society.
- Create and support innovative science and technology that will lead to sustainable social development.

Aiming to become “One of the World’s Top Ten Research Universities” by 2030

**Education**
- Produce master’s degree graduates who will thrive in a global society
- Produce doctoral degree graduates who will become the world’s top-level researchers and leaders

**Contributions to Society**
- Contribute to society through education and research

**Research**
- Produce globally recognized research findings and innovations
- Enhance research through system and infrastructure development

**International Activities**
- Develop an international education and research environment
The Current Tokyo Tech Education System and the Necessity of Reform

Problem: A quality education has not been the main goal or focus

- Students primarily focus on earning credits for graduation
- Students lack a sense of mission to develop professional skills, to set goals that contribute to society, and to cooperate in a diverse global society

To educate students with a passion for life-long learning, we need:

- to create systematic and well-defined curricula with quality syllabi
- to provide students diverse and flexible learning processes
- to employ effective teaching methods for students’ active participation in classes and labs
Outline of Talk

1. About Tokyo Tech’s Current Education System


3. New Education System

4. Expected Results after the Reforms
Three Pillars of Education Reform
(by the Board of Directors – September 6, 2013)

1) Build a New Education System for a World-class Technological University

- Create a new system in which undergraduate and graduate schools are joined.
- Revitalize the curricula and lectures and make them globally accessible.
- Tune the curricula and lectures to those of other top universities in the world so that students can easily transfer credits.
2) Innovate “Learning”

- Create extensive and systematically structured curricula to support students in pursuing their goals and interests.
- Change the fundamental definition of “learning” from “what year a student is in” to “what and how much knowledge a student gains.”
- Increase the depth of course content and make the evaluation of learning more rigorous.

3) Promote Ambitious Internationalization

- Make Tokyo Institute of Technology a center of interaction for talented individuals from around the world by implementing a globally accessible, top-class education system.
- Utilize the Institute’s strengths as a science and technology university to recruit larger numbers of students from overseas and foster greater student participation in opportunities abroad.
Education Reform Plan of Action

- **Sept. 2013**: established the “Education Reform Committee”
- **March 2014**: new curricula proposals from 9 separate discipline-based faculty committees due
- **April 2014 - March 2015**: revitalize curricula based upon reviews
- **April 2016**, university-wide implementation of new curricula at start of spring semester

Additionally

- **2014〜**: design a “lecture theater” course to motivate freshmen as a first step in education reform
- **2013-2014**: groups of faculty members and administrative staff will visit 20 world-class universities to learn about education systems, methods of active learning and classroom design
- **2013〜**: enhance student-exchange programs with world-class universities to increase mobility of students
A New System in Which Undergraduate and Graduate Schools are Blended

<table>
<thead>
<tr>
<th>Current Curriculum</th>
<th>New Curriculum in 2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>(yearly progress/semester system)</td>
<td>(achievement-based progress/quarter system)</td>
</tr>
<tr>
<td><strong>Doctoral</strong></td>
<td><strong>Doctoral thesis research</strong></td>
</tr>
<tr>
<td>3rd-year</td>
<td>Specialized courses (doctoral)</td>
</tr>
<tr>
<td>2nd-year</td>
<td>Master’s thesis research</td>
</tr>
<tr>
<td>1st-year</td>
<td>Specialized courses (master's)</td>
</tr>
<tr>
<td><strong>Master’s</strong></td>
<td><strong>Master’s thesis research</strong></td>
</tr>
<tr>
<td>2nd-year</td>
<td>Specialized courses (master's)</td>
</tr>
<tr>
<td>1st-year</td>
<td><strong>Specialized courses (master's)</strong></td>
</tr>
<tr>
<td><strong>Bachelor’s</strong></td>
<td><strong>Specialized courses (undergraduate)</strong></td>
</tr>
<tr>
<td>4th-year</td>
<td>Study abroad, internships, etc.</td>
</tr>
<tr>
<td>3rd-year</td>
<td><strong>Thesis research</strong></td>
</tr>
<tr>
<td>2nd-year</td>
<td>Liberal arts courses</td>
</tr>
<tr>
<td>1st-year</td>
<td><strong>Specialized courses (undergraduate)</strong></td>
</tr>
</tbody>
</table>

Numbering:
- **600-699**
- **500-599**
- **450-499**
- **400-449**
- **350-399**
- **300-349**
- **250-299**
- **200-299**
- **150-199**
- **100-199**

**Courses in graduate schools are provided in English**

**Students can take both Bachelor’s (200-399) and Master’s (400-599) courses**

**A high quality education to provide in-depth knowledge in the liberal arts**

**Arrange GIR (General Institute Requirements) in 100 level courses such as math, physics, chemistry and biology**
## Learning Outcomes, Assessment Criteria, and Competences

<table>
<thead>
<tr>
<th>Tokyo Tech Course Numbering</th>
<th>Learning Outcomes and Assessment Criteria in Study Programs</th>
<th>Competences in Study Programs</th>
</tr>
</thead>
<tbody>
<tr>
<td>300 Discipline-based Courses</td>
<td>- Gain knowledge in the main discipline, knowledge in the liberal arts and communication skills in one’s native language and in second and third languages.&lt;br&gt;- Gain knowledge in another discipline.&lt;br&gt;(+) Systematically gain knowledge in a second discipline (in addition to the first discipline).</td>
<td>B9: Fundamental knowledge gain in main and minor disciplines&lt;br&gt;B4: Liberal arts: understanding of humanities, arts and social sciences&lt;br&gt;B5: Communication in second and third languages&lt;br&gt;B8: Capacity for generating new practical ideas and teamwork&lt;br&gt;B10: Presentation skills&lt;br&gt;B11: Communication in one’s native language</td>
</tr>
<tr>
<td>200 Fundamental Courses</td>
<td>- Gain fundamental knowledge in main discipline, knowledge in the liberal arts and communication skills in a second language.&lt;br&gt;- Gain capacity for generating new ideas based on the knowledge in one’s discipline.&lt;br&gt;(+) Understand relations between knowledge gained in each each subject, and basic knowledge in the profession in English.</td>
<td>B6: Fundamental knowledge in main discipline&lt;br&gt;B4: Liberal arts: appreciation of diversity&lt;br&gt;B5: Communication in a second foreign language&lt;br&gt;B7: Capacity for analysis and synthesis&lt;br&gt;B8: Capacity for generating new ideas</td>
</tr>
<tr>
<td>100 Introductory Courses</td>
<td>- Gain basic knowledge and spirit as a student of Tokyo Institute of Technology independent of the groups (I to VII) and the schools.</td>
<td>B1: Grounding in basic knowledge in main discipline&lt;br&gt;B2: Capacity to learn and think&lt;br&gt;B3: Will to succeed&lt;br&gt;B4: Liberal arts: ethical commitment&lt;br&gt;B5: Knowledge of second and third languages</td>
</tr>
</tbody>
</table>

**Competences from B1 to B11 will be used as items in a portfolio.**
Bachelor Competences in New Curriculum

B1: Grounding in basic knowledge in main discipline
B2: Capacity to learn and think
B3: Will to succeed
B4: Understanding of humanities, arts and social sciences
B5: Communication in second and third languages
B6: Fundamental knowledge in main discipline
B7: Capacity for analysis and synthesis
B8: Capacity for generating new practical ideas and teamwork
B9: Fundamental knowledge gain in main and minor disciplines
B10: Presentation skills
B11: Communication in one’s native language
Increase in the Depth of Course Content and Application of Achievement-based Progress

**Depth of Courses**
- Cap system (48 credits/yr.):
  - Revitalize the lectures, and offer appropriate preparation and review to students
- Numbering system:
  - Students can choose courses based upon one’s own initiative according to their goals, learning plans and prerequisites
- Quarter system:
  - Revitalize the curricula, and facilitate going abroad & internships
- Common compulsory courses for basic skills:
  - Math, Physics, Chemistry, Biology, Liberal Arts, and English

**Student Support**
- Academic advisors:
  - Every faculty member mentors five to ten students
- Active learning:
  - Encourage students’ learning by delivering classes in an active learning format
- Faculty development:
- Portfolio & Rubric
- Development of self-study environment

**Achievement-based Progress**
- Rigorous course evaluation ▶ A student can proceed to advanced classes independent of the years studied. Therefore, highly motivated students will be able to acquire their degrees in a shorter period of time.
Outline of Talk

1. About Tokyo Tech’s Current Education System
3. New Education System
4. Expected Results after the Reforms
Impact of New Curriculum 2016 (1)

1) A variety of courses and educational opportunities will be offered to students to ensure an enriching academic life

- With a world-class curriculum and in-depth course content, highly motivated students will be able to acquire their degrees in a shorter period of time.

- With a shortened period of study, students will be able to study abroad and pursue internships or dual degrees. It will also be possible to get involved in a wider range of social activities and get hands-on experience in line with Tokyo Tech’s spirit of Monotsukuri (Making Things).

- Students will be able to attain linguistic proficiency and communication skills for adapting successfully in the global arena.
2) Tokyo Tech will maintain its high level of excellence in basic and specialized education, tuned to international standards

• As a top ranking science and technology university, Tokyo Tech implements a high quality education for all students in order to nurture human resources with in-depth knowledge in the sciences and liberal arts.

• With the new curriculum, students can transfer credits with top universities in the world

3) These reforms will contribute to the development of graduates with a sense of pride and the will to influence society
**Make Tokyo Institute of Technology a Central Point of Interaction for Talented Individuals**

- **Tune the curricula and lectures to those of other top universities so that students can easily transfer credits.**
- **Open curricula & syllabi to the public**
- **Open curricula & syllabi to the public**
- **Adjustment of lecture content**
- **Adjustment of curricula, etc.**
- **Adjustment of credits**
- **Tune the curricula and lectures to those of other top universities so that students can easily transfer credits.**
- **Open curricula & syllabi to the public**
- **Open curricula & syllabi to the public**
- **Adjustment of lecture content**
- **Adjustment of curricula, etc.**
- **Adjustment of credits**

**Other top universities in the world**
- **Tokyo Tech**
- **University of Minnesota 2013**

**Invite top researchers in the world**
- **Provide facilities and services for international researchers**
- **Increase number of classes in English**
- **Increase bilateral student mobility for courses and workshops**
- **Broaden academic cooperation agreements**

---

**Curriculum Examples**

<table>
<thead>
<tr>
<th>Course Name</th>
<th>Code</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dynamics of Machinery</td>
<td>2.670</td>
<td></td>
</tr>
<tr>
<td>Physics I</td>
<td>8.01</td>
<td></td>
</tr>
<tr>
<td>101</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Other Examples**

- **機械の動力学**
- **物理学 I**
Thank you for your kind attention